

902-420-9287 450 Cowie Hill Road P.O. Box 8388 RPO CSC Halifax, Nova Scotia Canada B3K 5M1

June 6, 2022

Becky Kent, B.A., Chair Halifax Water Halifax, NS

The regular meeting of the Halifax Water Board will be held virtually on Thursday, June 23, 2022, beginning at 9:00 a.m. Visit <u>www.halifaxwater.ca</u> to register to attend the public portion of the meeting.

# AGENDA

In Ca	In Camera Reports							
1C	Approval of Minutes of the In-Camera Meeting held on Thursday, March 24, 2022 <i>Motion:</i> That the Halifax Water Board approve the In-Camera minutes of March 25, 2021.							
2C	Business Arising from Minutes a)							
3C	Governance Matter (10 Minutes)							
4C	Enterprise Risk management (20 Minutes) <i>Motion:</i> The the Halifax Water Board approve the attached corporate risk register for 2022/23.							
5C	Personnel Matter (10 minutes) <i>Information Item (Verbal)</i>							
6C-I	Legal Matter (5 minutes) <i>Information Item (Verbal)</i>							
7C-I	Regulatory Matter (10 minutes)							
	Information Item (Verbal							



### **Regular Reports**

- a) Ratification of In-Camera motions (2 minutes)
   Motion: That the Halifax Water Board ratify the In-Camera Motions.
  - b) Approval of the order of business and approval of additions and deletions (2 minutes)
     *Motion:* That the Halifax Water Board approve the order of business and approve additions and deletions.
- 2. Approval of minutes of the Regular meeting held on Thursday, March 24, 2022 (2 minutes) *Motion:* That the Halifax Water Board approve the minutes of the March 24, 2022, Regular meeting.
- 3. Business arising from minutes
  - a)

### Financial

- 4.1 Audited Financial Statements for the year ended March 31, 2022 (20 minutes) LdM/AS
   *Motion:* That the Halifax Water Board approve the audited financial statements for the Plan for the year ended March 30, 2022.
- 4.2 Audited Pension Statements for the year ended December 31, 2021 (20 minutes) LdM/AC *Motion*: That the Halifax Water Board approve the audited financial statements of the HRWC Employees' Pension Plan (the Plan) for the year ended December 31, 2021.
- 4.3 Actuarial Valuation (20 minutes) LdM/CO

### **Capital approvals**

- 5.1 Bissett Lake Pump Station Component Upgrade (5 minutes)
- 5.2 Churchill Transmission Main Project (5 minutes)
- 5.3 First Lake Pumping Station Rehabilitation Project (5 minutes)

*Motion*: That the Halifax Water Board approve Captial Project Items 5.1-5.3 as described in the Board Reports at a total cost of \$18,621,000..



### **Other Business**

6. Corporate Balanced Scorecard – 2022/23 Program and Year-End Results (25 minutes)

Motion: That the Halifax Water Board approve:

- 1. Corporate Balanced Scorecard targets for the 2022/23 fiscal year as detailed in the attached Corporate Balanced Scorecard summary.
- 2. The Organizational Award Program for 22/23 tied to the outcomes of 12 Organizational Indicators as detailed in the attached presentation.
- Diversity, Equity and Inclusion Policy (10 min)
   Motion: That the Halifax Water Board endorse the Diversity, Equity and Inclusion framework goals for 2022/23

   2024/25 as set out in the report dated March 15, 2022.
- 8. Stormwater Infrastructure Cost Sharing Memorandum of Understanding with HRM (10 min) *Motion:* It is recommended that the Halifax Water Board approve the memorandum of understanding between HRM and Halifax Water for the funding of stormwater projects as is provided in Appendix A of this report.
- 9. Asset Management Policy (10 minutes) *Motion:* It is recommended that the Halifax Water Board approve the Asset Management Policy.

### Nova Scotia Utility and Review Board– Information Reports

*The items in this section are the reports ordered to be filed by Halifax Water with the Nova Scotia Utility and Review Board by June 30, 2022. These reports are being provided for information purposes.* 

- 10. Cost Containment Report
- 11. Lead Service Line Renewal Program
- 12. Stormwater Credit Program
- 13. RDC Stakeholder Engagement
- 14. RDC Financial Status Report
- 15. Capital Cost Contribution Financial Status Report for the Year Ended March 31, 2022.



### **Information Reports**

- 1-I Operational Performance Information Report
- 2-I Capital Expenditures for the Eleven Months ended May 31, 2022
- 3-I Halifax Water Compliance Statement Quarterly Certification
- 4-I Halifax Regional Water Commission Employees' Pension Plan Financial Report, First Quarter, 2022
- 5-I 2022/2023 Communications Plan and Approach
- 6-I HRM Master Trust Investment Performance, Fourth Quarter 2021
- 7-I .HRM Master Trust Investment Performance, First Quarter 2022

Lorna <sup>Di</sup>si pp Skinner <sup>Di</sup>

Digitally signed by Lorna Skinner Date: 2022.06.17 13:24:04 -03'00'

Heidi Schedler. Q.C. Secretary





TO:	Becky Kent, B.A., Chair and Members of the Halifax Regional Water Commission Board							
SUBMITTED BY:	Louis de Montbrun Date: 2022.06.15 20:27:24 -03'00'							
	Louis de Montbrun, CPA, CA Director, Corporate Services/CFO							
APPROVED:	Cathie Digitally signed by Cathie O'Toole Date: 2022.06.16 20:43:32 -03'00'							
	Cathie O'Toole, MBA, FCPA, FCGA, ICD.D General Manager							
DATE:	June 17, 2022							
SUBJECT:	Financial Statements for the year ended March 31, 2022							

### <u>ORIGIN</u>

Operational and Regulatory Requirement.

### **RECOMMENDATION**

It is recommended the Halifax Regional Water Commission Board approve the financial statements of the Halifax Regional Water Commission for the year ended March 31, 2022 as recommended by the Halifax Regional Water Commission Audit and Finance Committee.

### BACKGROUND

Halifax Regional Water Commission (Halifax Water) is required to submit audited financial statements, approved by the Halifax Water Board, to the Halifax Regional Municipality (HRM) by June 30, 2022, and the Nova Scotia Utility and Review Board (NSUARB) within 180 days of the fiscal year end.

### DISCUSSION

Attached are the financial statements for Halifax Water for the year ended March 31, 2022, with comparative figures for March 31, 2021. The auditor has indicated that they are prepared to issue an unqualified Auditor's Report.

Halifax Water is a fully regulated government business enterprise, falling under the jurisdiction of the NSUARB. The NSUARB requires that Halifax Water file financial statements and rate applications with them based on the NSUARB Water Utility Accounting and Reporting Handbook (NSUARB Handbook). The Accounting Standards Board (AcSB) requires rate regulated entities to conform to International

Financial Reporting Standards (IFRS). Halifax Water maintains the financial records in IFRS for the purposes of the annual audit and consolidation of the financial statements with those of HRM.

The following discussion of the operating results reflect direct operating costs by department and allocations among water, wastewater and stormwater for common costs shared across all the services provided by Halifax Water. The Schedules to the financial statements are prepared in accordance with the NSUARB Handbook.

### Statement of Financial Position – Page 3 of financial statements (IFRS)

Key indicators and balances from the Statement of Financial Position are provided in the following tables.

					From Prior Year			
March 31 (in thousands)	Notes		2022	2021	\$	Change	% Change	
Assets								
Current								
Cash and cash equivalents	Α	\$	65,586	\$ 48,228	\$	17,358	36.0%	
Receivables								
Customers charges and contractual	В		15,900	17,155		(1,255)	(7.3%)	
Unbilled service revenues	С		18,838	18,246		592	3.2%	
Halifax Regional Municipality	D		851	2,711		(1,860)	(68.6%)	
Inventory			2,042	2,003		39	1.9%	
Prepaids	E		2,408	1,570		838	53.4%	
	_		105,625	89,913		15,712	17.5%	
Intangible assets	G		20,805	20,588		217	1.1%	
Capital work in progress	F		51,013	30,908		20,105	65.0%	
Utility plant in service	G		1,277,360	1,280,283		(2,923)	(0.2%)	
Total assets			1,454,803	1,421,692		33,111	2.3%	
Regulatory deferral account	_		2,428	2,620		(192)	(7.3%)	
Total assets and regulatory deferral account		\$	1,457,231	\$ 1,424,312	\$	32,919	2.3%	

### Notes related to Table 1:

- A) *Cash and cash equivalents* consist of cash on hand and balances held within financial institutions reduced by outstanding cheques. They have increased \$17.4 million from the prior year due to new debt of \$20 million in May 2021 and net receipts of Regional Development Charges (RDC) of \$22.0 million, reduced by debt repayments of \$20.6 million and spend on capital. The total balance of the RDC reserves are \$67.1 million
- B) *Customer charges and contractual receivables* have decreased \$1.3 million from the prior year. The change in receivables is driven by the timing of billing cycles, down \$0.3 million from prior year, and an accrual for funding on transmission main projects of \$1.0 million accrued in the prior year and received in current year.

Customer charges and contractual										
		2021								
		'000		'000	Ş	Change	% Change			
Trade receivables	\$	15,954	\$	16,309	\$	(355)	(2.2%)			
Other receivables		3,177		4,099		(922)	(22.5%)			
Allowance for doubtful accounts		(3,231)		(3,253)		22	(0.7%)			
	\$	15,900	\$	17,155	\$	(1,255)	(7.3%)			

Aging of Trade Receivables (in thousands)											
	Current	31 to 60	61 to 120	120+	Grand Total						
2022	7,967	2,492	681	4,814	15,954						
2021	9,057	1,096	830	5,326	16,309						
\$ Change	(1,090)	1,396	(149)	(512)	(355)						
% Change	(12.0%)	127.4%	(18.0%)	(9.6%)	(2.2%)						
Number of customers	with receivable	s in each cate	gory*								
2022	29,216	11,871	4,593	10,531	56,211						
2021_	33,662	5,865	5,148	13,801	58,476						
Change	(4,446)	6,006	(555)	(3,270)	(2,265)						

\* Customers may have receivable balances in multiple aging categories.

- C) *Unbilled service revenues* have increased \$0.6 million due to the timing of billing cycles and the increase in rates for wastewater services.
- D) Halifax Regional Municipality (HRM) receivable has decreased from the prior year by \$1.9 million. This relates to receipt of payment for holdbacks related to the Fall River Water servicing project, Lucasville Road and Wanda Lane cost sharing invoices offset by an increase in the RDC. The increase in RDC is related to an increase of \$0.7 million in deferrals for charges greater than \$0.1 million, which is dependent on development activity.

HRM Receivables and Payables											
		2022		2021							
		'000		<b>'000'</b> '(		'000'	\$	Change	% Change		
Receivables	\$	401	\$	2,953	\$	(2,552)	(86.4%)				
RDC		4,262		3,597		665	18.5%				
Payables		(3,812)		(3,839)		27	(0.7%)				
	\$	851	\$	2,711	\$	(1,860)	(68.6%)				

- E) The increase in *prepaids* of \$0.8 million is a result of new software licenses, including the new payroll system, in addition to software licenses being paid prior to March 31 in the current year. Also contributing to the increase is the annual insurance premiums invoice, which in previous years was invoiced monthly.
- F) The \$20.1 million increase in *capital work in progress* relates to expenditures during the year of \$61.7 million compared to \$56.5 million in prior year. The top five projects remaining in capital work in progress of March 31, 2022 are detailed below:

Capital Work in Progress			
	Cumulative		
		'000	
Bedford South Reservoir	\$	5,865	
ERP Replacement Project		5,600	
Russell Lake Pumping Station		1,560	
Morris Lake Pump Station		1,533	
Bedford To Halifax Trunk Sewer Upgrade		1,422	
		15,980	
All other projects:			
Water		16,394	
Wastewater		16,184	
Stormwater		2,455	
		35,033	
Capital work in progress	\$	51,013	

G) *Utility plant in service* assets total \$1.3 billion and intangible assets \$20.8 million, a combined decrease of \$2.7 million from the prior year. The decrease is a result of additions at year end of \$48.9 million offset by disposals of \$0.7 million, less depreciation expense of \$50.9 million. The top five projects capitalized during the year are outlined in the following table:

Additions to Utility Plant in Service and Intangibles							
	Cur	Cumulative					
		'000					
Wastewater System Trenchless Rehabilitation Romans and Federal Avenues Sewer	\$	4,870					
Separation		2,862					
Ellenvale Run Retaining Wall Phase 4		2,123					
Ellenvale Run Retaining Wall Phase 5 Pump Station Control Panel/Electrical		2,236					
Replacement		1,745					
		13,836					
All other projects:							
Water		16,560					
Wastewater		13,026					
Stormwater		5,485					
		35,071					
Total additions	\$	48,907					

### Table 2: Liabilities and Equity

Tuble 21 Elubinities una Equity				From Prior Year		
March 31 (in thousands)	Notes	2022	2021	\$ Change	% Change	
Liabilities						
Current						
Payables and accruals						
Trade	Α	23,255	12,644	10,611	83.9%	
Non-trade	В	5,060	6,192	(1,132)	(18.3%)	
Interest on long term debt		2,038	2,065	(27)	(1.3%)	
Contractor and customer deposits	С	2,705	2,115	590	27.9%	
Current portion of deferred contributed capital		14,614	14,580	34	0.2%	
Current portion of long term debt	D	46,272	20,559	25,713	125.1%	
Unearned revenue		80	105	(25)	(23.8%)	
		94,024	58,260	35,764	61.4%	
Deferred contributed capital	Е	893,975	884,372	9,603	1.1%	
Long term debt	F	177,910	204,106	(26, 196)	(12.8%)	
Employee benefit obligation	G	41,950	73,796	(31,846)	(43.2%)	
Total liabilities	_	1,207,859	1,220,534	(12,675)	(1.0%)	
Equity						
Accumulated other comprehensive loss		11,225	(29,682)	40,907	(137.8%)	
Accumulated surplus		238,147	233,460	4,687	2.0%	
Total equity		249,372	203,778	45,594	22.4%	
Total liabilities and equity	\$	1,457,231	\$ 1,424,312	\$ 32,919	2.3%	

### Notes related to Table 2:

A) Trade payables and accruals have increased \$10.6 million from the prior year. Trade payables have increased \$4.9 million due to holdbacks for capital projects of \$1.7 million and invoicing for capital projects. Trade accrued payables also increased \$5.5 million relating to accruals for capital projects for which invoices were not received as of year-end.

Payables and Accruals										
			2022	2021						
	_		'000	'000		\$ Change		% Change		
Trade payable	-	\$	10,536	\$	5,602	\$	4,934	88.1%		
Trade accrued payal	bles		11,276		5,763		5,513	95.7%		
Accrued wastewater rebate			1,443		1,279		164	12.8%		
		\$	23,255	\$	12,644	\$	10,611	83.9%		
	Aging of A	Acc	ounts Pay	abl	e (in thous	and	ls)			
	Current	3	1 to 60	6	51 to 120		120+	Grand Total		
2022	7,502		464		1,173		1,397	10,536		
2021	4,833		295		248		226	5,602		
\$ Change	2,669		169		925		1,171	4,934		
% Change	55.2%		57.3%		373.0%		518.1%	88.1%		

B) *Non-trade payables and accruals* have decreased \$1.1 million due to timing of remittances for payroll as well as a decrease in accrued salaries and wages payable due to the timing of pay cycles.

- C) *Contractor and customer deposits* have increased \$0.6 million primarily due to the reallocation of credit balances from receivables.
- D) *Current portion of long term debt* has increased \$25.7 million due to balloon payments required for debt in May and November 2022 expected to be refinanced.
- E) *Deferred contributed capital* increased \$9.6 million due to contributed asset additions of \$7.3 million, collection of capital cost contributions (CCCs), RDCs and interest earned on RDC balances of \$21.0 million, offset by amortization of \$18.6 million.
- F) *Long term debt* has decreased \$26.2 million as \$27.3 million has been reallocated to current. New debt of \$20.0 million was issued in May 2021. Long term debt repayments have been \$20.6 million.

Long Term Debt										
		Total		Water	Wa	astewater	Sto	ormwater		
Opening debt	\$	225,591	\$	74,648	\$	129,520	\$	21,423		
New long term debt		20,000		10,000		6,000		4,000		
Long term debt repayments		(20,558)		(5,361)		(13,906)		(1,291)		
Less debt issue costs		(851)		(361)		(365)		(125)		
Total long term debt		224,182		78,926		121,249		24,007		
Less current portion		(46,272)		(11,079)		(33,702)		(1,491)		
Closing long term debt	\$	177,910	\$	67,847	\$	87,547	\$	22,516		

- G) The *employee benefit obligation* decreased \$31.8 million due to the following:
  - a. Improvement of the fair market value of the pension plan assets;
  - b. Increase in the discount rate used to measure the employee benefit obligation;
  - c. Additional information, including the actuarial assumptions adopted in measuring the employee benefit obligation, is described in Note 4 of the financial statements.

Debt servicing ratio is a function of total interest and principal payments (including accrued amounts) plus the amortization of debt issue costs divided by total operating revenue per service. Debt servicing ratio by service as of March 31, 2022, is as follows:

Debt Serv	icing Ratio by S	Service
	2021/22	2020/21
Water	13.79%	13.12%
Wastewater	21.63%	25.08%
Stormwater	26.94%	27.57%
Combined	18.98%	20.29%

The debt servicing ratio for each service, except wastewater, has increased from the prior year as a result of the issuance of new debt. The wastewater debt servicing ratio has decreased from the prior year due to higher revenues than the prior year as a result of an increase to the wastewater discharge rate. The combined debt servicing ratio of 18.98% is below the maximum 35.00% ratio allowed under the blanket guarantee agreement with HRM.

### Statement of Earnings and Comprehensive Earnings – Page 4 of financial statements (IFRS)

### Table 3: Summarized Statement of Comprehensive Earnings (IFRS)

Summarize	ed Comp	rehe	nsive Ea	rni	ngs		
	Notes_	202 '(	21/22 000		2020/21 '000	\$ Change	% Change
Operating revenues Operating expenditures Loss from operations before financial	A B_	\$	150,502 151,548	\$	136,569 141,973	\$ 13,933 9,575	10.2% 6.7%
and other revenues and expenditures			(1,046)		(5,404)	4,358	(80.6%)
Financial and other revenues	С		19,607		21,254	(1,647)	(7.7%)
Financial and other expenditures	D		13,682		13,348	334	2.5%
Earnings for the year before regulatory deferral account depreciation			4,879		2,502	2,377	95.0%
Regulatory deferral account depreciation			(192)		(192)	-	0.0%
Earnings for the year	-		4,687		2,310	2,377	102.9%
Other comprehensive earnings (loss)	E_		40,907		(3,229)	44,136	(1366.9%)
Total comprehensive earnings (loss) for the year		\$	45,594	\$	(919)	\$ 46,513	(5061.3%)

### Notes related to Table 3:

A) The *total comprehensive earnings* for the year are \$45.6 million, an increase of \$46.5 million over the prior year loss. The following is a discussion of factors influencing the change.

### Table 4: Operating Revenues:

				Ор	erating Rever	nues					
	Notes	Budget 2021/22 '000	Forecast 2021/22 '000	Actual 2021/22 '000	Actual 2020/21 '000	From P \$ Change	rior Year % Change	Actual to \$ Remaining	Forecast % Remaining	Budget to \$ Change	Forecast % Change
Consumption revenue Base charge revenue	B	\$ 96,526 34,003	\$ 97,073 34,180	\$ 96,497 33,635	\$ 84,538 33,544	\$ 11,959 91	14.15% 0.27%	\$ (576) (545)	(0.59%) (1.59%)	\$ 547 177	0.57% 0.52%
Wastewater rebate	D	(1,488)	(1,350)	(1,297)	(846)	(451)	53.31%	53	(3.93%)	138	(9.27%)
Metered sales total		129,041	129,903	128,835	117,236	11,599	9.89%	(1,068)	(0.82%)	862	0.67%
Stormwater site generated charge	Е	6,051	6,537	6,294	5,127	1,167	22.76%	(243)	(3.72%)	486	8.03%
Public fire protection	F	7,628	7,628	7,628	7,336	- 292	3.98%	-	0.00%	-	0.00%
Private fire protection	F	1,312	1,335	1,270	1,001	269	26.87%	(65)	(4.87%)	23	1.75%
Other operating revenue	G	2,600	2,549	2,640	2,034	606	29.79%	91	3.57%	(51)	(1.96%)
Operating revenue total	A	\$ 150,467	\$ 151,787	\$ 150,502	\$ 136,569	\$ 13,933	10.20%	\$ (1,285)	(0.85%)	\$ 1,320	0.88%

### Notes related to Table 4:

Operating revenues are presented above, broken down by type:

A) *Operating revenues* have increased \$13.9 million as compared to the previous year and were within budget.

B) Consumption has increased 1.2% on a volumetric basis compared to the prior year and is within budget. The other factor influencing the increase in consumption revenue of \$12.0 million over the prior year is the rate increase for wastewater discharge effective April 1, 2021 from \$1.753 per cubic meter to \$2.073 per cubic meter.

	Consumption b	oy Customer C	lass (m3)	
_	2021/22	2020/21	m3 Change	% Change
Commercial	5,995,586	5,692,124	303,462	5.3%
Industrial	1,962,919	1,847,687	115,232	6.2%
Institutional	3,813,783	3,449,739	364,044	10.6%
Multi-residential	7,697,436	7,322,493	374,943	5.1%
Residential	13,054,490	13,817,627	(763,137)	(5.5%)
	32,524,214	32,129,670	394,544	1.2%

- C) *Base charges* have remained similar to the prior year. Base charges were less than budget by \$0.4 million as the number of customers increased less than expected.
- D) Wastewater rebate is \$0.5 million more than prior year due to new customers in the current year and existing customers increasing their discharge into our system due to operational requirements post COVID-19. The forecast had decreased \$0.1 million compared to budget as annual wastewater rebate requests had been processed for lesser volumes of wastewater discharged, but still more than the prior year.
- E) *Stormwater site generated charge revenue* (SGC) is \$1.2 million more than the prior year due to the impervious area satellite imagery update. It had been forecast to be \$0.5 million more than budget due to the update. Overall, SGC is \$0.2 million less than forecast due to billing adjustments for appeals and revisions to impervious areas.
- F) *Public and private fire protection revenues* have increased by a combined \$0.6 million from the prior year due to an approved rate increase effective October 1, 2020.
- G) *Other operating revenue* has increased \$0.6 million over the prior year due to late payment and interest charges being waived in the prior year as a COVID-19 relief measure, the introduction of a new meter reading charge to recoup the cost of manual meter reads for non-AMI meters effective October 1, 2020, the introduction of a new hydrant flow test charge effective April 1, 2021, and an increase in drawing review fees which are dependent upon the level of development activity. Actuals were within \$0.1 million of budget and forecast.

### Table 5: Operating expenditures:

						Opera	tin	g Expendit	ure	s						
		Budget 2021/22	F 2	orecast 2020/21	2	Actual 2021/22		Actual 2020/21		From Pri	or Year	Actual to	Forecast		Budget to	Forecast
	Notes	'000		'000		'000		'000		\$ Change	% Change	\$ Remaining	% Remaining	Ş	Change	% Change
Water supply and treatment	в	5 10,778	\$	10,723	\$	10,760	\$	9,987	\$	773	7.74%	\$ 37	0.35%	\$	(55)	(0.51%)
Water transmission and distribution Wastewater collection	D	11,876		11,862		11,316		10,960		356 278	3.25% 2.19%	(546) 640	(4.60%) 5.18%		(14) (256)	(0.12%) (2.03%)
Stormwater collection Wastewater treatment	F	5,885 22,071		5,037 21,378		4,566 21,774		4,700 20,623		(134) 1,151	(2.85%) 5.58%	(471) 396	(9.35%) 1.85%		(848) (693)	(14.41%) (3.14%)
Engineering and technology services Regulatory services	G H	12,931 4,472		13,421 4,312		13,719 4,392		11,171 3,981		2,548 411	22.81% 10.32%	298 80	2.22% 1.86%		490 (160)	3.79% (3.58%)
Customer services Corporate services	l J	5,837 2,863		4,996 2,878		4,811 3,062		5,081 -		(270) 3,062	(5.31%) 0.00%	(185) 184	(3.70%) 6.39%		(841) 15	(14.41%) 0.52%
Administration services	۲ ا	5,189 8 837		4,995		5,359		7,067		(1,708)	(24.17%)	364	7.29%		(194)	(3.74%)
Depreciation and amortization	L	48,737		47,775		49,764		48,799		2,143 965	1.98%	 1,989	4.44 %		(962)	(1.97%)
	<u>A</u> \$	5 152,080	\$	148,562	\$	151,740	\$	142,165	\$	9,575	6.74%	\$ 3,178	2.14%	\$	(3,518)	(2.31%)

### Notes related to Table 5:

- A) Operating expenditures of \$151.7 million are \$9.6 million higher than the prior year.
- B) *Water supply and treatment* expenditures are within forecast and budget. They have increased \$0.8 million from prior year due to:
  - Increase in salaries and benefits \$111k relating to new positions and wage rate increases.
  - Increase in treatment chemicals \$555k, mostly alum and phosphates relating to the increased dosage for the Lake Major clarifier project.
  - Increase in consulting \$147k for a Dalhousie University project for the JD Kline water quality master plan.
  - Increases are offset by a decrease in equipment repairs (\$182k) due in part to a pump failure in prior year and materials and supplies purchases (\$73k) due to timing of required materials.
- C) Water transmission and distribution has increased \$0.4 million from the prior year due to:
  - Lead service line replacement costs increased \$700k due to the new program to pay for the private portion of service line replacements in the current year offset by a decrease of (\$130k) for the lead service rebates.
  - Traffic control costs increased \$171k due to an increase in activity over the prior year resulting from COVID-19 delays.
  - Road and street repairs increased \$146k relating to several significant watermain breaks in the current year.
  - Increases are offset by a decrease in salaries and benefits (\$291k), a decrease in personal protective equipment (\$51k), and a decrease in vehicle cost allocations (\$184k).
  - Water transmission and distribution was \$0.5 million less than forecast due to the following:
    - Contract services were (\$287k) less than forecast.
    - Lead service rebates were \$63k less than forecast.
    - Lower salaries and benefits \$55k and training and development \$55k.
- D) Wastewater collection has increased \$0.3 million from prior year due to:

- Increase in vehicle cost allocations \$400k, which is dependent upon usage, and an increase in traffic control costs \$75k due to an increase in activity over the prior year resulting from COVID-19 delays. The increases have been offset by a decrease in salaries and benefits (\$50k) based on the allocation of time between wastewater and stormwater services, and a decrease in materials and supplies purchases (\$153k) due to timing of required purchases.
- Wastewater collection was forecast to decrease \$0.3 million due mainly to vacancies during the year, particularly in the West region, which also resulted in lower costs associated with materials and supplies. Expenditures ended up being \$0.6 million more than forecast due to the allocation of resources between wastewater and stormwater collections.
- E) Stormwater collection has decreased \$0.1 million from prior year due to:
  - Decrease in contract services (\$313k) relating mainly to emergency repairs for the Pier A combined sewer overflow (CSO) in the prior year (\$150k).
  - Decreases were offset by an increase in salaries and benefits \$132k partially due to the allocation of resources between wastewater and stormwater services.
  - Stormwater collection was forecast to decrease \$0.8 million from budget based on reduced costs being experienced in expenditure categories such as contract services and traffic control, and associated reduction in wages and overtime. Expenditures ended up being \$0.5 million less than forecast due to the allocation of resources between wastewater and stormwater collections.
- F) *Wastewater treatment* has increased \$1.2 million from prior year due to:
  - Increases in salaries and benefits \$503k relating to new positions and wage rate increases.
  - Increases in chemicals of \$446k, mostly caustic soda and polymer due to price increases and sodium hypochlorite due to a dry summer requiring more use of the chemical to reduce odors.
  - Increase in heating fuel of \$110k.
  - Increase in consulting costs of \$106k for a Dalhousie research project due to reduced activity in prior year due to COVID-19.
  - Wastewater treatment expenditures had been forecast to decrease \$0.7 million from budget partially due to lower flows being experienced at the treatment plants, resulting in lower treatment costs and usage costs for chemicals such as alum. Additionally, the treatment train was down at the Halifax wastewater treatment facility longer than expected, resulting in lower biosolid treatment cost. Expenditures were \$0.4 million more than forecast due to higher chemical costs (alum and sodium hypochlorite).
- G) Engineering and technology services have increased \$2.5 million from prior year due to:
  - Increases in salaries and benefits \$597k relating to new positions and wage rate increases.
  - New Microsoft Azure licenses of \$378k which had been included in the revised forecast and other increases in software and program licenses of \$698k including the VIP payroll system, customer portal, helpdesk licenses, Microsoft, and executive programs.

- Consulting costs increased for the document management system, the enterprise data warehouse, and the cyber security program by \$323k. Increases were offset by savings from other completed programs in the prior year of (\$170k).
- Engineering and technology services were \$0.3 million more than forecast mainly due to higher salaries and benefits.
- H) *Regulatory Services* were within forecast and have increased \$0.4 million from the prior year due to increases in salaries and benefits \$411k relating to wage rate increases and new staff.
- I) *Customer services* have decreased \$0.3 million from the prior year due to:
  - Decreases in salaries and benefits (\$30k) relating to vacant positions and a decrease in the bad debt expense (\$360k) due to improved collection activities.
  - The decreases are offset by an increase in software costs of \$97k.
  - Customer services are \$0.2 million less than forecast due to a lower bad debt expense relating to improved collections. Budget was forecasted to decrease by \$0.8 million. This is attributed to deferring implementation of the monthly customer billing project resulting in savings of approximately \$0.7 million as well as cost savings of \$0.1 million relating to salaries due to vacant positions. The decrease has been offset by an increase in subscription costs, which were forecasted to increase \$0.1 million.
- J) *Corporate services and administration services* have increased \$1.4 million from the prior year due to:
  - Increases in salaries and benefits \$1.1m relating to new positions, wage rate increases, salary adjustments for non-union compensation, and allocations between services.
  - Other increases include an increase in insurance policy premiums \$200k and an increase in merchant fees \$242k.
  - Corporate services and administration services are \$548k higher than forecast due in part to the merchant discount fees being \$250k more than forecast and lesser consulting. New program at HRM allows for online payment via credit card and it was not known that the majority of payments would be made online. Administration services were forecast to decrease \$0.2 million from budget due to awards banquet cancellation, fewer arbitrations, and low number of investigations, as well as a decrease in consulting costs for rate and utility consulting.
- K) *Pension services* have increased \$2.1 million from the prior year as a result of higher accrued pension expense based on actuarial valuation.
- L) Depreciation and amortization have increased \$1.0 million as a result of additions to utility plant in service and intangibles. Depreciation and amortization are budgeted and forecast for NSUARB reporting purposes, not IFRS, therefore a comparison between budget and forecast to actual under IFRS is not realistic as the two reporting frameworks account for depreciation differently. For NSUARB reporting purposes, actuals were within forecast.

							Operating	j Ex	penditur	es b	y Nature						
		Βι 20	udget 21/22	F 2	orecast 2020/21	:	Actual 2021/22	:	Actual 2020/21		From Pr	rior Year		Actual to F	orecast	Budget to	Forecast
N	otes		000		'000		'000		'000	\$	Change	% Change	\$ F	Remaining %	Remaining	\$ Change	% Change
Salaries and benefits	А	\$	42,831	\$	42,401	\$	43,817	\$	42,007	\$	1,810	4.31%	\$	1,416	3.34%	\$ (430)	(1.00%)
Pension	в		8,837		8,837		9,229		7,086		2,143	30.24%		392	4.44%	-	0.00%
Training	С		1,126		861		432		325		107	32.92%		(429)	(49.87%)	(265)	(23.53%)
Contract services	D		15,399		14,319		13,938		13,182		756	5.73%		(381)	(2.66%)	(1,080)	(7.01%)
Electricity			7,156		7,134		7,160		6,868		293	4.26%		26	0.37%	(22)	(0.31%)
Operating supplies	Е		13,970		13,567		13,081		10,672		2,409	22.57%		(486)	(3.58%)	(403)	(2.88%)
Professional services			5,318		5,676		5,953		5,650		303	5.36%		277	4.88%	358	6.73%
Chemicals	F		6,793		6,623		7,046		5,973		1,073	17.97%		423	6.39%	(170)	(2.50%)
Depreciation on assets allocated			1,913		1,369		1,320		1,603		(283)	(17.65%)	)	(49)	(3.58%)	(544)	(28.44%)
Depreciation and amortization			48,737		47,775		49,572		48,607		965	1.99%		1,797	3.76%	(962)	(1.97%)
		\$ 1	52,080	\$	148,562	\$	151,548	\$	141,972	\$	9,575	6.74%		2,986	2.01%	(3,518)	(2.31%)

### Table 6: Operating Expenditures by Nature:

### Notes related to Table 6:

Operating expenditures of \$151.5 million are \$9.6 million higher than the prior year.

Compared to the prior year and forecast, expenditure types with the largest changes in costs are:

- A) Salaries and benefits increase of \$1.8 million is due to wage rate increases and new positions, offset by several retirements. The actual increase is \$1.4 million more than forecast.
- B) Pension expense was discussed previously.
- C) Training was \$0.1 million more than the prior year due to an increase in offerings post COVID-19. There were still delays and postponements resulting in the actuals being \$0.4 million less than forecast.
- D) Contract services increase of \$0.8 million from prior year is due to an increase in traffic control services and hired equipment relating to an increase in activity post COVID-19 along with an increase in biosolids treatment due to higher volume being sent for processing at third-party facility. Compared to forecast, actuals were \$0.4 million lower due to factors discussed previously.
- E) Operating supplies increase of \$2.4 million is due mainly to engineering and technology services cost increases relating to software licenses, network costs, and equipment purchases. Compared to forecast, actuals were \$0.5 million lower mainly due to lesser computer supplies purchases.
- F) Chemicals increase of \$1.1 million is due mainly to price increases and greater usage of certain chemicals. Actuals were \$0.4 million more than forecast due to increased usage.

### Table 7: Financial and other revenues:

					_	Financ	ial	and other	reve	enues							
		Budget 2021/22	F	<sup>:</sup> orecast 2021/22		Actual 2021/22		Actual 2020/21		From Pri	ior Year		Actual to	Forecast		Budget to	Forecast
	Notes	'000		'000		'000		'000	\$	Change	% Change	\$ F	Remaining	% Remaining	:	\$ Change	% Change
	-																
Interest		\$ 173	\$	163	\$	178	\$	215	\$	(37)	(17.21%)	\$	15	9.20%	\$	(10)	(6.13%)
Amortization of deferred																	
contributed capital	Α	17,864		17,864		18,592		18,810		(218)	(1.16%)		728	4.08%		0	0.00%
Other	В	549		620		837		2,229		(1,392)	(62.45%)		217	35.00%		71	12.93%
Total financial and other revenue	-	\$ 18,586	\$	18,647	\$	19,607	\$	21,254	\$	(1,647)	(7.75%)	\$	960	5.15%	\$	61	0.33%

### Notes related to Table 7:

- A) *Amortization of deferred contributed capital* is \$0.7 million higher than forecast as donated assets were more than expected resulting in higher amortization.
- B) *Other revenues* include various un-regulated activities such as tower lease revenues, energy generation revenues, consulting activities, contracted service revenues, and gains on sale of assets. The increase in the forecast is mainly related to a new source of revenue for the sale of wood. The decrease over the prior year of \$1.3 million is related to a large gain on the sale of property in the prior year.

### Table 8: Financial and other expenditures:

	• •				Financial a	nd	other exp	enditur	es					
		Budget 2021/22	Foi 20	recast )21/22	Actual 2021/22		Actual 2020/21	i	From Pri	or Year	Actual to	Forecast	Budget to	Forecast
	Notes	'000		'000	'000		'000	\$ Ch	ange	% Change	\$ Remaining	% Remaining	\$ Change	% Change
Interest on long term debt	В	\$ 7,603	\$	6,822	\$ 6,859	\$	7,118	\$	(259)	(3.64%)	\$ 37	0.54%	\$ (781)	(11.45%)
Amortization of debt discount		258		229	228		209		19	9.09%	(1)	(0.44%)	(29)	(11.24%)
Dividend/grant in lieu of taxes	С	6,837		6,626	6,466		5,951		515	8.65%	(160)	(2.41%)	(211)	(3.09%)
Other		46		160	129		70		59	84.29%	(31	(19.38%)	114	247.83%
Total financial and other expenditures	А	\$ 14,744	\$	13,837	\$ 13,682	\$	13,348	\$	334	2.50%	\$ (155)	(1.12%)	\$ (907)	(6.15%)

### Notes related to Table 8:

- A) *Financial and other expenditures* have increased \$0.3 million over the prior year mainly due to an increase in the *dividend/grant in lieu of taxes* due to additions to utility plant in service and a dividend of 0.25% on wastewater and stormwater rate based assets, effective October 1, 2020 offset by a decrease in long term debt interest.
- B) Long term debt appropriation expenditures (interest and amortization) were forecast to decrease \$0.8 million due to the budgeted debt issuance for this fiscal year being higher than actual debt acquired.
- C) *Dividend/grant in lieu of taxes* were \$0.2 million less than forecast due to lower capital additions as at March 31, 2021 which drives the basis for the dividend.

# Results under NSUARB Handbook as compared to International Financial Reporting Standards (IFRS)

As a rate regulated utility, the Accounting Standards Board (AcSB) requires Halifax Water, to report financial results using IFRS. The NSUARB requires Halifax Water to report in accordance with the NSUARB Handbook. Table 9 below reconciles the results between IFRS and the NSUARB Handbook:

### Table 9: Reconciliation IFRS to NSUARB:

Reconcile IFRS to N	ISUARB			
		2	2021/22	2020/21
	Notes		'000	'000
IFRS comprehensive earnings (loss)	-	\$	45,594	\$ (919)
Add non-cash pension expense	Α		9,229	7,086
Subtract debt principal payments	В		(21,477)	(20,379)
Add depreciation expense on contributed assets	С		18,592	18,810
Subtract amortization of contributed capital	С		(18,592)	(18,810)
Add various depreciation adjustments	D		1,179	412
Add (subtract) OCI loss (gain)	_		(40,907)	3,229
NSUARB Loss		\$	(6,382)	\$ (10,571)

### Notes related to Table 9:

Operating revenues are the same under both IFRS and the NSUARB Handbook.

The main differences relate to reporting requirements surrounding the recognition of various expenditures as follows:

- A) *Non-cash pension expense* represents the accrual of unpaid contributions to the pension plan and is not considered an expense for NSUARB Handbook reporting purposes.
- B) The *principal payments* on long term debt are recognized as an expense for NSUARB Handbook reporting purposes but are not an expense under IFRS.
- C) *Depreciation expense on contributed assets* is not an expense for NSUARB Handbook purposes, however, it is offset by the removal of the amortization of contributed capital. IFRS requires *contributed capital* to be treated as a long term liability and amortized, resulting in higher long term liabilities and lower equity on the statement of financial position.
- D) The *various depreciation adjustments* include the add back of gains on the disposal of utility plant in service and IFRS requires componentization of assets and shorter useful lives resulting in higher depreciation than under NSUARB Handbook reporting.

Schedule C (pages 25 to 27) of the audited statements presents the Statement of Earnings under the NSUARB Handbook and contain the adjustments referenced above.

### Table 10: Operating Results by Service:

						(	Operating	Re	esults by Se	rvice					
	E 2	Budget 2021/22	Forecast 2021/22		Actual 2021/22	2	Actual 2020/21		From Pri	or Year	Actual t	o Forecast		Budget to	Forecast
		'000	'000		'000		'000	5	\$ Change	% Change	\$ Remaining	% Remaining	S	\$ Change	% Change
Water	\$	(5,221)	\$ (2,59	8)\$	6 (3,428)	\$	493	\$	(3,921)	(795.33%)	\$ (830	) 31.95%	\$	2,623	(50.24%)
Wastewater		(1,517)	1,49	0	389		(7,110)		7,499	(105.47%)	(1,101	) (73.89%)		3,007	(198.22%)
Stormwater		(4,912)	(3,57	9)	(3,343)		(3,954)		611	(15.45%)	236	(6.59%)		1,333	(27.14%)
Loss	\$	(11,650)	\$ (4,68	7) \$	6,382)	\$	(10,571)	\$	4,189	(39.63%)	(1,695	) 36.16%	\$	6,963	(59.77%)

The results in Table 10 are explained in more detail in Tables 11 to 13.

### Table 11: Operating Results by Service – Water:

					0	perating R	lesu	ults by Ser	vice	- Water					
		Budget 2021/22	F	Forecast 2021/22	:	Actual 2021/22		Actual 2020/21		From Pr	ior Year	Actual to	Forecast	Budget to	Forecast
	Notes	'000		'000		'000		'000	\$	Change	% Change	\$ Remaining	% Remaining	\$ Change	% Change
Operating revenues	Α	\$ 58,213	\$	58,556	\$	58,012	\$	56,645	\$	1,367	2.41%	\$ (544)	(0.93%)	\$ 343	0.59%
Operating expenditures	В	48,638		47,835		48,361		43,876		4,485	10.22%	526	1.10%	(803)	(1.65%)
Earnings from operations	-	9,575		10,721		9,651		12,769		(3,118)	(24.42%)	(1,070)	(9.98%)	1,146	11.97%
Financial and other revenues		495		578		590		699		(109)	(15.59%)	12	2.08%	83	16.77%
Financial and other expenditures	С	15,291		13,897		13,669		12,975		694	5.35%	(228)	(1.64%)	(1,394)	(9.12%)
Earnings (loss) for the year	-	\$ (5,221)	\$	(2,598)	\$	(3,428)	\$	493	\$	(3,921)	(795.33%)	\$ (830)	31.95%	\$ 2,623	(50.24%)

*Water services loss* has decreased from the prior year earnings by \$3.9 million due to the following factors: A) *Operating revenues* increase of \$1.4 million is attributable to the following:

- i. Increase in base charges and consumption by new and existing customers.
- ii. Increase in fire protection revenues of \$0.6 million as a result of a rate increase effective October 1, 2020.
- iii. Increase in late payment fees of \$0.1 million as prior year fees were waived for part of the year as a result of COVID-19 relief measures.
- iv. Increase in miscellaneous revenues of \$0.1 million mainly due to new meter reading fee allocated between water and wastewater services.
- B) Increase in *operating expenditures* of \$4.5 million as discussed previously including increases in salaries and benefits and depreciation.
- C) Increase in *financial and other expenditures* of \$0.7 million due to higher debt servicing costs and the dividend/grant in lieu of taxes.

*Water services loss* is \$0.8 million more than forecast due to the following factors:

- A) *Operating revenues* are \$0.5 million less due to fewer new customers and base charge revenue being lower than forecast. They were within \$0.2 million of budget.
- B) *Operating expenditures* are \$0.5 million more due to allocations between administration services and engineering and technology services which saw increases over their forecast due to factors discussed previously.
- C) *Financial and other expenditures* are \$0.2 million less due to the dividend/grant in lieu of taxes.

					c	Dpe	rating Res	ults	by Servic	ə - V	Vastewate	r				
		Ві 20	udget 121/22	F	orecast 2021/22		Actual 2021/22		Actual 2020/21		From Pr	ior Year	Actual to	Forecast	Budget to I	Forecast
	Notes		'000		'000		'000		'000'	\$	Change	% Change	\$ Remaining	% Remaining	\$ Change	% Change
Operating revenues	Α	\$	82,167	\$	82,682	\$	82,065	\$	70,822	\$	11,243	15.88%	\$ (617)	(0.75%)	\$ 515	0.63%
Operating expenditures	в		64,837		62,744		63,317		59,987		3,330	5.55%	573	0.91%	(2,093)	(3.23%)
Earnings (loss) from operations			17,330		19,938		18,748		10,835		7,913	73.03%	(1,190)	(5.97%)	2,608	15.05%
Financial and other revenues			196		187		187		231		(44)	(19.05%)	-	0.00%	(9)	(4.59%)
Financial and other expenditures	С		19,043		18,635		18,546		18,176		370	2.04%	(89)	(0.48%)	(408)	(2.14%)
Earnings (loss) for the year	-	\$	(1,517)	\$	1,490	\$	389	\$	(7,110)	\$	7,499	(105.47%)	\$ (1,101)	(73.89%)	\$ 3,007	(198.22%)

### Table 12: Operating Results by Service – Wastewater:

*Wastewater services earnings* of \$0.4 million have increased from the prior year loss by \$7.5 million due to the following factors:

- A) *Operating revenues* increase of \$11.2 million is attributable to the following:
  - i. Increase in the wastewater discharge rate from \$1.753 to \$2.073 effective April 1, 2021.
  - ii. Increase in late payment fees of \$91k as prior year fees were waived for part of the year as a result of COVID-19 relief measures.
  - iii. Increase in miscellaneous revenues of \$70k mainly due to new meter reading fee allocated between water and wastewater services.
- B) Increase in *operating expenditures* of \$3.3 million as discussed previously including increases in salaries and benefits increases and depreciation.
- C) Increase in *financial and other expenditures* of \$0.4 million due to the first full year for the new dividend/grant in lieu of taxes on wastewater assets which became effective October 1, 2020.

Wastewater services earnings is \$1.1 million less than forecast due to the following factors:

- A) *Operating revenues* are \$0.6 million less due to fewer new customers and base charge revenue being lower than forecast. They were within \$0.1 million of budget.
- B) *Operating expenditures* are \$0.6 million more due to higher chemical costs (alum and sodium hypochlorite) and allocation of resources between wastewater and stormwater collections offset by allocations between administration services which saw increases over their forecast due to factors discussed previously.
- C) *Financial and other expenditures* are \$0.1 million less due to lower debt servicing costs.

Operating Results by Service - Stormwater																	
		Budget 2021/22		Forecast Actual 2021/22 2021/22		Actual 2021/22	Actual 2020/21			From Prior Year			Actual to Forecast			Budget to Forecast	
	Notes	'000		'000		'000		'000	\$	Change	% Change	\$ I	Remaining	% Remaining	\$ Chan	ge	% Change
Operating revenues	Α	\$ 10,08	\$	10,549	\$	10,425	\$	9,102	\$	1,323	14.54%	\$	(124)	(1.18%)	\$	462	4.58%
Operating expenditures	в	11,904	ŀ	11,282		10,843		10,513		330	3.14%		(439)	(3.89%)	(	622)	(5.23%)
Loss from operations	_	(1,81	')	(733)		(418)		(1,411)		993	(70.38%)		315	(42.97%)	1,	084	(59.66%)
Financial and other revenues		31		18		19		33		(14)	(42.42%)		1	5.56%		(13)	(41.94%)
Financial and other expenditures	С	3,120	;	2,864		2,944		2,576		368	14.29%		80	2.79%	(	262)	(8.38%)
Loss for the year	-	\$ (4,91)	2) \$	(3,579)	\$	(3,343)	\$	(3,954)	\$	611	(15.45%)	\$	236	(6.59%)	\$ 1,	333	(27.14%)

### Table 13: Operating Results by Service – Stormwater:

*Stormwater services loss* of \$3.3 million is \$0.6 million less than the prior year. The following factors influenced the results:

- A) Increase of \$1.2 million in site generated revenue due to satellite imagery update and an increase in late payment fees of \$0.1 million as prior year fees were waived for part of the year as a result of COVID-19 relief measures.
- B) Increase in *operating expenditures* of \$0.3 million including an increase in depreciation offset by decreases in salaries and benefits as resources are allocated between wastewater and stormwater collection.
- C) Increase in *financial and other expenditures* of \$0.4 million due to higher debt servicing costs and the first full year for the new dividend/grant in lieu of taxes on stormwater assets which became effective October 1, 2020.

Stormwater services loss is \$0.2 million less than forecast due to the following factors:

- A) *Operating revenues* are \$0.1 million less due to due to billing adjustments for appeals and revisions to impervious areas.
- B) *Operating expenditures* are \$0.4 million less due to allocations between allocation of resources between wastewater and stormwater collections.
- C) *Financial and other expenditures* are \$0.1 million more due to higher debt servicing costs.

### **Table 14: Summary of Depreciation by Service**

					Si	umr	nary of De	pre	ciation						
		Budget	Forecast		Actual		Actual								
		2021/22	2021/22		2021/22 2020/21			From Prior Year		Actual to Forecast			Budget to Forecast		
	Notes	'000	'000		'000		'000	\$	Change	% Change	\$ F	Remaining	% Remaining	\$ Change	% Change
Water depreciation	A \$	12,052	\$ 11,634	\$	11,489	\$	10,879	\$	610	5.61%	\$	(145)	(1.25%)	\$ (418)	(3.47%)
Wastewater depreciation	в	16,775	15,909		15,882		15,019		863	5.75%		(27)	(0.17%)	(866)	(5.16%)
Stormwater depreciation	с_	2,046	2,368		2,403		2,198		205	9.33%		35	1.48%	322	15.74%
	\$	30,873	\$ 29,911	\$	29,774	\$	28,096	\$	1,678	5.97%		(137)	(0.46%)	(962)	(3.12%)

### Notes related to Table 14:

- A) Water depreciation of \$11.5 million has increased \$0.6 million from the prior year as a result of \$16.6 million of utility plant in service additions during the year.
- B) Wastewater depreciation of \$15.9 million has increased \$0.9 million from the prior year as a result of \$22.5 million of utility plant in service additions during the year.
- C) Stormwater depreciation of \$2.4 million has increased \$0.2 million from the prior year as a result of \$9.8 million of utility plant in service additions during the year.

Table 15:	Debt Servici	ng by Service:
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Debt S	ervicing	j by	Service					
	Notes	2	2021/22 '000		2020/21 '000		Change	% Change
Water Services								
Interest on long term debt		\$	2,113	\$	2,028	\$	85	4.2%
Repayment on long term debt			5,808		5,331		477	8.9%
Amortization of debt discount			81		74		7	9.5%
Total debt servicing cost - water services	Α	\$	8,002	\$	7,433	\$	569	7.7%
Wastewater Services								
Interest on long term debt		\$	4,019	\$	4,405	\$	(386)	(8.8%)
Repayment on long term debt			13,610		13,242		368	2.8%
Amortization of debt discount			125		117		8	6.8%
Total debt servicing cost - wastewater services	В	\$	17,754	\$	17,764	\$	(10)	(0.1%)
Stormwater Services								
Interest on long term debt		\$	727	\$	685	\$	42	6.1%
Repayment on long term debt			2,059		1,806		253	14.0%
Amortization of debt discount			22		18		4	22.2%
Total debt servicing cost - stormwater services	С	\$	2,808	\$	2,509	\$	299	11.9%

### Notes related to Table 15:

- A) *Water debt servicing costs* of \$8.0 million have increased \$0.6 million from the prior year as a result of \$22.0 million in new debt.
- B) *Wastewater debt servicing costs* of \$17.6 million have increased \$0.1 million from the prior year as a result of \$13.4 million in new debt.
- C) *Stormwater debt servicing costs* of \$2.8 million have increased \$0.3 million from the prior year as a result of \$9.6 million in new debt.

### Table 16: Operating Results by Activity:

	Operating Results by Activity										
		Budget 2021/22	Forecast 2021/22	Actual 2021/22	Actual 2020/21	From Pr	ior Year	Actual to	Forecast	Budget to	Forecast
	Notes	'000	'000	'000	'000	\$ Change	% Change	\$ Remaining	% Remaining	\$ Change	% Change
Regulated activities	A	\$ (12,175)	\$ (5,124)	\$ (6,889)	\$ (11,397)	\$ 4,508	(39.55%)	\$ (1,765)	34.45%	\$ 7,051	(57.91%)
Unregulated activities	в	525	437	507	826	(319)	(38.62%)	70	16.02%	(88)	(16.76%)
Loss		\$ (11,650)	\$ (4,687)	\$ (6,382)	\$ (10,571)	\$ 4,189	(39.63%)	\$ (1,695)	36.16%	\$ 6,963	(59.77%)

### Notes related to Table 16:

- A) *Regulated activities* loss has decreased from the prior year loss by \$4.5 million due to the factors as previously explained.
- B) Unregulated activities earnings of \$0.5 million have decreased \$0.3 million from the prior year due to an increase in operating costs for wastewater treatment and allocation of administrative costs.

Corporate Balan	Corporate Balance Scorecard - Responsible Financial Management									
			Budget		Actual		Actual	From	Budget to	
			2021/22		2021/22	2020/21		Prior Year	Actual	
	Notes		'000		'000		'000	% Change	% Change	
Expense to Revenue Ratio *(budget expenses reduced by \$1.6 million	<b>A</b>		81.99%		81.19%		83.45%	(2.26%)	(0.80%)	
Annual Cost per Connection - Water *(target reduced by 3%)	В	\$	543.00	\$	540.00	\$	509.07	6.08%	(0.55%)	
Annual Cost per Connection - Wastewater *(target reduced by 3%)	С	\$	758.00	\$	741.00	\$	727.43	1.87%	(2.24%)	
<ol> <li>Targets calculated based on the 2021/22 Operating Budget.</li> <li>Operating expenses reduced by \$1,600,000 to incorporate stretch goals for cost containment incentives.</li> </ol>										
<ul> <li>3 - Targets reported above exclude pension plan accrual amounts.</li> <li>4 - Connection costs are based on the budgeted customer base for March 31, 2021, with an estimated increase for the 2021/22 fiscal year.</li> </ul>										
5 - Forecast results to March 31, 2022.										

### Table 17: Corporate Balance Scorecard - Responsible Financial Management:

6 - Customer connections as at March 31, 2022

### Notes related to Table 17:

Halifax Water measures and reports annually specific indicators related to the performance of the utility. Three of the indicators are related to the financial results of the utility, these are the expense to revenue ratio, annual cost per connection for water services, and annual cost per connection for water services. The expense to revenue ratio is one of several gateway indicators which is required to be met in order to qualify for the organizational award.

- A) The budgeted expense to revenue ratio for the year was 81.99%. The actual as of March 31, 2022 is higher than budget.
- B) The budgeted *annual cost per connection for water services* for the year was \$543.00. The actual as of March 31, 2022 is less than budget.
- C) The budgeted *annual cost per connection for wastewater services* for the year was \$758.00. The actual as of March 31, 2022 is less than budget.

### **Attachments**

Attachment 1: Financial statements for the fiscal year ended March 31, 2022.

Report prepared by:	Alicia Scallion Date: 2022.06.14 15:20:46 -03'00'	_	
	Alicia Scallion, CPA, CA Manager, Accounting (902) 497-9785		



**Financial Statements** 

Halifax Regional Water Commission

March 31, 2022



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# Independent auditor's report

To the Members of the Board of the Halifax Regional Water Commission

Grant Thornton LLP Nova Centre, North Tower Suite 1000, 1675 Grafton Street Halifax, NS B3J 0E9

T (902) 421-1734 F (902) 420-1068 www.GrantThornton.ca



# Halifax Regional Water Commission Statement of financial position

March 31 (in thousands) 2022 2021 Assets Current \$ 65,586 Cash and cash equivalents \$ 48,228 Receivables (Note 8) Customer charges and contractual 15,900 17,155 Unbilled service revenues 18,838 18,246 Halifax Regional Municipality 851 2.711 Inventory 2,042 2,003 Prepaids 2,408 1,570 105,625 89,913 Intangible assets (Note 10) 20,805 20,588 Capital work in progress 51,013 30,908 1,277,360 1,280,283 Utility plant in service (Note 11) 1,454,803 Total assets 1,421,692 Regulatory deferral account (Note 5) 2,428 2,620 Total assets and regulatory deferral account \$ 1,457,231 \$ 1,424,312 Liabilities Current Payables and accruals Trade \$ 23,255 \$ 12,644 5,060 6,192 Non-trade Interest on long term debt 2,038 2,065 2,705 Contractor and customer deposits 2,115 Current portion of deferred contributed capital (Note 12) 14,614 14,580 Current portion of long term debt (Note 13) 46,272 20,559 1<u>05</u> Unearned revenue 80 94,024 58,260 Deferred contributed capital (Note 12) 893,975 884,372 Long term debt (Note 13) 177,910 204,106 Employee benefit obligations (Note 4) 41,950 73,796 **Total liabilities** 1,207,859 1,220,534 Equity Accumulated other comprehensive income (loss) 11,225 (29, 682)Accumulated surplus 238,147 233,460 Total equity 249,372 203,778 **Total liabilities and equity** <u>\$ 1,457,231</u> \$ 1,424,312 Contingent liabilities (Note 3)

Commitments (Note 6)

Approved by the Halifax Regional Water Commission Board

\_ Chair

Vice Chair

Halifax Regional Water Commission Statement of earnings and comprehensive earn	ings			
Year ended March 31 (in thousands)	5	2022		2021
Water	¢	18 180	¢	17 631
Water	φ	40,109	φ	47,031
Stermuster		40,040		09,005
Stormwater Dublic fire protection		10,129		8,962
Public fire protection		7,628		7,330
Private fire protection		1,270		1,001
Other operating revenue		2,640		2,034
		150,502		136,569
Operating expenditures (Note 14)				
Water supply and treatment		10.760		9,987
Water transmission and distribution		11,316		10,960
Wastewater collection		12 988		12 710
Stormwater collection		4 566		4 700
Wastewater treatment		21 774		20 623
Engineering and technology services		13 710		11 171
Regulatory convices		13,713		2 0 9 1
Customer convises		4,392		5,901
		4,011		5,001
Administration convinces		5,002		-
Administration services		5,359		7,007
Pension services		9,229		7,086
Depreciation and amortization		49,572		48,607
		151,548		141,973
Loss from operations before financial and other				
revenues and expenditures		(1.046)		(5 404)
		(1,0.0)		(0,10.1)
Financial and other revenues				
Interest		178		215
Amortization of deferred contributed capital		18,592		18,810
Other		837		2,229
		<u>19,607</u>		21,254
Financial and other expenditures				
Interest on long term debt		6,859		7,118
Amortization of debt issue costs		228		209
Dividend/grant in lieu of taxes (Note 6)		6,466		5,951
Other		129		70
		13,682		13,348
Farnings for the year before regulatory deferral account				
depreciation		1 879		2 502
depreciation		4,073		2,002
Regulatory deferral account depreciation		(192)		(192)
Earnings for the year		4,687		2,310
Other comprehensive earnings (loss)				
Items that will not be reclassified subsequently to earnings:				
Re-measurement on defined benefit plans		<u>40,907</u>		(3,229)
Total comprehensive earnings (loss) for the year	\$	45.594	\$	(919)
	<u>¥</u>		<u>¥</u>	(010)

# Halifax Regional Water Commission Statement of changes in equity

Year ended March 31 (in thousands)

	Accumulated other comprehensive income (loss)	Accumulated	Total
Balance, April 1, 2020	<u>\$ (26,453)</u>	<u>\$     231,150</u>	<u>\$ 204,697</u>
Earnings for the year Other comprehensive loss Comprehensive earnings (loss) for the year	(3,229) (3,229)	2,310  2,310	2,310 (3,229) (919)
Balance, March 31, 2021	<u>\$ (29,682)</u>	<u>\$ 233,460</u>	<u>\$ 203,778</u>
Earnings for the year Other comprehensive earnings Comprehensive earnings for the year	- 40,907 40,907	4,687  4,687	4,687 <u>40,907</u> <u>45,594</u>
Balance, March 31, 2022	<u>\$ 11,225</u>	<u>\$     238,147</u>	<u>\$249,372</u>

# Halifax Regional Water Commission Statement of cash flows

Year ended March 31 (in thousands)

Increase (decrease) in cash and cash equivalents

Operating				
Comprehensive earnings (loss) for the year	\$	45.594	\$	(919)
Depreciation and amortization	•	32,492	•	31.592
Employee benefit obligation		(31,846)		10,431
Gain on disposal of utility plant in service		(219)		(1,481)
Can on alopooar of anny plant in control		46.021		39 623
		.0,021		00,020
Change in non-cash operating working capital items				
Receivables, customer charges and contractual		1,255		1,250
Receivables, unbilled service revenues		(592)		(879)
Receivable from Halifax Regional Municipality		1,860		957
Inventory		(39)		(267)
Prepaids		(838)		(568)
Payables and accruals, trade		10,611		(9,303)
Pavables and accruals, non-trade		(1,132)		808
Pavables and accruals, accrued interest on long term debt		(27)		(74)
Contractor and customer deposits		590		493
Unearned revenue		(25)		(473)
		11.663		(8.056)
		57,684		31,567
Financing				· · · ·
Proceeds from issuance of long term debt		20,000		26,700
Contributed capital and interest		20.958		16.226
Amortization of debt issue costs		75		3
Principal repayment on Halifax Regional Municipality long term debt		(6.500)		(6.500)
Principal repayments on long term debt		(14,058)		(14,684)
		20.475		21.745
Investing				
Proceeds from sale of utility plant in service		940		1,576
Purchase of capital work in progress		(34,203)		(23,031)
Purchase of utility plant in service and intangible assets		(27,538)		(33,582)
		(60,801)		(55,037)
Net increase (decrease) in cash and cash equivalents		17,358		(1,725)
				10.0=5
Cash and cash equivalents, beginning of year		48,228		<u>49,953</u>
Cash and cash equivalents, end of year	\$	65,586	\$	48,228
	••	<b>i</b>	· ·	· · · ·

2022

2021

March 31, 2022 (in thousands)

### 1. Nature of operations

The Halifax Regional Water Commission (Halifax Water) is a public utility owned and controlled by the Halifax Regional Municipality (HRM). Halifax Water is responsible for the supply of municipal Water, Wastewater and Stormwater Services to the residents of HRM. Halifax Water's principal place of business is 450 Cowie Hill Road, Halifax, Nova Scotia. Halifax Water is exempt from income tax.

### 2. Summary of significant accounting policies

### (a) Statement of compliance

The financial statements have been prepared in accordance with International Financial Reporting Standards (IFRS) issued by the International Accounting Standards Board (IASB). The principal accounting policies applied in the preparation of these financial statements are set out below. These policies have been consistently applied to all years presented, unless otherwise stated.

The financial statements were authorized for issue by the Board of Commissioners on June 23, 2022.

### (b) Basis of measurement

Halifax Water's financial statements are prepared on the historical cost basis, except for certain financial instruments measured at fair value. The financial statements are presented in Canadian dollars and all values are rounded to the nearest thousand. The financial statements are presented in accordance with International Accounting Standards (IAS) 1: Presentation of Financial Statements.

### (c) Regulation

In matters of administrative policy relating to customers, rates and other charges, capital expenditures, depreciation rates and accounting matters, Halifax Water is subject to the jurisdiction of the Nova Scotia Utility and Review Board (NSUARB). Rates and other charges charged to and collected from customers are designed to recover the cost of providing the regulated services. Halifax Water is required to prepare submissions in accordance with the Water Utility Accounting and Reporting Handbook (the NSUARB Handbook) issued by the NSUARB. There are differences in the accounting treatment of certain transactions from IFRS including the accounting of principal debt payments, employee future benefits, depreciation and amortization, gains and losses on the disposal of utility plant in service, and accumulated surplus.

Regulatory assets represent costs incurred that have been deferred as approved by the NSUARB and will be recovered through future rates collected from customers. These assets are described as the "regulatory deferral account" and are disclosed in Note 5.

### (d) Utility plant in service

Utility plant in service (Note 11) is recorded at cost, being the purchase price and directly attributable cost of acquisition or construction. Losses or gains related to assets retired, demolished or sold are charged or credited to the statement of earnings.

### (e) Leased assets

Halifax Water makes use of lease arrangements for office space and equipment, and assesses whether a contract is, or contains a lease at the inception of the contract. A lease conveys the right to direct the use and obtain substantially all of the economic benefits of an identified asset for a period of time in exchange for consideration.

At lease commencement date, Halifax Water assess whether the recognition of a right-of-use asset and lease liability would have a material impact on the financial statements.

March 31, 2022 (in thousands)

### 2. Summary of significant accounting policies (continued)

### (e) Leased assets (continued)

A right-of-use asset is initially measured at cost, which is comprised of the initial measurement of the lease liability, any initial direct costs incurred, an estimate of any costs to dismantle and remove the asset at the end of the lease, and any lease payments made in advance of the lease commencement date (net of any incentives received). A right-of-use asset is subsequently measured at cost less any accumulated depreciation or impairment losses and adjusted for certain remeasurements of the lease liability. A lease liability is initially measured at the present value of the lease payments that are not paid at the commencement date, discounted using the interest rate implicit in the lease or, if that rate cannot be readily determined, Halifax Water's incremental borrowing rate.

Halifax Water has elected to apply the practical expedients available under IFRS 16 for short-term leases and leases for which the underlying asset is of low value. Short-term leases and low value leases are expensed in the period incurred.

Halifax Water maintains very few lease arrangements and management will assess future leases as they arise to determine whether the impact of the recognition of a right-of-use asset and lease liability on the statements of financial position, where Halifax Water is acting as a lessee, is material to the financial statements. All existing leases have been assessed and recognition in the financial statements has been deemed immaterial.

### (f) Deferred contributed capital

Contributions towards capital projects are treated as deferred contributed capital on the statement of financial position and amortized over the estimated useful lives of the assets (Note 12). Deferred contributed capital is initially measured at cost, being the value of contributions received by Halifax Water for the acquisition of utility plant in service. Contributions for capital expenditures are amortized over the estimated useful lives of the assets and show as a reduction in the amortization of utility plant in service.

### (g) Cash and cash equivalents

Cash and cash equivalents consist of cash on hand and cash balances managed by HRM that are held within financial institutions.

### (h) Depreciation of utility plant in service

Depreciation is calculated using the straight-line method over the estimated useful lives of the assets.

The estimated useful lives for the major classifications of utility plant in service are as follows:

Office equipment and furniture and	
transportation equipment	3 to 10 years
Supervisory control and data acquisition	
(SCADA) equipment	5 to 25 years
Meters	20 to 25 years
Pumping equipment	5 to 30 years
Tools and work equipment	5 to 30 years
Culverts	25 to 50 years
Purification and treatment equipment	20 to 50 years
Services and laterals	50 to 60 years
Hydrants	50 to 80 years
Structures and improvements	50 to 100 years
Water, Wastewater and Stormwater mains	50 to 100 years

March 31, 2022 (in thousands)

### 2. Summary of significant accounting policies (continued)

### (h) Depreciation of utility plant in service (continued)

Depreciation commences in the year an asset is placed into service and ready for its intended use. In the year of acquisition, depreciation is calculated at 50% of the above rates unless a project is significant, in which case depreciation is prorated for the number of months the asset was in use. Halifax Water does not maintain a depreciation fund per regulatory reporting requirements. Halifax Water has received NSUARB approval for exemption from establishing a depreciation fund as long as net depreciable additions to utility plant in service exceed the depreciation expense included within the rates.

### (i) Inventory

Inventory is comprised of direct materials and supplies. Inventory is valued at the lower of cost and net realizable value with cost being determined on the weighted average cost method.

### (j) Revenues and expenditures

Halifax Water recognizes revenue in a manner that depicts the transfer of goods or services to customers at an amount that reflects the consideration Halifax Water is entitled to in exchange for those goods or services rendered.

All revenues and expenditures are recorded on an accrual basis. Revenues relating to supplying Water, Wastewater and Stormwater Services are recorded based on cyclical billings and include an accrual for estimated amounts not yet billed. Fire protection revenue is recorded based on approved rates. Other revenues are recorded at the time services are performed, the amount can be measured reliably, and collection is reasonably assured.

### (k) Long term debt

Debt issue costs are deferred and amortized over the term of the debt to which they relate.

### (I) Use of estimates and critical accounting judgments

In preparing Halifax Water's financial statements, management is required to make estimates and assumptions that affect the reported amounts of assets and liabilities, the disclosure of contingent assets and liabilities at the date of the financial statements and reported amounts of revenue and expenditures during the period. Significant estimates and assumptions include the following:

- At year end, unbilled service revenues from Water, Wastewater and Stormwater Services have been earned, but not yet billed due to the timing of the billing cycles. Management estimates the unbilled service revenues accrual based on historic billing trends.
- Management assumptions are used in the actuarial determination of employee benefit obligations, such as standard rates of inflation, mortality, discount rates, and anticipation of future salary increases.
- Useful lives of utility plant in service are reviewed based on expected patterns of usage and historical information.
- Recognition and measurement of provisions and contingencies.

Actual results could differ from these estimates.

### (m) Financial instruments

### Recognition and derecognition

Financial assets and financial liabilities are recognized when Halifax Water becomes a party to the contractual provisions of the financial instrument. Financial assets are derecognized when the contractual rights to the cash flows from the financial asset expire, or when the financial asset and substantially all the risks and rewards are transferred. A financial liability is derecognized when it is extinguished, discharged, cancelled or expired.

March 31, 2022 (in thousands)

### 2. Summary of significant accounting policies (continued)

### (m) Financial instruments (continued)

### Classification and initial measurement of financial instruments

All financial instruments are initially measured at fair value and adjusted for transaction costs, where applicable. Financial instruments are classified as: those measured at amortized cost, fair value through other comprehensive income (assets only), or fair value through profit and loss (FVTPL).

Halifax Water has classified its financial instruments as follows:

Asset/Liability	<b>Classification</b>
Cash and cash equivalents	Amortized cost
Receivables	Amortized cost
Payables and accruals	Amortized cost
_ong term debt	Amortized cost
Contractor and customer deposits	Amortized cost

The classification is determined by both the Halifax Water business model for managing the financial instrument and the contractual cash flow characteristics of the financial instrument.

### Subsequent measurement of financial assets

Financial assets are measured at amortized cost if the assets meet the following conditions, and are not designated as FVTPL:

- they are held within a business model whose objective is to hold the financial assets and collect its contractual cash flows; and
- the contractual terms of the financial assets give rise to cash flows that are solely payments of principal and interest on the principal amount outstanding.

After initial recognition, financial instruments are measured at amortized cost using the effective interest method. Discounting is omitted where the effect of discounting is immaterial.

### Impairment of financial assets

Impairment requirements use more forward-looking information to recognize expected credit losses, the expected credit loss (ECL) model. Financial assets that are subject to the ECL model include cash and cash equivalents and receivables.

### (n) Provisions

A provision is recognized in the statement of financial position when Halifax Water has a legal or constructive obligation as a result of a past event, and it is probable that an outflow of economic benefits will be required to settle the obligation. If the effect is material, provisions are determined by discounting the expected future cash flows at a rate that reflects current market assessment of the time value of money and, where appropriate, the risks specific to the obligation.

### (o) Impairments

At the end of each reporting period, Halifax Water reviews the carrying amounts of its tangible and intangible assets to determine whether there is an indication of an impairment loss. If any such indication exists, the recoverable amount of the assets is estimated in order to determine the extent of impairment loss, if any. The recoverable amount of any asset is the higher of its fair value less costs to sell and its value in use. Where it is not possible to estimate the recoverable amount of an individual asset, the impairment test is carried out on the asset's cash-generating unit (CGU), which is the lowest group of assets to which the asset belongs for which there are separately identifiable cash inflows that are largely independent of the cash inflows from other assets. Halifax Water has three CGU's (Water, Wastewater and Stormwater) for which impairment testing is performed.

March 31, 2022 (in thousands)

### 2. Summary of significant accounting policies (continued)

### (o) Impairments (continued)

If the recoverable amount of the asset is estimated to be less than its carrying amount, the carrying amount of the asset is reduced to its recoverable amount. An impairment loss is recognized immediately in earnings. When an impairment loss is subsequently reversed, the carrying amount of the assets is increased to the revised estimate of its recoverable amount, but so that the increased carrying amount does not exceed the carrying amount that would have been determined had no impairment loss been recognized for the asset in prior years.

### (p) Intangible assets

Intangible assets include land rights, water removal rights, studies, and capital master plans. These are recorded at cost less accumulated amortization. Land rights include payment for easements and right of use over land and have an indefinite useful life. Intangibles with finite useful lives are amortized annually over the estimated useful lives. The expected useful lives are as follows:

Intangible assets 10 to 30 years

### (q) Employee benefit obligations

Halifax Water accrues annually, the estimated liabilities for pension and other employee benefits.

### Pension benefits

Halifax Water provides employment, post-retirement and pre-retirement benefits through defined benefit plans and supplemental retirement plans.

The cost of pension benefits for the supplemental retirement plans are expensed at the time active employees are compensated.

The defined benefit plan sponsored by Halifax Water determines the amount of pension benefits employees will receive on retirement by reference to length of service and salary levels. Obligations associated with the defined benefit plan reside with Halifax Water, even if plan assets for funding the plan are set aside.

The liability recognized in the statement of financial position for the defined benefit plan sponsored by Halifax Water is the present value of the defined benefit obligation at the end of the reporting date less the fair value of plan assets.

Management estimates the defined benefit obligation annually with assistance from an independent actuary using the projected unit credit method. The defined benefit obligation uses estimates for inflation, medical cost trends, mortality, and anticipated salary levels. The discount factor used to present value estimated future cash flows is determined with reference to high quality corporate bonds that have terms to maturity approximating the terms of the related pension liability.

Gains and losses resulting from re-measurements of the net defined benefit liability are charged to other comprehensive income in the period in which they arise. Service costs are recognized immediately into earnings.

Net interest cost related to pension obligations and returns on plan assets are included in salary and benefits on the statement of earnings.

Halifax Water is responsible for funding the employer share of contributions to the HRM pension plan for certain employees that transferred from HRM as of August 1, 2007. HRM administers this defined benefit pension plan and Halifax Water reimburses HRM for the pension costs related to Halifax Water's proportionate share of the employees covered under the plan. Due to the nature of the plan, Halifax Water does not have sufficient information to account for the plan as a defined benefit pension plan; therefore, the multi-employer defined benefit plan is accounted for in the same manner as the supplemental retirement plans. An expense is recorded in the period when Halifax Water is obligated to make contributions for services rendered by the employee.
March 31, 2022 (in thousands)

### 2. Summary of significant accounting policies (continued)

### (q) Employee benefit obligations (continued)

### Short-term employee benefits

Short-term employee benefit obligations that are due to be settled wholly within twelve months after the end of the annual reporting period in which the employees rendered the related service are measured on an undiscounted basis and are expensed as the related service is provided.

### (r) Regulatory deferral account

The regulatory deferral account is recognized and measured at historical cost less depreciation. Management continually assesses the likelihood of recovery of regulatory assets. If recovery through future rates is no longer considered probable, the amounts would be charged to the results of operations in the period that the assessment is made.

### 3. Contingent liabilities

As a condition of sale in 2004 of a property, Halifax Water indemnified the purchaser from claims or actions resulting from migration of halocarbons. The environmental risk is assessed to be low and the likelihood of any related liability is not determinable.

Halifax Water is currently reviewing environmental risk factors at other owned properties to determine whether there is an obligation for reclamation. As of the date of issue of the financial statements the likelihood of any related liability is not determinable.

Halifax Water has been named in lawsuits that are ongoing and a liability has been accrued for legal fees and the insurance deductible.

There are other active claims against Halifax Water; however, the likelihood of actual liability is not determinable at this time. If Halifax Water's defence of active claims is unsuccessful, the potential exposure would be \$1,000 - \$2,000.

### 4. Employee benefit obligations

### Retirement benefit plan – employees transferred from HRM

For employees that transferred from HRM, Halifax Water records an expense for the employer share of the contributions to the Halifax Regional Municipality Pension Plan (HRM Pension Plan) in the period when Halifax Water is obligated to make contributions for services rendered by the employee. During 2022, Halifax Water funded \$532 (2021 – \$543) in contributions to the HRM Pension Plan. The number of employees included in this plan is 53 (2021 – 55) and this number is reducing over time. As former HRM employees retire, they are replaced with employees in the Halifax Regional Water Commission Employee Pension Plan (the Plan).

### Supplemental retirement plans sponsored by Halifax Water

For employees who participate in the supplemental retirement plans, the cost of pension benefits are expensed at the time active employees are compensated. During 2022, Halifax Water funded 23 (2021 - 23) in contributions to these plans. The number of employees included in these plans is 6 (2021 - 7).

### Defined benefit plan sponsored by Halifax Water and other long term employment benefits

For all other employees, Halifax Water maintains a defined benefit pension plan and offers post-retirement health and insurance benefits. The defined benefit pension plan provides pensions based upon length of service and best seven consecutive years' earnings. The defined benefit pension plan is funded by employer and employee contributions with employees contributing 9.60% of pensionable employee earnings (10.34% to December 31, 2021), and Halifax Water matching employee contributions. The defined benefit pension plan assets are managed by the HRM Pension Committee.

March 31, 2022 (in thousands)

### 4. Employee benefit obligations (continued)

Employees, who retired prior to July 1, 1998, have extended health benefits coverage for life and drug coverage until age 65. Employees, who retired after July 1, 1998 and before December 31, 2008, have coverage for drug, extended health, dental and life insurance until age 65 on a 50/50 cost shared basis and a 100% basis for employees who retired after December 31, 2008. Extended health coverage for these retirees and their spouses after the age of 65 is available on an optional basis at 100% retiree cost and drug coverage is available through the provincially managed drug program.

Halifax Water has a non-funded pre-retirement benefit that is accrued annually, and is payable on retirement, termination or death of the employee. For individuals who elected to defer receipt of their benefit until the time which they leave employment, their individual benefit equates to approximately three days' pay for each year of completed service. Completed service for unionized employees was frozen as at June 7, 2019, and June 20, 2019 for non-union employees, for the purposes of determining their pre-retirement benefit. Pre-retirement benefits accrue to a maximum of six months' salary and can be taken as a lump sum payment at the time of retirement in lieu of pre-retirement leave.

Information about Halifax Water's plans, based on an actuarial extrapolation of the defined benefit pension plan, and an actuarial valuation of the pre-retirement benefits and the post-retirement benefits as at March 31, 2022, is as follows:

	Defined ben	Defined benefit pension plan		ement benefits	Pre-retire	ment benefits	Total		
	2022	2021	2022	2021	2022	2021	2022	2021	
Change in accrued benefit obligat	ion								
Balance, April 1	\$ 227,572	\$ 195,904 <b>\$</b>	395	\$ 460	\$ 1,718	\$ 1,536	\$ 229,685	\$197,900	
Current service cost	13,648	11,036	-	-	100	91	13,748	11,127	
Interest cost	7,877	7,549	10	15	52	57	7,939	7,621	
Benefit payments	(5,433)	(5,514)	(53)	(53)	(92)	(106)	(5,578)	(5,673)	
Re-measurements – actuarial (gains)/ losses from changes in	/								
financial/experience assumptions	(35,037)	18,597	(42)	(27)	(141)	140	(35,220)	18,710	
Balance, March 31	208,627	227,572	310	395	1,637	1,718	210,574	229,685	
Change in fair value of plan asset	S								
Balance, April 1	155,889	134,535	-	-	-	-	155,889	134,535	
Investment income	5,326	5,129	-	-	-	-	5,326	5,129	
Administrative expenses	(80)	(69)	-	-	-	-	(80)	(69)	
Actual return on plan assets	5,869	15,362	-	-	-	-	5,869	15,362	
Benefit payments	(5,433)	(5,514)	(53)	(53)	(92)	(106)	(5,433)	(5,673)	
Contributions: Employee	3,581	3,287	-	-	-	-	3,581	3,287	
Employer	3,472	3,159	53	53	92	106	<u>3,472</u>	3,318	
Balance, March 31	168,624	155,889	-	<u> </u>		<u> </u>	168,624	155,889	
Accrued benefit liability, March 31	<u>\$ 40,003</u>	<u>\$    71,683</u> <u></u> \$	310	<u>\$ 395</u>	<u>\$    1,637 </u>	<u>\$ 1,718</u>	\$ 41,950	<u>\$ 73,796</u>	

March 31, 2022 (in thousands)

### 4. Employee benefit obligations (continued)

Included in the statement of earnings and comprehensive earnings is pension expense of \$13,066 (2021 - \$10,903).

The significant actuarial assumptions adopted in measuring Halifax Water's accrued benefit obligations are as follows:

	2022 Defined	2021 Defined	2022	2021	2022	2021
	benefit	benefit	Post-	Post-	Pre-	Pre-
_	pension plan	plan	benefits	benefits	benefit	benefit
Discount rate	4.00%	3.40%	3.70%	2.75%	3.90%	2.90%
Expected return on plan assets	4.00%	3.40%	N/A	N/A	N/A	N/A
Rate of compensation increase	3.75%	3.75%	N/A	N/A	3.75%	3.75%
Expenses for life benefits as a % of claims	5 <b>N/A</b>	N/A	9.36%	9.36%	N/A	N/A
Health benefit trending per year	N/A	N/A	6.18%	6.26%	N/A	N/A
Dental benefit trending per year	N/A	N/A	4.00%	4.00%	N/A	N/A

The measurement date used to determine the plan assets and the accrued benefit obligation was March 31, 2022. The most recent actuarial valuation for the defined benefit pension plan was January 1, 2022, with the next going concern extrapolation scheduled for January 1, 2023.

The estimated employer contributions expected to be paid to the pension plans for the next fiscal year are \$3,831.

#### 5. Regulatory deferral account

In 2011, the NSUARB granted Halifax Water approval to defer depreciation charges on certain assets transferred in 2010 from HRM relating to the Halifax Harbour Solutions Project (HHSP). Depreciation of \$2,078 was deferred in each of fiscal 2011 and 2012. As a result, Halifax Water recognized a \$4,156 regulatory deferral account. In absence of rate regulation, this regulatory deferral account would have been expensed as depreciation in fiscal 2011 and 2012. In 2012, the NSUARB granted approval of the depreciation of this deferral account over the remaining useful lives of the underlying assets, beginning in 2014. The expense recognized in 2022 is \$192 (2021 - \$192).

	<u>2022</u>	<u>2021</u>
Balance, April 1 Depreciation	\$ 2,620 \$ <u>(192)</u>	2,812 (192)
Balance, March 31	\$ <b>2,428</b> \$	2,620

### 6. Commitments

An agreement with HRM for the dividend/grant in lieu of taxes (dividend) for fiscal years 2020/21 to 2022/23 was signed in the prior fiscal year. Dividend payments are approved as part of revenue requirements by the NSUARB. For the Water System, the dividend is equal to 1.56% of Halifax Water's rate base assets allocated to the Water System at March 31 of the previous fiscal year. For the Wastewater System and Stormwater System, the dividends are equal to 0.25% of Halifax Water's rate base assets allocated to the Wastewater's rate base assets allocated to the Stormwater System at March 31 of the previous fiscal year, plus 0.25% of Halifax Water's rate base assets allocated to the Stormwater System at March 31 of the previous fiscal year.

For 2021/22, the dividends have been capped at 1% more than the dividend amounts for 2020/21 that would have been payable had the dividend amounts for 2020/21 been for a full year. The dividends paid in 2020/21 were prorated from the effective date of the agreement of October 1, 2020. The dividends payable for 2022/23 will be capped at 1% more than the dividends payable in the preceding fiscal year.

March 31, 2022 (in thousands)

### 7. Capital management

Halifax Water's objective when managing capital is to ensure sufficient liquidity to support its financial obligations and execute its operating and capital plans. Halifax Water monitors and adjusts its capital structure through additional borrowings of long term debt which are used to finance capital projects.

Halifax Water considers its total capitalization to include all long term debt and total equity. The calculation is set out as follows:

	<u>2022</u>	<u>2021</u>
Long term debt Equity	\$ 224,182 249,372	\$ 224,665 203,778
Capital under management	\$ 473,554	\$ 428,443

Halifax Water has obtained regulatory approval for all borrowings during the fiscal year. Halifax Water is not subject to financial borrowing covenants other than as outlined in Note 9.

### 8. Financial instruments and risk management

Halifax Water applies a three-tier hierarchy framework for disclosing fair value of financial instruments, based on whether the inputs into the various valuation techniques are observable or unobservable. Observable techniques reflect market data obtained from independent sources, while unobservable inputs reflect management assumptions. Changes in valuation techniques of financial instruments may result in transfers of assigned levels. The hierarchy of input is as follows:

- Level I Quoted prices in active markets for identical assets or liabilities;
- Level II Inputs other than quoted prices included in Level I that are observable, either directly or indirectly; and
- Level III Inputs that are not based on observable market data.

The carrying values of current assets and current liabilities approximate their fair value due to the relatively short period to maturity of these financial instruments. The fair value of fixed rate long-term debt is assumed to approximate its carrying value given the limitations where Halifax Water can obtain long-term debt.

There were no transfers between classes of the fair value hierarchy during the year.

Halifax Water is exposed to risks as a result of holding financial instruments. Management considers and evaluates those risks on an on-going basis to ensure that the risks are appropriately managed. These potential risks include credit risk, interest risk, market risk and liquidity risk.

March 31, 2022 (in thousands)

#### 8. Financial instruments and risk management (continued)

#### Credit risk

Credit risk arises from the possibility that Halifax Water's customers may experience financial difficulty and be unable to fulfill their obligations. Halifax Water's maximum exposure to credit risk corresponds to customer charges and contractual receivables. However, Halifax Water's customers are numerous and diverse, which reduces the concentration of credit risk.

Halifax Water makes use of a simplified approach in accounting for receivables and records the loss allowance as lifetime ECL. These are the expected shortfalls in contractual cash flows, considering the potential for default at any point during the life of the financial instrument. In calculating, Halifax Water uses its historical experience, external indicators and forward-looking information to calculate the ECL using a provision matrix. Halifax Water includes 75% of the balance of closed accounts in the allowance and 1% of active accounts. Halifax Water assesses impairment of receivables on a collective basis. As receivables possess shared credit risk characteristics, receivables have been grouped based on the days past due.

An analysis of Halifax Water's receivables and continuity of Halifax Water's provision for impairment losses on receivables is as follows:

		<u>2022</u>		<u>2021</u>
Receivables Customer charges, contractual, and unbilled service revenues Less: allowance for doubtful accounts	\$	37,969 (3,231)	\$	38,654 <u>(3,253)</u>
	<u>\$</u>	34,738	<u>\$</u>	35,401

The credit quality of financial assets that are neither past due nor impaired are assessed with reference to historical information and includes the following considerations; new customers, existing customers and payment pattern history.

#### Interest risk

Interest risk arises from the possibility that changes in interest rates will cause fluctuations in expenses and/or cash flows associated with Halifax Water's long term debt. Halifax Water's long term debt has been acquired with a variety of fixed rates and has staggered maturity dates which mitigates the interest rate risk.

#### Market risk

Market risk arises from the possibility that the value of an investment will fluctuate as a result of changes in market prices. These changes could affect the market value of the investments in Halifax Water's Plan and consequently the Plan's surplus. The risk is mitigated by the Plan diversifying the types of investments in its portfolio.

#### Liquidity risk

Liquidity risk arises from the possibility of Halifax Water not being able to meet its cash requirements in a timely and costeffective manner. Halifax Water manages this risk by closely monitoring the cash on hand in comparison to upcoming cash commitments.

March 31, 2022 (in thousands)

### 9. Related party transactions

The immediate parent and ultimate controlling party of Halifax Water is HRM.

Halifax Water is obligated to make payments on debt, held in the name of HRM, associated with Wastewater and Stormwater assets which were transferred to Halifax Water in 2007 and subsequent years.

Amounts receivable from HRM have normal credit terms.

Halifax Water had the following related party transactions with HRM:

		<u>2022</u>	<u>2021</u>
Revenue for provision of Water, Wastewater and Stormwater Services Public fire protection revenue Dividend Operating expenditures	\$	4,987 7,628 (6,466) <u>(1,537)</u>	\$ 4,808 7,336 (5,951) (1,694)
Net revenue and expenditures	<u>\$</u>	4,612	\$ 4,499

The debt issued by Halifax Water was covered by a blanket guarantee from HRM subject to Halifax Water maintaining a debt service ratio of less than 35%. The debt service ratio at March 31, 2022 is 18.98% (2021 – 20.29%).

### Compensation of key management personnel

Members of the Board of Commissioners and Executive Management team are deemed to be key management personnel. It is the Board of Commissioners and Executive Management team who have the responsibility for planning, directing and controlling the activities of Halifax Water.

The following is compensation expense for key management personnel:

		<u>2022</u>		2021
Regular compensation and benefits Post-employment benefits	\$	1,370 132	\$	1,428 163
Total compensation	<u>\$</u>	1,502	<u>\$</u>	1,591

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March 31, 2022 (in thousands)

| 10.   | Intangible assets     | <u>2022</u>      | <u>2021</u>  |
|-------|-----------------------|------------------|--------------|
| Cost  | st                    |                  |              |
| Ba    | alance, April 1       | \$ 29,498        | \$<br>25,933 |
| Ad    | dditions              | 2,469            | 3,565        |
| Ba    | alance, March 31      | 31,967           | <br>29,498   |
| Accu  | umulated amortization |                  |              |
| Ba    | alance, April 1       | 8,910            | 6,982        |
| An    | mortization           | 2,252            | 1,928        |
| Ba    | alance, March 31      | 11,162           | <br>8,910    |
| Net b | book value, March 31  | <u>\$ 20,805</u> | \$<br>20,588 |

### 11. Utility plant in service

|                                                                                                                       | Li                 | and                            | impro     | Structures<br>and<br>ovements               | ar        | Treatment<br>nd network<br>equipment        | [<br>and  | Distribution<br>I collection<br>network      | е         | Tools<br>and work<br>quipment             |             | Total                                            |
|-----------------------------------------------------------------------------------------------------------------------|--------------------|--------------------------------|-----------|---------------------------------------------|-----------|---------------------------------------------|-----------|----------------------------------------------|-----------|-------------------------------------------|-------------|--------------------------------------------------|
| Cost                                                                                                                  | •                  |                                |           |                                             |           |                                             |           |                                              |           |                                           |             |                                                  |
| Balance, April 1, 2021<br>Additions<br>Disposals<br>Balance, March 31, 2022                                           | \$25,<br>(2<br>25, | 989<br>-<br><u>218)</u><br>771 | \$        | 268,236<br>4,731<br><u>(332)</u><br>276,635 | \$        | 276,330<br>6,523<br><u>(218)</u><br>282,635 | \$        | 958,673<br>32,137<br><u>(162)</u><br>990,648 | \$        | 33,492<br>3,047<br><u>(985)</u><br>35,554 | \$1<br>1    | ,562,720<br>46,438<br><u>(1,915)</u><br>,607,243 |
| Accumulated depreciation<br>Balance, April 1, 2021<br>Depreciation<br>Depreciation retired<br>Balance, March 31, 2022 | \$                 | -<br>-<br>-                    | \$        | 72,724<br>9,111<br><u>(54)</u><br>81,781    | \$        | 86,766<br>15,536<br><u>(149)</u><br>102,153 | \$        | 112,483<br>18,222<br>(11)<br>130,694         | \$        | 10,464<br>5,771<br><u>(980)</u><br>15,255 | \$          | 282,437<br>48,640<br>(1,194)<br>329,883          |
| Net book value, March 31, 2022                                                                                        | <u>\$ 25</u>       | 771                            | <u>\$</u> | 190,854                                     | <u>\$</u> | 180,482                                     | <u>\$</u> | 859,954                                      | <u>\$</u> | 20,299                                    | <u>\$ 1</u> | <u>,277,360</u>                                  |

|                                                                                                                       | Land                             | impr      | Structures<br>and<br>ovements             | ar | Treatment<br>nd network<br>equipment       | [<br>and  | Distribution<br>collection<br>network | е         | Tools<br>and work<br>quipment               | Total                                         |
|-----------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------|-------------------------------------------|----|--------------------------------------------|-----------|---------------------------------------|-----------|---------------------------------------------|-----------------------------------------------|
|                                                                                                                       |                                  | •         |                                           |    |                                            |           |                                       |           |                                             |                                               |
| Cost<br>Balance, April 1, 2020<br>Additions<br>Disposals<br>Balance, March 31, 2021                                   | \$ 21,603<br>4,386<br><br>25,989 | \$        | 263,360<br>4,925<br>(49)<br>268,236       | \$ | 271,047<br>5,477<br>(194)<br>276,330       | \$        | 934,692<br>23,981<br>-<br>958,673     | \$        | 33,892<br>8,881<br>(9,281)<br>33,492        | \$1,524,594<br>47,650<br>(9,524)<br>1,562,720 |
| Accumulated depreciation<br>Balance, April 1, 2020<br>Depreciation<br>Depreciation retired<br>Balance, March 31, 2021 | \$ -<br>-<br>-<br>-              | \$        | 62,646<br>10,120<br><u>(42)</u><br>72,724 | \$ | 71,773<br>15,104<br><u>(111)</u><br>86,766 | \$        | 94,691<br>17,792<br>-<br>112,483      | \$        | 14,474<br>5,266<br><u>(9,276)</u><br>10,464 | \$ 243,584<br>48,282<br>(9,429)<br>282,437    |
| Net book value, March 31, 2021                                                                                        | <u>\$ 25,989</u>                 | <u>\$</u> | 195,512                                   | \$ | 189,564                                    | <u>\$</u> | 846,190                               | <u>\$</u> | 23,028                                      | <u>\$1,280,283</u>                            |

March 31, 2022 (in thousands)

#### Deferred contributed capital 12

| 12. Deferred contributed capital                                                                     | 2022                                     | <u>2021</u>                               |
|------------------------------------------------------------------------------------------------------|------------------------------------------|-------------------------------------------|
| Balance, April 1<br>Assets contributed during the year<br>Contributions and interest<br>Amortization | \$ 898,952<br>7,271<br>20,958<br>(18,592 | \$ 894,130<br>7,406<br>16,226<br>(18,810) |
| Balance, March 31                                                                                    | 908,589                                  | 898,952                                   |
| Less: current portion                                                                                | (14,614                                  | (14,580)                                  |
|                                                                                                      | <u>\$ 893,975</u>                        | <u>\$ 884,372</u>                         |

Deferred contributed capital is comprised of contributions received by Halifax Water for the acquisition of utility plant in service. Contributions for capital expenditures are amortized over the estimated useful lives of the assets.

| 13.  | Long-term debt                              | Interest rates   | <u>2022</u>   |           | <u>2021</u> |
|------|---------------------------------------------|------------------|---------------|-----------|-------------|
| Paya | able to Municipal Finance Corporation (MFC) |                  |               |           |             |
| Ŵ    | ater                                        | 0.400% to 4.221% | \$<br>79,286  | \$        | 74,648      |
| H    | HSP                                         | 2.015% to 2.561% | 5,200         |           | 5,850       |
| W    | astewater                                   | 0.400% to 3.614% | 96,915        |           | 97,670      |
| St   | ormwater                                    | 0.400% to 3.614% | 24,132        |           | 21,423      |
|      |                                             |                  | <br>205,533   |           | 199,591     |
| Pava | able to Halifax Regional Municipality       |                  |               |           |             |
| Ŵ    | astewater/Stormwater                        | 1.200% to 5.940% | 19,500        |           | 26,000      |
|      |                                             |                  | <br>225,033   |           | 225,591     |
| less | s: debt issue costs                         |                  | (851)         |           | (926)       |
| 2000 |                                             |                  | <br>224,182   |           | 224,665     |
| Less | s: amount payable within one year           |                  | (46.272)      |           | (20.559)    |
|      | ······································      |                  | <br><u> </u>  |           | (==,==)     |
|      |                                             |                  | \$<br>177,910 | <u>\$</u> | 204,106     |

During the year Halifax Water acquired \$20,000 in new debt with a ten year term and twenty year amortization period.

The debentures are repayable in fixed annual principal instalments plus interest payable semi-annually. Interest paid during the year was \$6,859 (2021 - \$7,118). Principal instalments for the next five years are as follows:

| 2022/23    | \$<br>46,272 |
|------------|--------------|
| 2023/24    | \$<br>42,951 |
| 2024/25    | \$<br>33,065 |
| 2025/26    | \$<br>23,417 |
| 2026/27    | \$<br>9,999  |
| Thereafter | \$<br>69,329 |

March 31, 2022 (in thousands)

| 14. Operating expenditures by nature            | <u>2022</u>   | <u>2021</u>   |
|-------------------------------------------------|---------------|---------------|
| Salaries and benefits                           | \$<br>43,817  | \$<br>42,007  |
| Pension                                         | 9,229         | 7,086         |
| Training                                        | 432           | 325           |
| Contract services                               | 13,938        | 13,182        |
| Electricity                                     | 7,160         | 6,868         |
| Operating supplies                              | 13,081        | 10,672        |
| Professional services                           | 5,953         | 5,650         |
| Chemicals                                       | 7,046         | 5,973         |
| Depreciation on assets allocated to departments | 1,320         | 1,603         |
| Depreciation and amortization                   | <br>49,572    | <br>48,607    |
|                                                 | \$<br>151,548 | \$<br>141,973 |

### 15. Subsequent event

On April 13, 2022, the NSUARB approved the Stormwater Service Expansion application filed on October 13, 2021. With that approval, Halifax Water will assume responsibility for Stormwater infrastructure in several new areas effective June 1, 2022 from HRM. A comprehensive assessment of the existing infrastructure will be required to determine the value of assets acquired in order to recognize the assets within the financial statements. Halifax Water will not compensate HRM for the transfer of these assets. In addition, an assessment of properties will be required to determine which are connected to the Stormwater system and will receive services.

### 16. Comparative figures

Certain of the comparative figures have been reclassified to conform to the financial statement presentation adopted for the current fiscal year.

### Halifax Regional Water Commission Schedule of utility plant in service

Year ended March 31, 2022 (in thousands)

#### Water

|                                                   |    | Land   | imp | Structures<br>and<br>provements | Pumping<br>equipment |    | Purification<br>equipment | SCADA<br>equipment | Tra | ansmission<br>and<br>distribution<br>mains | Services     | Meters       | Hydrants     | Ae<br>sma | rotech and<br>all systems |    | Tools and<br>work<br>equipment |    | Total   |
|---------------------------------------------------|----|--------|-----|---------------------------------|----------------------|----|---------------------------|--------------------|-----|--------------------------------------------|--------------|--------------|--------------|-----------|---------------------------|----|--------------------------------|----|---------|
| Cost                                              |    |        |     |                                 |                      |    |                           |                    |     |                                            |              |              |              |           |                           |    |                                |    |         |
| Balance, April 1, 2021                            |    |        |     |                                 |                      |    |                           |                    |     |                                            |              |              |              |           |                           |    |                                |    |         |
| Cost                                              | \$ | 18,433 | \$  | 121,564                         | \$<br>10,745         | \$ | 28,232                    | \$<br>11,371       | \$  | 411,533                                    | \$<br>43,158 | \$<br>19,147 | \$<br>21,990 | \$        | 10,048                    | \$ | 32,162                         | \$ | 728,383 |
| Additions                                         |    | -      |     | 1.593                           | 33                   |    | 1,179                     | 19                 |     | 7.086                                      | 1.894        | 208          | 457          |           | -                         |    | 3.514                          | -  | 15,983  |
| Disposals                                         |    | (218)  |     | (332)                           | -                    |    | , -                       | (97)               |     | (154)                                      | -            | (121)        | -            |           | -                         |    | (545)                          |    | (1,467) |
| Balance, March 31, 2022                           |    | 18,215 |     | 122,825                         | <br>10,778           | _  | 29,411                    | <br>11,293         |     | 418,465                                    | <br>45,052   | <br>19,234   | 22,447       |           | 10,048                    | _  | 35,131                         |    | 742,899 |
| Accumulated depreciation                          |    |        |     |                                 |                      |    |                           |                    |     |                                            |              |              |              |           |                           |    |                                |    |         |
| Balance, April 1, 2021                            |    | -      |     | 33.572                          | 8.167                |    | 19.863                    | 4.931              |     | 100.002                                    | 9.081        | 5.874        | 5.216        |           | 3.963                     |    | 16.695                         |    | 207.364 |
| Depreciation                                      |    | -      |     | 2,125                           | 301                  |    | 1,206                     | 536                |     | 5,287                                      | 769          | 900          | 365          |           | 333                       |    | 3,340                          |    | 15,162  |
| Depreciation retired                              |    | -      |     | (32)                            | -                    |    | -                         | (92)               |     | (10)                                       | -            | (57)         | -            |           | -                         |    | (545)                          |    | (736)   |
| Total accumulated depreciation,                   |    |        |     | <u> </u>                        | <br>                 |    |                           | <br>               |     |                                            |              |              |              |           |                           |    | · · · · ·                      |    |         |
| March 31, 2022                                    |    | -      |     | 35,665                          | 8,468                |    | 21,069                    | 5,375              |     | 105,279                                    | 9,850        | 6,717        | 5,581        |           | 4,296                     |    | 19,490                         |    | 221,790 |
| Net book value, March 31, 2022                    | \$ | 18,215 | \$  | 87,160                          | \$<br>2,310          | \$ | 8,342                     | \$<br>5,918        | \$  | 313,186                                    | \$<br>35,202 | \$<br>12,517 | \$<br>16,866 | \$        | 5,752                     | \$ | 15,641                         | \$ | 521,109 |
| Cost                                              |    |        |     |                                 |                      |    |                           |                    |     |                                            |              |              |              |           |                           |    |                                |    |         |
| Balance, April 1, 2020                            |    |        |     |                                 |                      |    |                           |                    |     |                                            |              |              |              |           |                           |    |                                |    |         |
| Cost                                              | \$ | 16,240 | \$  | 118,167                         | \$<br>10,686         | \$ | 27,775                    | \$<br>10,996       | \$  | 399,537                                    | \$<br>41,546 | \$<br>18,799 | \$<br>21,497 | \$        | 10,054                    | \$ | 33,048                         | \$ | 708,345 |
| Additions                                         |    | 2,193  |     | 3,546                           | 59                   |    | 474                       | 375                |     | 11,996                                     | 1,612        | 542          | 493          |           | -                         |    | 5,712                          |    | 27,002  |
| Disposals                                         |    | -      |     | (149)                           | <br>-                |    | (17)                      | <br>-              |     | -                                          | <br>-        | <br>(194)    | <br>-        |           | (6)                       |    | (6,598)                        |    | (6,964) |
| Balance, March 31, 2021                           | _  | 18,433 |     | 121,564                         | <br>10,745           | _  | 28,232                    | <br>11,371         |     | 411,533                                    | <br>43,158   | <br>19,147   | <br>21,990   |           | 10,048                    |    | 32,162                         |    | 728,383 |
| Accumulated depreciation                          |    |        |     |                                 |                      |    |                           |                    |     |                                            |              |              |              |           |                           |    |                                |    |         |
| Balance, April 1, 2020                            |    | -      |     | 31,504                          | 7,869                |    | 18,699                    | 4,405              |     | 94,804                                     | 8,347        | 5,082        | 4,860        |           | 3,627                     |    | 20,393                         |    | 199,590 |
| Depreciation                                      |    | -      |     | 2,082                           | 298                  |    | 1,166                     | 526                |     | 5,198                                      | 734          | 895          | 356          |           | 337                       |    | 2,856                          |    | 14,448  |
| Depreciation retired                              |    | -      |     | (14)                            | <br><u> </u>         |    | (2)                       | <br>-              |     |                                            | <br>-        | <br>(103)    | <br>-        |           | (1)                       |    | (6,554)                        |    | (6,674) |
| Total accumulated depreciation,<br>March 31, 2021 |    | -      |     | 33.572                          | 8.167                |    | 19.863                    | 4,931              |     | 100.002                                    | 9.081        | 5.874        | 5.216        |           | 3.963                     |    | 16.695                         |    | 207.364 |
| Net book value. March 31, 2021                    | \$ | 18,433 | \$  | 87.992                          | \$<br>2.578          | \$ | 8,369                     | \$<br>6.440        | \$  | 311.531                                    | \$<br>34.077 | \$<br>13.273 | \$<br>16.774 | \$        | 6.085                     | \$ | 15.467                         | \$ | 521.019 |

Schedule A is presented in accordance with the NSUARB Water Utility Accounting and Reporting Handbook (NSUARB Handbook).

Utility plant in service under IFRS differs from the NSUARB Handbook due to exclusion of intangible assets, componentization of certain assets and differences in useful lives for depreciation.

### Halifax Regional Water Commission Schedule of utility plant in service

Year ended March 31, 2022 (in thousands)

#### Wastewater

|                                 |    | Land  | imp | Structures<br>and<br>provements |    | Pumping<br>equipment |    | Treatment<br>equipment |    | SCADA<br>equipment |    | Collection<br>system |    | Laterals |    | Meters  | Ae<br>sma | rotech and<br>all systems |    | Tools and<br>work<br>equipment             |    | Total   |
|---------------------------------|----|-------|-----|---------------------------------|----|----------------------|----|------------------------|----|--------------------|----|----------------------|----|----------|----|---------|-----------|---------------------------|----|--------------------------------------------|----|---------|
| Cost                            |    |       |     |                                 |    |                      |    |                        |    |                    |    |                      |    |          |    |         |           |                           |    |                                            |    |         |
| Balance, April 1, 2021          |    |       |     |                                 |    |                      |    |                        |    |                    |    |                      |    |          |    |         |           |                           |    |                                            |    |         |
| Cost                            | \$ | 7,083 | \$  | 196,408                         | \$ | 23,273               | \$ | 176,639                | \$ | 15,954             | \$ | 336,514              | \$ | 31,433   | \$ | 8,763   | \$        | 12,784                    | \$ | 45,649                                     | \$ | 854,500 |
| Additions                       |    | -     |     | 3,089                           |    | 2,869                |    | 1,549                  |    | -                  |    | 12,637               |    | 846      |    | 208     |           | -                         |    | 1,691                                      |    | 22,889  |
| Disposals                       |    | -     |     | -                               |    | -                    |    | -                      |    | -                  |    | -                    |    | -        |    | -       |           | -                         |    | (440)                                      |    | (440)   |
| Balance, March 31, 2022         |    | 7,083 |     | 199,497                         |    | 26,142               |    | 178,188                |    | 15,954             |    | 349,151              |    | 32,279   |    | 8,971   |           | 12,784                    |    | 46,900                                     |    | 876,949 |
| Accumulated depreciation        |    |       |     |                                 |    |                      |    |                        |    |                    |    |                      |    |          |    |         |           |                           |    |                                            |    |         |
| Balance April 1 2021            |    | -     |     | 68 574                          |    | 9 814                |    | 81 043                 |    | 4 222              |    | 75 282               |    | 3 581    |    | 963     |           | 4 815                     |    | 20 604                                     |    | 268 898 |
| Depreciation                    |    | -     |     | 4 430                           |    | 1 020                |    | 9 079                  |    | 924                |    | 4 744                |    | 646      |    | 444     |           | 394                       |    | 3 958                                      |    | 25 639  |
| Depreciation retired            |    | -     |     | -                               |    | -,020                |    | -                      |    | -                  |    |                      |    | -        |    | -       |           | -                         |    | (435)                                      |    | (435)   |
| Total accumulated depreciation  |    |       |     |                                 |    |                      |    |                        |    |                    |    |                      |    |          |    |         |           |                           |    | (100)                                      |    | (100)   |
| March 31. 2022                  |    | -     |     | 73.004                          |    | 10.834               |    | 90.122                 |    | 5,146              |    | 80.026               |    | 4.227    |    | 1.407   |           | 5.209                     |    | 24,127                                     |    | 294.102 |
| Net book value, March 31, 2022  | \$ | 7,083 | \$  | 126,493                         | \$ | 15,308               | \$ | 88,066                 | \$ | 10,808             | \$ | 269,125              | \$ | 28,052   | \$ | 7,564   | \$        | 7,575                     | \$ | 22,773                                     | \$ | 582,847 |
| Cost                            |    |       |     |                                 |    |                      |    |                        |    |                    |    |                      |    |          |    |         |           |                           |    |                                            |    |         |
| Balance April 1 2020            |    |       |     |                                 |    |                      |    |                        |    |                    |    |                      |    |          |    |         |           |                           |    |                                            |    |         |
| Cost                            | \$ | 5 329 | \$  | 194 939                         | \$ | 22 110               | \$ | 174 761                | \$ | 15 761             | \$ | 332 994              | \$ | 29 258   | \$ | 8 4 4 0 | \$        | 12 784                    | \$ | 42 137                                     | \$ | 838 513 |
| Additions                       | Ψ  | 1 754 | Ψ   | 1 599                           | Ψ  | 1 340                | Ψ  | 1 991                  | Ψ  | 193                | Ψ  | 3,930                | Ψ  | 2 175    | Ψ  | 323     | Ψ         | - 12,701                  | Ψ  | 6 023                                      | Ψ  | 19 328  |
| Disposals                       |    | -     |     | (130)                           |    | (177)                |    | (113)                  |    | -                  |    | (410)                |    | _,       |    |         |           | -                         |    | (2.511)                                    |    | (3.341) |
| Balance, March 31, 2021         |    | 7,083 |     | 196,408                         |    | 23,273               |    | 176,639                |    | 15,954             |    | 336,514              |    | 31,433   |    | 8,763   |           | 12,784                    |    | 45,649                                     |    | 854,500 |
| Accumulated depreciation        |    |       |     |                                 |    |                      |    |                        |    |                    |    |                      |    |          |    |         |           |                           |    |                                            |    |         |
| Balance, April 1, 2020          |    | -     |     | 64.252                          |    | 8.947                |    | 72,195                 |    | 3,298              |    | 70.660               |    | 2,966    |    | 532     |           | 4,402                     |    | 19,458                                     |    | 246.710 |
| Depreciation                    |    | -     |     | 4,383                           |    | 897                  |    | 8,879                  |    | 924                |    | 4,639                |    | 615      |    | 431     |           | 413                       |    | 3,650                                      |    | 24,831  |
| Depreciation retired            |    | -     |     | (61)                            |    | (30)                 |    | (31)                   |    | -                  |    | (17)                 |    | -        |    | -       |           | -                         |    | (2,504)                                    |    | (2,643) |
| Total accumulated depreciation, |    |       |     | <u>`</u>                        |    | <u>, -1_</u>         |    | <u>`</u>               |    |                    |    | <u>, /_</u>          |    |          |    |         |           |                           |    | <u>, , , , , , , , , , , , , , , , , ,</u> |    |         |
| March 31, 2021                  |    | -     |     | 68,574                          |    | 9,814                |    | 81,043                 |    | 4,222              |    | 75,282               |    | 3,581    |    | 963     |           | 4,815                     |    | 20,604                                     |    | 268,898 |
| Net book value, March 31, 2021  | \$ | 7,083 | \$  | 127,834                         | \$ | 13,459               | \$ | 95,596                 | \$ | 11,732             | \$ | 261,232              | \$ | 27,852   | \$ | 7,800   | \$        | 7,969                     | \$ | 25,045                                     | \$ | 585,602 |

Schedule A is presented in accordance with the NSUARB Handbook.

Utility plant in service under IFRS differs from the NSUARB Handbook due to exclusion of intangible assets, componentization of certain assets and differences in useful lives for depreciation.

### Halifax Regional Water Commission Schedule of utility plant in service

Year ended March 31, 2022 (in thousands)

#### Stormwater

|                                     |    |       |     | Structures |    | Callestian |    |          | ۸         |             |           |
|-------------------------------------|----|-------|-----|------------|----|------------|----|----------|-----------|-------------|-----------|
|                                     |    | Land  | imp | provements |    | system     |    | Laterals | Ae<br>sma | all systems | Total     |
| Cost                                |    |       |     |            |    |            |    |          |           |             |           |
| Balance, April 1, 2021              |    |       |     |            |    |            |    |          |           |             |           |
| Cost                                | \$ | 473   | \$  | 12.683     | \$ | 270.385    | \$ | 5.374    | \$        | 6.076       | \$294.991 |
| Additions                           | Ŧ  | -     | *   | 49         | •  | 9.523      | +  | 151      | +         | 312         | 10.035    |
| Disposals                           |    | -     |     | -          |    | (8)        |    | -        |           | -           | (8)       |
| Balance, March 31, 2022             |    | 473   |     | 12,732     |    | 279,900    |    | 5,525    |           | 6,388       | 305,018   |
| Accumulated depreciation            |    |       |     |            |    |            |    |          |           |             |           |
| Balance, April 1, 2021              |    | -     |     | 2,208      |    | 61,212     |    | 703      |           | 2,970       | 67,093    |
| Depreciation                        |    | -     |     | 236        |    | 6,655      |    | 109      |           | 721         | 7,721     |
| Depreciation retired                |    | -     |     | -          |    | (2)        |    | -        |           | -           | (2)       |
| Total accumulated depreciation,     |    |       |     |            |    |            |    |          |           |             |           |
| March 31, 2022                      |    | -     |     | 2,444      |    | 67,865     |    | 812      |           | 3,691       | 74,812    |
| Net book value, March 31, 2022      | \$ | 473   | \$  | 10,288     | \$ | 212,035    | \$ | 4,713    | \$        | 2,697       | \$230,206 |
| Cost                                |    |       |     |            |    |            |    |          |           |             |           |
| Balance, April 1, 2020              |    |       |     |            |    |            |    |          |           |             |           |
| Cost                                | \$ | 34    | \$  | 12,672     | \$ | 265,896    | \$ | 5,190    | \$        | 5,537       | \$289,329 |
| Additions                           |    | 439   |     | 11         |    | 4,779      |    | 184      |           | 769         | 6,182     |
| Disposals                           |    | -     |     | -          |    | (290)      |    |          |           | (230)       | (520)     |
| Balance, March 31, 2021             |    | 473   |     | 12,683     |    | 270,385    |    | 5,374    |           | 6,076       | 294,991   |
| Accumulated depreciation            |    |       |     |            |    |            |    |          |           |             |           |
| Balance, April 1, 2020              |    | -     |     | 1,972      |    | 54,702     |    | 597      |           | 2,469       | 59,740    |
| Depreciation                        |    | -     |     | 236        |    | 6,520      |    | 106      |           | 731         | 7,593     |
| Depreciation retired                |    | -     |     | -          |    | (10)       |    |          |           | (230)       | (240)     |
| Total accumulated depreciation,     |    |       |     |            |    |            |    |          |           |             |           |
| March 31, 2021                      |    | -     |     | 2,208      |    | 61,212     |    | 703      |           | 2,970       | 67,093    |
| Net book value, March 31, 2021      | \$ | 473   | \$  | 10,475     | \$ | 209,173    | \$ | 4,671    | \$        | 3,106       | \$227,898 |
| Cumulative utility plant in service |    | Water |     | Wastewater |    | Stormwater |    | Tota     | I         |             |           |

| Cumulative utility plant in service | Water         | Wa | stewater | Sto | rmwater | Total           |
|-------------------------------------|---------------|----|----------|-----|---------|-----------------|
| Net book value, March 31, 2022      | \$<br>521,109 | \$ | 582,847  | \$  | 230,206 | \$<br>1,334,162 |
| Net book value, March 31, 2021      | \$<br>521,019 | \$ | 585,602  | \$  | 227,898 | \$<br>1,334,519 |

Schedule A is presented in accordance with the NSUARB Handbook.

Utility plant in service under IFRS differs from the NSUARB Handbook due to exclusion of intangible assets, componentization of certain assets and differences in useful lives for depreciation.

# Halifax Regional Water Commission Schedule of long term debt Year ended March 31, 2022 (in thousands)

### Schedule B

|                                          |                                      |                |    | Balar           | nce Rer | naining         |
|------------------------------------------|--------------------------------------|----------------|----|-----------------|---------|-----------------|
|                                          | Interest rate                        | Final Maturity |    | 2022            |         | <u>2021</u>     |
| Payable to Municipal Finance Corporation |                                      |                |    |                 |         |                 |
| Vvater<br>Debenture 31 A 1               | 1 630% to 1 221%                     | 2021           | ¢  | _               | ¢       | 150             |
| Debenture 32 A 1                         | 1 636% to 3 480%                     | 2021           | Ψ  | 200             | Ψ       | 400             |
| Debenture 32 C 1                         | 1 510% to 3 160%                     | 2022           |    | 5.904           |         | 6 4 4 0         |
| Debenture 33 A 1                         | 1.330% to 2.979%                     | 2023           |    | 6.067           |         | 6.573           |
| Debenture 33 B 1                         | 1.285% to 3.614%                     | 2023           |    | 4,447           |         | 4.818           |
| Debenture 34 B 1                         | 1.200% to 3.190%                     | 2024           |    | 8.887           |         | 9.571           |
| Debenture 35 A 1                         | 1.040% to 2.894%                     | 2025           |    | 9.427           |         | 10,100          |
| Debenture 36 A 1                         | 1.150% to 2.925%                     | 2026           |    | 1,000           |         | 1,200           |
| Debenture 36 B 1                         | 1.150% to 2.506%                     | 2026           |    | 3,254           |         | 3,471           |
| Debenture 37 A 1                         | 1.734% to 3.073%                     | 2027           |    | 2,800           |         | 2,975           |
| Debenture 38 A 1                         | 2.060% to 3.295%                     | 2028           |    | 900             |         | 1,100           |
| Debenture 38 B 1                         | 2.490% to 3.389%                     | 2028           |    | 5,100           |         | 5,400           |
| Debenture 39 A 1                         | 2.015% to 2.561%                     | 2029           |    | 9,900           |         | 10,450          |
| Debenture 40 A 1                         | 0.678% to 1.879%                     | 2030           |    | 11,400          |         | 12,000          |
| Debenture 40 B 1                         | 0.400% to 2.376%                     | 2031           |    | 10,000          |         | -               |
| Wastewater                               |                                      |                |    |                 |         |                 |
| Debenture 32 A 1                         | 1.636% to 3.480%                     | 2022           |    | 1,318           |         | 1,438           |
| Debenture 32 B 1                         | 1.380% to 3.156%                     | 2022           |    | 17,600          |         | 19,200          |
| Debenture 32 C 1                         | 1.510% to 3.160%                     | 2022           |    | 2,527           |         | 2,757           |
| Debenture 33 A 1                         | 1.330% to 2.979%                     | 2023           |    | 10,116          |         | 10,959          |
| Debenture 33 B 1                         | 1.285% to 3.614%                     | 2023           |    | 6,536           |         | 7,080           |
| Debenture 34 A 1                         | 1.245% to 3.347%                     | 2024           |    | 3,620           |         | 3,898           |
| Debenture 34 B 1                         | 1.200% to 3.190%                     | 2024           |    | 5,581           |         | 6,010           |
| Debenture 35 A 1                         | 1.040% to 2.894%                     | 2025           |    | 9,877           |         | 10,583          |
| Debenture 36 B 1                         | 1.150% to 2.506%                     | 2026           |    | 1,360           |         | 1,450           |
| Debenture 37 A 1                         | 1.734% to 3.073%                     | 2027           |    | 4,880           |         | 5,185           |
| Debenture 38 B 1                         | 2.490% to 3.389%                     | 2028           |    | 5,440           |         | 5,760           |
| Debenture 39 A 1                         | 2.015% to 2.561%                     | 2029           |    | 13,500          |         | 14,250          |
| Debenture 40 A 1<br>Debenture 40 B 1     | 0.678% to 1.879%<br>0.400% to 2.376% | 2030           |    | 8,560<br>6.000  |         | 9,100           |
|                                          |                                      |                |    | -,              |         |                 |
| HHSP<br>Deporture 20 A 1                 | 2 015% to 2 561%                     | 2020           |    | 5 200           |         | 5 950           |
| Debeniture 39 A 1                        | 2.015 /0 10 2.301 /0                 | 2029           |    | 3,200           |         | 5,650           |
| Stormwater                               |                                      |                |    |                 |         |                 |
| Debenture 33 A 1                         | 1.330% to 2.979%                     | 2023           |    | 324             |         | 351             |
| Debenture 33 B 1                         | 1.285% to 3.614%                     | 2023           |    | 1,584           |         | 1,715           |
| Depenture 34 B 1                         | 1.200% to 3.190%                     | 2024           |    | 3,837           |         | 4,132           |
| Depenture 35 A 1                         | 1.040% to 2.894%                     | 2025           |    | 2,261           |         | 2,423           |
| Depenture 36 B 1                         | 1.150% to 2.506%                     | 2026           |    | 6/6             |         | 722             |
| Depenture 37 A 1<br>Depenture 28 B 1     | 1.734% to $3.073%$                   | 2027           |    | 320             |         | 340             |
| Debenture 30 A 1                         | 2.490% to 2.561%                     | 2020           |    | 2,210           |         | 2,340           |
| Debenture $40 \text{ A} 1$               | 0.678% to 1.879%                     | 2029           |    | 5,000           |         | 5,600           |
| Debenture 40 B 1                         | 0.400% to 2.376%                     | 2030           |    | 4,000           |         |                 |
|                                          |                                      |                |    | 205 522         |         | 100 501         |
| Payable to Halifax Regional Municipality |                                      |                |    | 200,000         |         | 199,091         |
| Wastewater/Stormwater                    | 2 8400/ to 5 0400/                   | 2024           |    | 16 500          |         | 22.000          |
| Debenture 34 B 1                         | 2.040% to 3.940%                     | 2024<br>2024   |    | 3 000           |         | ZZ,000<br>1 000 |
| Dependire 54 B 1                         | 1.200 % 10 3.190 %                   | 2024           |    | 10 500          |         | 26,000          |
|                                          |                                      |                |    | 10,000          |         | 20,000          |
|                                          |                                      |                |    | 225,033         |         | 225,591         |
| Less: dedt issue costs                   |                                      |                |    | (851)           |         | (926)           |
|                                          |                                      |                |    | 224,182         |         | 224,000         |
| Less: amount payable within one year     |                                      |                |    | <u>(46,272)</u> |         | (20,559)        |
|                                          |                                      |                | \$ | 177,910         | \$      | 204,106         |

# Halifax Regional Water Commission Schedule of earnings

Year ended March 31, 2022 (in thousands)

### Water

|                                                     | <u>2022</u>   | <u>2021</u>  |
|-----------------------------------------------------|---------------|--------------|
| Operating revenues                                  |               |              |
| Water                                               | \$<br>48,189  | \$<br>47,631 |
| Public fire protection                              | 7,628         | 7,336        |
| Private fire protection                             | 1,270         | 1,001        |
| Other operating revenue                             |               |              |
| Bulk water stations                                 | 317           | 318          |
| Late payment and connection fees                    | 275           | 155          |
| Miscellaneous                                       | <br>333       | <br>204      |
|                                                     | <br>58,012    | <br>56,645   |
| Operating expenditures                              |               |              |
| Water supply and treatment                          | 10,760        | 9,987        |
| Water transmission and distribution                 | 11,316        | 10,960       |
| Engineering and technology services                 | 6,188         | 4,725        |
| Regulatory services                                 | 1,220         | 1,091        |
| Customer services                                   | 2,505         | 2,614        |
| Corporate services                                  | 1,454         | -            |
| Administration services                             | 3,429         | 3,620        |
| Depreciation and amortization                       | <br>11,489    | <br>10,879   |
|                                                     | <br>48,361    | <br>43,876   |
| Earnings from operations before financial and other |               |              |
| revenues and expenditures                           | <br>9,651     | <br>12,769   |
| Financial and other revenues                        |               |              |
| Interest                                            | 123           | 127          |
| Other                                               | <br>467       | <br>572      |
|                                                     | <br>590       | <br>699      |
| Financial and other expenditures                    |               |              |
| Interest on long term debt                          | 2,113         | 2,028        |
| Repayment of long term debt                         | 5,808         | 5,331        |
| Amortization of debt issue costs                    | 81            | 74           |
| Dividend/grant in lieu of taxes                     | 5,553         | 5,498        |
| Other                                               | <br>114       | <br>44       |
|                                                     | <br>13,669    | <br>12,975   |
| Earnings (loss) for the year                        | \$<br>(3,428) | \$<br>493    |

### Halifax Regional Water Commission Schedule of earnings

Year ended March 31, 2022 (in thousands)

#### Wastewater

|                                                     | <u>2022</u> |          | <u>2021</u> |
|-----------------------------------------------------|-------------|----------|-------------|
| Operating revenues                                  |             |          |             |
| Wastewater                                          | \$ 80,646   | \$       | 69,605      |
| Other operating revenue                             |             |          |             |
| Leachate and other contract revenue                 | 483         |          | 416         |
| Septage tipping fees                                | 490         |          | 486         |
| Over strength surcharge                             | -           |          | 1           |
| Airplane effluent                                   | 3           |          | 33          |
| Late payment and connection fees                    | 209         |          | 118         |
| Miscellaneous                                       | 234         | <u> </u> | 163         |
|                                                     | 82,065      | • —      | 70,822      |
| Operating expenditures                              |             |          |             |
| Wastewater collection                               | 12,988      |          | 12,710      |
| Wastewater treatment                                | 21,774      |          | 20,623      |
| Engineering and technology services                 | 6,014       |          | 5,096       |
| Regulatory services                                 | 1,584       |          | 1,385       |
| Customer services                                   | 2,032       |          | 2,189       |
| Corporate services                                  | 1,383       |          | -           |
| Administration services                             | 1,660       |          | 2,965       |
| Depreciation and amortization                       | 15,882      |          | 15,019      |
|                                                     | 63,317      |          | 59,987      |
| Farnings from operations before financial and other |             |          |             |
| revenues and expenditures                           | 18.748      |          | 10.835      |
|                                                     |             | ·        | 10,000      |
| Financial and other revenues                        | 20          |          |             |
| Interest                                            | 30          |          | 55          |
| Other                                               | 151         |          | 176         |
|                                                     | 187         | . —      | 231         |
| Financial and other expenditures                    |             |          |             |
| Interest on long term debt                          | 4,019       |          | 4,405       |
| Repayment of long term debt                         | 13,610      |          | 13,242      |
| Amortization of debt issue costs                    | 125         |          | 117         |
| Dividend/grant in lieu of taxes                     | 777         |          | 386         |
| Other                                               | 15          | . —      | 26          |
|                                                     | 18,546      | . —      | 18,176      |
| Earnings (loss) for the year                        | \$ 389      | \$       | (7,110)     |

### Halifax Regional Water Commission Schedule of earnings

Year ended March 31, 2022 (in thousands)

### Stormwater

|                                                 |           | <u>2022</u>    |           | <u>2021</u> |
|-------------------------------------------------|-----------|----------------|-----------|-------------|
| Operating revenues                              |           |                |           |             |
| Stormwater site generated service               | \$        | 6,294          | \$        | 5,127       |
| Stormwater right-of-way service                 |           | 3,835          |           | 3,835       |
| Other operating revenue                         |           |                |           |             |
| Late payment and connection fees                |           | 170            |           | 38          |
| Miscellaneous                                   |           | 126            |           | 102         |
|                                                 |           | 10,425         |           | 9,102       |
| Operating expenditures                          |           |                |           |             |
| Stormwater collection                           |           | 4,566          |           | 4,700       |
| Engineering and technology services             |           | 1,517          |           | 1,288       |
| Regulatory services                             |           | 1,588          |           | 1,350       |
| Customer services                               |           | 274            |           | 278         |
| Corporate services                              |           | 225            |           | -           |
| Administration services                         |           | 270            |           | 482         |
| Depreciation and amortization                   |           | 2,403          |           | 2,198       |
|                                                 |           | 10,843         |           | 10,513      |
| Loss from operations before financial and other |           |                |           |             |
| revenue and expenditures                        |           | (418)          |           | (1,411)     |
| Financial and other revenues                    |           |                |           |             |
| Interest                                        |           | <u> </u>       |           | 33          |
| Financial and other expenditures                |           |                |           |             |
| Interest on long term debt                      |           | 727            |           | 685         |
| Repayment of long term debt                     |           | 2 059          |           | 1 806       |
| Amortization of debt issue costs                |           | 22             |           | 18          |
| Dividend/grant in lieu of taxes                 |           | 136            |           | 67          |
|                                                 |           | 2,944          |           | 2,576       |
| Loss for the year                               | <u>\$</u> | <u>(3,343)</u> | <u>\$</u> | (3,954)     |

In 2017, the NSUARB approved the inclusion of a percentage of depreciation on contributed Stormwater assets within expenditures. This depreciation was not previously reported within Schedules C and D, although reported for IFRS purposes. The current fiscal year includes depreciation of \$0.7 and the comparative figures have been restated to include the prior year amount of \$0.7.

# Halifax Regional Water Commission Schedule of earnings Year ended March 31, 2022 (in thousands)

### **Regulated activities**

|                                                     | <u>2022</u> | <u>2021</u>        |
|-----------------------------------------------------|-------------|--------------------|
| Operating revenues                                  |             |                    |
| Water                                               | \$ 48,189   | \$ 47,631          |
| Wastewater                                          | 80,646      | 69,605             |
| Stormwater                                          | 10,129      | 8,962              |
| Public fire protection                              | 7,628       | 7,336              |
| Private fire protection services                    | 1,270       | 1,001              |
| Other operating revenue                             | 1,625       | 1,061              |
|                                                     | 149,487     | 135,596            |
| Operating expenditures                              |             |                    |
| Water supply and treatment                          | 10,720      | 9,970              |
| Water transmission and distribution                 | 11,316      | 10,960             |
| Wastewater collection                               | 12,965      | 12,664             |
| Stormwater collection                               | 4,566       | 4,700              |
| Wastewater treatment                                | 21,053      | 20,060             |
| Engineering and technology services                 | 13,719      | 11,171             |
| Regulatory services                                 | 4,392       | 3,981              |
| Customer services                                   | 4,777       | 5,026              |
| Corporate services                                  | 3,044       | -                  |
| Administration services                             | 5,244       | 7,029              |
| Depreciation and amortization                       | 29,756      | 28,078             |
|                                                     | 121,552     | 113,639            |
| Earnings from operations before financial and other |             |                    |
| revenues and expenditures                           | 27,935      | 21,957             |
| Financial and other revenues                        |             |                    |
| Interest                                            | 178         | 215                |
| Other                                               | 28          | 88                 |
|                                                     | 206         | 303                |
| Financial and other expenditures                    |             |                    |
| Interest on long term debt                          | 6,859       | 7,118              |
| Repayment of long term debt                         | 21,477      | 20,379             |
| Amortization of debt issue costs                    | 228         | 209                |
| Dividend/grant in lieu of taxes                     | 6,466       | 5,951              |
|                                                     | 35,030      | 33,657             |
| Loss for the year                                   | \$ (6,889)  | <u>\$ (11,397)</u> |

### Halifax Regional Water Commission Schedule of earnings

Year ended March 31, 2022 (in thousands)

### **Unregulated activities**

|                                                     | <u>2022</u> | <u>2021</u> |
|-----------------------------------------------------|-------------|-------------|
| Operating revenues<br>Septage tipping fees \$       | <b>490</b>  | \$<br>486   |
| Leachate treatment and contract revenue             | 483         | 416         |
| Airplane effluent                                   | 3           | 33          |
| Other operating revenue                             | 39          | <br>38      |
| -                                                   | 1,015       | <br>973     |
| Operating expenditures                              |             |             |
| Water supply and treatment                          | 40          | 17          |
| Wastewater treatment                                | 721         | 563         |
| Wastewater collection                               | 23          | 46          |
| Customer services                                   | 34          | 55          |
| Corporate services                                  | 18          | -           |
| Administration services                             | 115         | 38          |
| Depreciation and amortization                       | 18          | <br>18      |
| -                                                   | 969         | <br>737     |
| Earnings from operations before financial and other |             |             |
| revenues and expenditures                           | 46          | <br>236     |
| Financial and other revenues                        |             |             |
| Other                                               | <u>590</u>  | <br>660     |
| Financial and other expenditures                    |             |             |
| Other                                               | 129         | <br>70      |
| Earnings for the year \$                            | 507         | \$<br>826   |

### Halifax Regional Water Commission Nova Scotia Utility and Review Board information

Schedule E

2021

2022

Year ended March 31, 2022 (in thousands)

### Return on rate base

|       | 2021                    |
|-------|-------------------------|
| 1.13% | 1.99%                   |
| 5.77% | 3.09%                   |
| 0.24% | 0.09%                   |
|       | 1.13%<br>5.77%<br>0.24% |

Return on rate base is calculated based on earnings from operations before financial and other revenues and expenditures divided by the net book value of funded utility plant in service.

#### Special purpose reserves

|                            | Was<br>Stor<br>R | atewater<br>and<br>rmwater<br>eserves | Deve | Regional<br>elopment<br>Charge<br>Water<br>Reserve | De<br>\   | Regional<br>evelopment<br>Charge<br>Wastewater<br>Reserve | <br>Other<br>Capital<br><u>Reserves</u> | <br>2022<br>Total | <br>2021<br>Total |
|----------------------------|------------------|---------------------------------------|------|----------------------------------------------------|-----------|-----------------------------------------------------------|-----------------------------------------|-------------------|-------------------|
| Reserve, April 1           | \$               | 1,964                                 | \$   | 3,125                                              | \$        | 48,359                                                    | \$<br>608                               | \$<br>54,056      | \$<br>46,001      |
| Contributions and interest |                  | -                                     |      | 3,609                                              |           | 18,732                                                    | 271                                     | 22,612            | 15,466            |
| Expenditures               |                  |                                       |      | (3,729)                                            |           | (2,978)                                                   | <br>                                    | <br>(6,707)       | <br>(7,411)       |
| Reserve, March 31          | <u>\$</u>        | 1,964                                 | \$   | 3,005                                              | <u>\$</u> | 64,113                                                    | \$<br>879                               | \$<br>69,961      | \$<br>54,056      |

| Summarized consolidated operating results                                     |           | <u>2022</u>        |           | <u>2021</u>          |
|-------------------------------------------------------------------------------|-----------|--------------------|-----------|----------------------|
| Operating revenues<br>Operating expenditures                                  | \$        | 150,502<br>122,521 | \$        | 136,569<br>114,376   |
| Earnings from operations before financial and other revenues and expenditures |           | 27,981             |           | 22,193               |
| Financial and other revenues<br>Financial and other expenditures              |           | 796<br>35,159      |           | 963<br><u>33,727</u> |
| Loss for the year                                                             | <u>\$</u> | (6,382)            | <u>\$</u> | (10,571)             |

Schedule E is presented in accordance with the NSUARB Handbook.



| TO:           | Becky Kent, B.A., Chair and Members of the Halifax Regional Water<br>Commission Board, as Trustees of the Halifax Regional Water<br>Commission Employees' Pension Plan |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SUBMITTED BY: | Louis de<br>MontbrunDigitally signed by Louis<br>de Montbrun<br>Date: 2022.06.15<br>20:28:21 -03'00'Louis de Montbrun, CPA, CA<br>Director, Corporate Services / CFO   |
| APPROVED:     | CathieDigitally signed by CathieO'TooleO'TooleDate: 2022.06.1620:45:10 -03'00'Cathie O'Toole, MBA, FCPA, FCGA, ICD.D, General Manager                                  |
| DATE:         | June 9, 2022                                                                                                                                                           |
| SUBJECT:      | Halifax Regional Water Commission Employees' Pension Plan<br>Financial Statements for the Year Ended December 31, 2021                                                 |

### <u>ORIGIN</u>

The Halifax Regional Water Commission Board (the "Board"), as Trustees of the Halifax Regional Water Commission Employees' Pension Plan (the "Plan"), approves the audited financial statements for the Plan annually.

### **RECOMMENDATION**

It is recommended the Board approve the audited financial statements for the Plan for the year ended December 31, 2021.

### BACKGROUND

Annually, the Plan's financial statements are prepared by staff and audited by the Commission's auditors, currently Grant Thornton LLP.

The Audit and Finance Committee of Halifax Water, in its meeting of June 9, 2022, approved the following motion:

"The Audit and Finance Committee recommend that the Halifax Regional Water Commission Board approve the financial statements for the Halifax Regional Water Commission Employees' Pension Plan for the year ended December 31, 2021."



### DISCUSSION

Attached are the audited financial statements of the Plan for the year ended December 31, 2021, with comparative figures for 2020.

The auditor has indicated that they are prepared to issue an unqualified auditor's report. The auditor's report, on Page 1, indicates that the financial statements present fairly, in all material respects, the financial position of the Plan as at December 31, 2021, the changes in net assets available for benefits, and changes in pension obligations in accordance with Canadian accounting standards for pension plans.

The statement of financial position for the Plan is reported on page 3 of the financial statements, and the highlights are summarized in Table 1 below. The surplus as at December 31, 2021 of \$30.0 million compares favourably to the surplus reported the prior year of \$13.2 million, representing an increase of \$16.8 million. This is the result of higher reported values at yearend for net assets available for benefits relative to the increase in pension obligations. Net assets available for benefits as at December 31, 2021 amounted to \$174.6 million compared to \$155.0 million the prior year, an increase of \$19.7 million or 12.7%. Pension obligations increased \$2.8 million or 2.0% to \$144.6 million as at December 31, 2021, up from \$141.8 million in 2020.

| Statemen<br>E                     | t of financial posit<br>December 31 | ion           |               |        |
|-----------------------------------|-------------------------------------|---------------|---------------|--------|
|                                   |                                     |               | Change        | e      |
|                                   | 2021                                | 2020          | \$            | %      |
| Net assets available for benefits | \$174,636,362                       | \$154,956,157 | \$ 19,680,205 | 12.7%  |
| Pension obligations               | 144,611,949                         | 141,762,849   | 2,849,100     | 2.0%   |
| Surplus                           | \$ 30,024,414                       | \$ 13,193,308 | \$ 16,831,106 | 127.6% |

### Table 1:

The statement of changes in net assets available for benefits are reported on page 4 of the financial statements, with highlights summarized in Table 2 below. As stated previously, net assets available for benefits as at December 31, 2020 are reported as \$174.6 million, compared to \$155.0 million the previous year, representing an increase of \$19.7 million or 12.7%.

| Table | 2: |
|-------|----|
|-------|----|

| Statement of changes in net assets available for benefits<br>December 31 |                            |                            |                         |               |  |  |  |
|--------------------------------------------------------------------------|----------------------------|----------------------------|-------------------------|---------------|--|--|--|
|                                                                          |                            |                            | Change                  | )             |  |  |  |
|                                                                          | 2021                       | 2020                       | \$                      | %             |  |  |  |
| Revenue<br>Expenses                                                      | \$ 18,771,312<br>5,783,777 | \$ 12,199,235<br>5.363,136 | \$ 6,572,077<br>420,641 | 53.9%<br>7.8% |  |  |  |
| Increase in Net Revenue                                                  | 12,987,535                 | 6,836,099                  | 6,151,436               | 90.0%         |  |  |  |
| Contributions                                                            | 6,692,670                  | 6,540,244                  | 152,426                 | 2.3%          |  |  |  |
| Increase in net assets available for benefits                            | \$ 19,680,206              | \$ 13,376,343              | \$ 6,303,863            | 47.1%         |  |  |  |

Of the \$19.7 million increase in net assets available for benefits in the current year, net revenue accounted for \$13.0 million, with contributions of \$6.7 million representing the remaining balance. Revenue consists of changes in the fair value of investment assets of \$15.4 million, and net investment income of \$3.4 million. Compared to 2020, the change in the fair value of investment assets was higher by \$6.8 million, and net investment income decreased \$0.2 million. Assets of the Plan are invested as part of the Halifax Regional Municipality Master Trust, and represent 6.5% (2019, 6.4%) of the Master Trust's assets. The Plan's gross fund rate for 2021 was 11.7% (2020, 7.7%), and the net fund rate after expenses was 11.4% (2020, 7.4%).

Contributions also factor into the increase in net assets available for benefits. Combined contributions from employees and Halifax Water are reported at \$6.7 million in 2021, representing a net increase of \$0.2 million or 2.3% compared to 2020. The increase is reflective of new hires, as well as associated increases in remuneration of existing employees, either through normal pay increases or movements within individual bands. Required contributions for employees in 2021 and 2020 were 10.34% of pensionable earnings, with Halifax Water matching employees' contributions. Further details with respect to contributions can be found in Note 7 (page 14) of the financial statements.

Expenses reduce net assets available for benefits, with retirement benefit payments being the main driver, representing \$4.7 million of the \$5.8 million reported in 2021. Retirement benefit payments increased \$0.2 million compared to 2020, and is attributed to 9 (2020, 3) new retirements in 2021, in addition to increases with respect to annual indexing. Termination benefit payments are also included in expenses and represent \$0.8 million of reported expenses in 2021, representing an increase of \$0.1 million compared to 2020. Termination benefits were paid in 2021 to 12 former employees (2020, 17). Termination benefits vary year-over- year, with changes not only related to staff turnover levels, but also the pensionable service of terminating employees.

The statement of changes in pension obligations is reported on page 5 of the financial

statements and summarized in Table 3 below. The valuation of pension obligations as at December 31, 2021 was the result of an actuarial valuation performed January 1, 2022.

| Statement of changes in pension obligations<br>December 31 |               |               |              |         |  |  |  |
|------------------------------------------------------------|---------------|---------------|--------------|---------|--|--|--|
|                                                            |               |               | Change       | e       |  |  |  |
|                                                            | 2021          | 2020          | \$           | %       |  |  |  |
| Pension obligations, beginning of year                     | \$141,762,849 | \$132,840,559 | \$ 8,922,290 | 6.7%    |  |  |  |
| Changes in pension obligations                             |               |               |              |         |  |  |  |
| Changes in actuarial assumptions                           | (\$6,142,473) | -             | (6,142,473)  | -       |  |  |  |
| Miscellaneous sources of decrease                          | (320,600)     | -             | (320,600)    | -       |  |  |  |
| Interest accrued on benefits                               | 8,252,800     | 7,738,600     | 514,200      | 6.6%    |  |  |  |
| Benefits accrued                                           | 6,646,900     | 6,413,400     | 233,500      | 3.6%    |  |  |  |
| Benefits paid                                              | (5,587,527)   | (5,229,710)   | (357,817)    | 6.8%    |  |  |  |
|                                                            | 2,849,100     | 8,922,290     | (6,073,190)  | (68.1%) |  |  |  |
| Pension obligations, end of year                           | \$144,611,949 | \$141,762,849 | \$ 2,849,100 | 2.0%    |  |  |  |

### Table 3:

Pension obligations increased to \$144.6 million in 2021 compared to \$141.8 million the prior year, an increase of \$2.8 million or 2.0%. Increases to pension obligations came from two (2) sources, benefits accrued of \$6.6 million and interest on accrued benefits of \$8.3 million. Reductions to pension obligations totaled \$12.1 million, with \$5.6 million related to retirement and termination benefit payments in 2021, and \$6.5 million resulting from the actuarial valuation. Further details with respect to pension obligations including assumptions can be found in Note 5 (page 13) of the financial statements.

Solvency funding is not required as the Plan received a solvency funding exemption effective June 1, 2015. Currently the ratio of solvency assets to solvency liabilities is greater than the "solvency concerns" threshold of 85%, under Nova Scotia pension legislation. Under legislative effective April 1, 2020, should the solvency ratio fall below the 85% threshold, a full actuarial valuation report would be required every 3 years, and a cost certificate annually. The Superintendent may require a valuation sooner than the 3 years if deemed warranted. The actuarial valuation as at January 1, 2022 reported a solvency ratio of 105.0%.

After December 31, 2021, there have been several factors around the world that have been affecting economic activity and causing material disruptions to businesses and significant volatility and weakness in the global equity markets. As a result, Note 13 (page 18) Subsequent Event has been added to provide information on the impact on the Plan's investments. As at April 30, 2022, the fair value of the Plan's investments declined by 4.61%, or approximately \$7,970,000 since December 31, 2021. Currently the Plan does not foresee a significant impact to future operations or its ability in continuing to make benefit payments.

### **BUDGET IMPLICATIONS**

There are no budget implications associated with the audited financial statements of the Plan for 2021. Budget implications arise from actuarial valuations.

### ALTERNATIVES

None

### **ATTACHMENT**

- 1. Halifax Regional Water Commission Employees' Pension Plan Financial Statements as at December 31, 2021.
- 2. Report to the Audit and Finance Committee by Grant Thornton.

Report Prepared by:

Digitally signed by Allan Campbell Date: 2022.06.14 14:47:58 -03'00'

Allan Campbell, B. Comm, CPA, CMA Manager, Finance (902) 266-8655



# **Financial Statements**

# Halifax Regional Water Commission

Employees' Pension Plan

December 31, 2021

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Grant Thornton LLP Nova Centre, North Tower Suite 1000, 1675 Grafton Street Halifax, NS B3J OE9

T (902) 421-1734 F (902) 420-1068 www.GrantThornton.ca

# Independent auditor's report

To the Members of the Board of the Halifax Regional Water Commission



Grant Thornton LLP Nova Centre, North Tower Suite 1000, 1675 Grafton Street Halifax, NS B3J OE9

T (902) 421-1734 F (902) 420-1068 www.GrantThornton.ca

| Employees' Pension Plan<br>Statement of financial position     | 1                                               |                                          |
|----------------------------------------------------------------|-------------------------------------------------|------------------------------------------|
| December 31                                                    | 2021                                            | 2020                                     |
| <b>Assets</b><br>Investment assets<br>Contributions receivable | \$ 174,426,797<br><u>269,675</u><br>174,696,472 | \$ 154,762,753<br>223,912<br>154,986,665 |
| <b>Liabilities</b><br>Payables and accruals<br>Trade           | 60,109                                          | 30,508                                   |
| Net assets available for benefits (note 4)                     | 174,636,363                                     | 154,956,157                              |
| Pension obligations                                            | 144,611,949                                     | 141,762,849                              |
| Surplus                                                        | \$ 30,024,414                                   | \$ 13,193,308                            |

On behalf of the Board of Trustees

Trustee

Trustee

See accompanying notes to the financial statements.

### Halifax Regional Water Commission Employees' Pension Plan

| Statement of changes | in net | assets | available | for | benefits |
|----------------------|--------|--------|-----------|-----|----------|
|----------------------|--------|--------|-----------|-----|----------|

| Year Ended December 31                               |    | 2021        |          | 2020        |
|------------------------------------------------------|----|-------------|----------|-------------|
| Revenue                                              |    |             |          |             |
| Net investment income (note 6)                       | \$ | 3,356,629   | \$       | 3,568,646   |
| Changes in the fair value of investment assets       |    | 15,414,684  |          | 8,630,589   |
|                                                      |    | 18,771,313  |          | 12,199,235  |
| Contributions (note 7)                               |    |             |          |             |
| Participants                                         |    | 3,391,324   |          | 3,310,113   |
| Sponsor                                              |    | 3,301,346   |          | 3,230,131   |
|                                                      |    | 6,692,670   |          | 6,540,244   |
| Expenses                                             |    |             |          |             |
| Benefit payments (note 8)                            |    | 5.587.527   |          | 5.229.710   |
| Administrative (note 9)                              |    | 196,250     |          | 133,426     |
|                                                      |    | 5,783,777   |          | 5,363,136   |
|                                                      | •  |             | <b>^</b> | 40.070.040  |
| Increase in net assets available for benefits        | \$ | 19,680,206  | \$       | 13,376,343  |
|                                                      |    |             |          |             |
| Net assets available for benefits, beginning of year | \$ | 154,956,157 | \$       | 141,579,814 |
| Increase in net assets available for benefits        | _  | 19,680,206  |          | 13,376,343  |
| Net assets available for benefits, end of year       | \$ | 174,636,363 | \$       | 154,956,157 |
|                                                      |    |             |          |             |

See accompanying notes to the financial statements.

### Halifax Regional Water Commission Employees' Pension Plan Statement of changes in pension obligations

| Year Ended December 31                    | 2021                     | 2020           |
|-------------------------------------------|--------------------------|----------------|
| Pension obligations, beginning of year    | \$ 141,762,849           | \$ 132,840,559 |
| Change in pension obligations             |                          |                |
| Changes in actuarial assumptions (note 5) | (6,142,473)<br>(320,600) | -              |
| Interest accrued on benefits              | 8,252,800                | 7,738,600      |
| Benefits accrued                          | 6,646,900                | 6,413,400      |
| Benefits paid (note 8)                    | (5,587,527)              | (5,229,710)    |
|                                           | 2,849,100                | 8,922,290      |
| Pension obligations, end of year          | \$ 144,611,949           | \$ 141,762,849 |

See accompanying notes to the financial statements.

December 31, 2021

### 1. Description of the Plan

The Halifax Regional Water Commission Employees' Pension Plan (the "Plan") is registered under the Pension Benefits Act of Nova Scotia (Registration Number 0344614). The following description of the Plan is a summary only. For more complete information, reference should be made to the Plan agreement restated as at January 1, 2021 as amended and consolidated.

### (a) General

The Halifax Regional Water Commission maintains a contributory defined benefit pension plan for all employees, and participation in the Plan is compulsory for full-time and part-time employees. The pension plan provides pensions based upon length of service and best seven consecutive years' earnings.

The employees who transferred to the Halifax Regional Water Commission on August 1, 2007 with the transfer of the wastewater/stormwater operations have remained members of the Halifax Regional Municipality Pension Plan. The Halifax Regional Water Commission is responsible for funding the employer share of the contributions for these employees. All new employees hired after August 1, 2007 join the Plan.

### (b) Funding policy

Employees' required contributions in 2021 were 10.34% (2020 – 10.34%) of pensionable earnings with the Halifax Regional Water Commission matching employee contributions. Basic contributions from employers and members due to the Plan at the end of the year are recorded on an accrual basis. Pensionable earnings are capped temporarily to a maximum of \$140,945 through 2023 and will be indexed at a rate of 1% per annum thereafter.

In addition, the Plan and the Pension Benefits Act of Nova Scotia require that the Halifax Regional Water Commission, from time to time, make contributions to the Plan of such amounts which are required as special payments in accordance with the provisions of the Plan as determined by the actuary (see note 5).

Effective April 1, 2020, new funding Regulations require a "Provision for Adverse Deviation" (PfAD), which is an explicit level of conservatism added to the going concern liabilities of the Plan. The PfAD is based on the riskiness of the asset mix of the Plan, and for the actuarial valuation of January 1, 2022, the PfAD is reported at 7%. As a result, total liabilities are required to be increased 7% in the determination of the Plan's surplus (unfunded liability/deficit) position. With the implementation of the PfAD, the Plan was able to remove its implicit margin of conservatism included in the interest rate assumption adopted in previous actuarial valuations (see note 5).

December 31, 2021

### 1. Description of the Plan (continued)

### (c) Retirement benefits

Employees are entitled to annual pension benefits of an amount equal to 2.0% of their best earnings averaged over the best seven consecutive years' earnings for each year of credited service up to the maximum permitted by the Canada Revenue Agency. For credited service prior to January 1, 2016, the best average earnings cannot be less than the best average five consecutive years of earnings paid to an employee prior to 2016.

Benefits are adjusted each year. Adjustments are based on the increase in the Consumer Price Index over the previous calendar year to a maximum of 2% for benefits earned prior to January 1, 2016, and to a maximum of 1% for benefits earned after December 31, 2015.

### (d) Disability pensions

Disabled employees continue to accrue credited service without having to continue their contributions. The employer and employees fund the actuarial cost of the pensions for disabled employees annually. Disabled employees are eligible for a pension if they meet the following criteria:

- a) they have completed 10 years of continuous participation in the Plan;
- b) they are not in receipt of a salary continuance benefit under an insured plan to which the Halifax Regional Water Commission contributes; and
- c) they are totally and permanently disabled as certified by a medical practitioner.

### (e) Death benefits

In the event a pensioner died after the commencement of their pension payments, the death benefit will be in accordance with the normal or optional form of pension elected at the time of retirement.

In the event a member died before their retirement date, a survivor pension is payable to the member's surviving spouse at the rate of 60% of the member's pension credits accrued prior to June 1, 1998. The beneficiary of a single employee who died before retirement will be entitled to the member's contributions and interest up to the month preceding death during that same period. In respect of pension credits accrued after June 1, 1998, the commuted value of the normal retirement benefits shall be paid to the member's surviving spouse, beneficiary or estate. For pension credits accrued between January 1, 1988 and May 31, 1998 whereby a survivor pension payable to the member's surviving spouse is calculated as the greater of: 1) 60% of the survivor pension, or 2) the commuted value of the normal retirement benefits. The beneficiary or estate of a single employee who died during this same period, January 1, 1988 and May 31, 1998, would be entitled to the commuted value of the normal retirement benefits.

December 31, 2021

### 1. Description of the Plan (continued)

### (f) Termination of employment

Subject to any statutory limitations, Plan members become vested immediately upon joining the Plan. Vesting previously occurred after two years of Plan membership. Members may elect to receive one of the following options upon termination:

- a) a paid-up deferred vested pension commencing on the member's normal retirement date in an amount equal to benefits accrued to date of termination; or
- b) transfer the commuted value of the deferred vested pension benefit to the member's new employer's pension plan, a Retirement Savings Plan, or purchase a deferred annuity.

### (g) Voluntary contributions

Members of the Plan may make additional voluntary contributions up to the deductible limit provided under the Income Tax Act of \$600 per annum. The non locked-in additional voluntary contributions may be withdrawn from the Plan by a member prior to termination or retirement, either in the form of a lump sum cash payment or transferred directly to the member's Retirement Savings Plan.

Members of the Plan may transfer non locked-in or locked-in benefits from a previous employer. Non locked-in benefits are administered as outlined in the previous paragraph. Locked-in benefits can be withdrawn within ten years of the normal retirement date. Upon retirement, the locked-in and non locked-in contributions may be used to purchase an annuity.

### (h) Income taxes

The Plan is not subject to income taxes since it is a Registered Pension Trust as defined by the Income Tax Act.

### (i) Surplus

Where the Plan is continuing and there is a surplus resulting from an actuarial review, the Halifax Regional Water Commission may decide how the surplus is to be treated. Pursuant to the Memorandum of Understanding-Pensions between the Halifax Regional Water Commission and each of the two union groups dated June 7, 2019, indexing to a maximum of 2% would be reinstated once the going concern special payments made by the Halifax Regional Water Commission related to any unfunded liability have been recouped by the Halifax Regional Water Commission, and subject to the Plan having a going concern funded ratio of 108% (or above), no solvency deficit, and so long as the implementation can be affected while maintaining a going concern funded ratio of 108%. However, no amounts can be paid out of the fund to the employer without prior approval of the Superintendent of Pensions.

A surplus resulting from the wind-up of the Plan will be used to increase the benefits to the living Members of the Plan (including pensioners) and their beneficiaries to the extent permitted by the Income Tax Act and Regulations. Any balance remaining will be returned to the Halifax Regional Water Commission however, no amounts can be paid out of the fund to the employer without prior approval of the Superintendent of Pensions.

December 31, 2021

# 2. Statement of compliance with Canadian accounting standards for pension plans and summary of significant accounting policies

The financial statements are presented in accordance with Canadian accounting standards for pension plans in Part IV of the Chartered Professional Accountants of Canada (CPA) Handbook, Section 4600 – Pension Plans. Section 4600 provides specific accounting guidance on pension obligations and investments, with investments complying with international financial reporting standards ("IFRS") in Part I of the CPA Canada Handbook. For accounting policies that do not relate to either investments or pension obligations, the plan must consistently comply with either IFRS or Canadian accounting standards for private enterprises ("ASPE") in Part II of the CPA Canada Handbook. The Plan has elected to comply on a consistent basis with ASPE. To the extent that ASPE is inconsistent with Section 4600, Section 4600 takes precedence.

### (a) Financial instruments

Financial assets and financial liabilities are recognized when the Plan becomes a party to the contractual provisions of the financial instrument.

Financial assets are derecognized when the contractual rights to the cash flows from the financial assets expire, or when the financial asset and all substantial risks and rewards are transferred.

A financial liability is derecognized when it is extinguished, discharged, cancelled, or expires.

All financial assets and financial liabilities are initially measured at fair value. Fair value is an estimate of the amount of consideration that would be agreed upon in an arm's length transaction between knowledgeable, willing parties who are under no compulsion to act.

Financial assets and liabilities are subsequently measured as described below:

#### Investment assets

All investment assets are measured at fair value at the date of the statement of financial position in accordance with IFRS 13: Fair Value Measurement Part I of the CPA Canada Handbook. Fair values of investment assets are determined as follows:

• Pooled funds are valued at the unit value supplied by the Master Trust administrator, and which represent the Plan's proportionate share of underlying net assets at fair value determined using closing bid prices.

Transaction costs are not included in the fair value of investment assets either on initial recognition or on subsequent re-measurement. Transaction costs are included in the statement of changes in net assets available for benefits as part of expenses incurred in the period.

Investment income, excluding changes in the fair value of investment assets, is presented in the statement of changes in net assets available for benefits.

December 31, 2021

# 2. Statement of compliance with Canadian accounting standards for pension plans and summary of significant accounting policies (continued)

### (a) Financial instruments (continued)

#### Financial liabilities

Financial liabilities are measured subsequently at amortized cost using the effective interest method.

### (b) Pension obligations

The Plan is a defined benefit plan established for members. The pension obligations recognized in the statements of financial position are the actuarial present value of accrued pension benefits determined by applying best estimate assumptions and the projected benefit method prorated on services.

### (c) Net investment income

Income from investments is recognized on an accrual basis and includes dividend income (recognized on ex-dividend date), interest income, and is net of investment manager fees.

### (d) Changes in the fair value of investment assets and liabilities

This includes both realized gains or losses on sale of investments and unrealized gains or losses on investments.

Realized gains or losses on sale of investments are the difference between the proceeds received and the average cost of investments sold.

Unrealized gains or losses on investments represent the difference between the carrying value at the year end and the carrying value at the previous year end or purchase value during the year, less the reversal of previously recognized unrealized gains and losses in respect of disposals during the year.

#### (e) Contributions

Required employee and employer contributions are recorded the month following when the payroll deductions are made. Employee and employer contributions, as well as special payments due to the Plan at the end of the year are recorded on an accrual basis. Cash received from pension plan transfers or members for service purchases are recorded when received.
December 31, 2021

# 2. Statement of compliance with Canadian accounting standards for pension plans and summary of significant accounting policies (continued)

#### (f) Benefits

Benefit payments to retired members, commuted value payments and refunds to former members are recorded in the period paid. Accrued benefits are recorded as part of the accrued pension benefit obligation.

#### (g) Estimation uncertainty

When preparing the financial statements, management undertakes a number of judgements, estimates and assumptions about recognition and measurement of assets, liabilities, revenue, and expenses. The actual results are likely to differ from the judgments, estimates and assumptions made by management and will seldom equal the estimated results. Information about the significant judgments, estimates and assumptions that have the most significant effect on the recognition and measurement of assets, liabilities, revenue, and expenses are discussed below:

#### Fair value of financial instruments

Management uses valuation techniques in measuring the fair value of financial instruments, where active market quotes are not available. Details of the assumptions used are given in the notes regarding financial assets and liabilities. In applying the valuation techniques, management makes maximum use of market inputs, and uses estimates and assumptions that are, as far as possible, consistent with observable data that market participants would use in pricing the instrument. Where applicable data is not observable, management uses its best estimate about the assumptions that market participants would make. These estimates may vary from the actual prices that would be achieved in an arm's length transaction at the reporting date.

#### Pension obligations

Management estimates the pension obligations annually with the assistance of an independent actuary; however, the actual outcome may vary due to estimation uncertainties. The estimate of the pension obligation of \$144,611,949 (2020 - \$141,762,849) is based on assumed rates of retirement, mortality, breaks in service and contributory hours. Discount factors are determined at or near year-end to reflect the long-term expectation of investment returns that are denominated in the currency in which the benefits will be paid and that have terms to maturity approximating the terms of the related pension obligation.

December 31, 2021

#### 3. Investment assets

The investment in the Halifax Regional Municipality Master Trust (the "HRM Master Trust") is recorded at its fair value. The Plan's interest in the HRM Master Trust represents 6.50% (December 31, 2020 – 6.39%) of the HRM Master Trust units. The remaining units are held by the Halifax Regional Municipality ("HRM"). The co-mingling of investments does not affect the actuarial liabilities or the net assets available for benefits of the Plan.

The fair value of the investment in the HRM Master Trust is determined as at the date of the statements of financial position as described in note 2(a). The fair value of the investment in the HRM Master Trust is categorized as a Level 2 investment under fair value hierarchy measurement.

Section 67 (3) of the *Pension Benefits Act Regulations* requires disclosure of each investment asset that has a fair value greater than two percent (2%) of the fair value of all the investment assets of the Plan. The following schedule reports all investments having a fair value greater than 2% of the fair value of all investment assets of the Plan.

| Investment                                                                                                                                                                                                                                                                                  | Asset Class                                                                                                                                           | Market Value                                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| BlackRock Canadian World Index Fund<br>Wellington Management Global Total Return                                                                                                                                                                                                            | Global Equities<br>Foreign Bonds                                                                                                                      | \$ 9,807,858<br>8,860,366                                                  |
| Fund<br>BlackRock Alpha Advantage Global Fund<br>BlackRock Active Canadian Equity Fund<br>Mawer International Equity Pooled Fund<br>Marathon International Equity Fund<br>UBS (UK) Real Estate Funds Selection Global<br>Ex Canada, L.P.<br>Minto Multi-Residential Income Partners I, L.P. | Global Equities<br>Canadian Equities<br>International Equities<br>International Equities<br>Real Estate-Limited<br>Partnership<br>Real Estate-Limited | 7,960,498<br>6,619,310<br>5,613,572<br>5,259,916<br>4,450,695<br>4,241,308 |
| Wellington Emerging Markets Local Equity Fund                                                                                                                                                                                                                                               | Partnership<br>Emerging Market<br>Equities<br>Emerging Market Equities                                                                                | 3,916,894<br>3,571,810                                                     |
|                                                                                                                                                                                                                                                                                             |                                                                                                                                                       | \$ 60,302,227                                                              |
| 4. Net assets available for benefits                                                                                                                                                                                                                                                        | 2020                                                                                                                                                  | 2021                                                                       |
| To pension plan                                                                                                                                                                                                                                                                             | \$ 173,777,663                                                                                                                                        | \$ 154,221,503                                                             |
| To extra voluntary contribution benefits                                                                                                                                                                                                                                                    | 589,577                                                                                                                                               | 469,448                                                                    |
| To individual locked in amounts                                                                                                                                                                                                                                                             | 269,123                                                                                                                                               | 265,206                                                                    |
|                                                                                                                                                                                                                                                                                             | \$ 174,636,363                                                                                                                                        | \$ 154,956,157                                                             |

December 31, 2021

#### 5. Pension obligations

An actuarial valuation of the Halifax Regional Water Commission Employees' Pension Plan was performed as at January 1, 2022.

The actuarial value of accrued benefits, determined periodically by the Plan's actuary, is the amount that results from applying actuarial assumptions to adjust the Plan benefits to reflect the time value of money between the valuation date and the expected date of payment. The significant actuarial assumptions used include:

- a) 40% of members will retire at the age of 65, and 60% will retire at the earliest date of eligibility for an unreduced pension;
- b) interest rate assumption of 6.35% per annum (2019 5.80%);
- c) salary scale assumption of 3.90% per annum (2019 3.90%); and
- d) life expectancy of participants based upon the CPM-2014 Combined mortality table, with Scale CPM-B (post retirement), no mortality in pre-retirement.

The 2019 interest rate assumption of 5.80% referenced above included an implicit margin for conservatism of 0.60% as determined by the Plan. As a result of the new funding Regulations effective April 1, 2020, the Plan's implicit margin for conservatism has been removed for the actuarial valuation of January 1, 2022, as an explicit level of conservatism has been added through legislation (see note 1(b)).

As a result of the January 1, 2022 actuarial valuation, special payments in respect of going concern liabilities are no longer required. The next actuarial valuation for the Plan is required to be performed no later than January 1, 2025.

| 6. Net investment income     | <br>2021        | <br>2020        |
|------------------------------|-----------------|-----------------|
| Income from investment funds | \$<br>3,657,805 | \$<br>3,763,614 |
| Investment manager fees      | <br>(301,176)   | <br>(194,968)   |
|                              | \$<br>3,356,629 | \$<br>3,568,646 |

December 31, 2021

| 7. Contributions             | <br>2021        | <br>2020        |
|------------------------------|-----------------|-----------------|
| Participants' contributions  |                 |                 |
| Required                     | \$<br>3,301,346 | \$<br>3,230,131 |
| Voluntary                    | 89,978          | <br>79,982      |
|                              | \$<br>3,391,324 | \$<br>3,310,113 |
| Sponsor's contributions      |                 |                 |
| Required                     | \$<br>3,301,346 | \$<br>3,230,131 |
|                              |                 | <br>            |
| 8. Benefit payments          | <br>2020        | 2019            |
| Retirement benefit payments  | \$<br>4,739,794 | \$<br>4,552,474 |
| Termination benefit payments | 783,885         | 677,236         |
| Death benefit payment        | <br>63,848      | <br>-           |
|                              | \$<br>5,587,527 | \$<br>5,229,710 |

During 2021, there were 13 termination benefit payments (2020 - 17) and 1 death benefit payment (2020 - 0). Termination benefits are paid out as described in note 1(f).

| <u>2021</u>   |                                                                                                                                                    | 2020                                                                                                                                             |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| \$<br>83,773  | \$                                                                                                                                                 | 42,143                                                                                                                                           |
| 10,027        |                                                                                                                                                    | 8,648                                                                                                                                            |
| 27,576        |                                                                                                                                                    | 30,479                                                                                                                                           |
| 10,600        |                                                                                                                                                    | 9,636                                                                                                                                            |
| 18,083        |                                                                                                                                                    | 16,724                                                                                                                                           |
| 43,529        |                                                                                                                                                    | 23,151                                                                                                                                           |
| 2,662         |                                                                                                                                                    | 2,645                                                                                                                                            |
| \$<br>196,250 | \$                                                                                                                                                 | 133,426                                                                                                                                          |
| \$            | 2021           \$ 83,773           10,027           27,576           10,600           18,083           43,529           2,662           \$ 196,250 | 2021         \$       83,773       \$         10,027       27,576         27,576       10,600         18,083       43,529         2,662       \$ |

#### 10. Related party transactions

The Halifax Regional Water Commission, the Plan's sponsor, collects the Plan's contributions and pays certain expenses on behalf of the Plan. These items are then credited or charged back to the Plan.

December 31, 2021

#### 11. Financial instruments

#### Financial instruments risk exposure and management

The Plan is exposed to various risks in relation to its investment in the HRM Master Trust, consisting of investment assets. The Plan's financial assets are categorized in Level 2. The main types of risks are market risk, credit risk and liquidity risk.

The Plan's risk management policy is derived from the HRM Master Trust in which the Plan holds units. The HRM Master Trust has formal policies and procedures placed upon it that establish an asset mix among equity and fixed income investments, required diversification of investments within categories, a set limit on the size of exposure to individual investments, and a requirement to use A-rated counterparties.

The Plan does not actively engage in the trading of financial assets for speculative purposes, nor does it write options. The most significant financial risks to which the Plan is exposed are described below:

(a) Market risks

Market risk is the risk that the fair value or future cash flows of a financial instrument will fluctuate because of changes in market prices. For purposes of this disclosure, the Plan segregates market risk into three categories: interest rate risk, currency risk and other price risk.

i. Interest rate risk

Interest rate risk refers to the fact that the value of the Plan's assets is affected by changes in nominal interest rates and equity markets.

ii. Currency risk

The Plan's functional currency is Canadian dollars, and all the Plan's transactions are carried out in Canadian dollars.

iii. Other price risk

Other price risk is the risk that the fair value or future cash flows of financial instruments will fluctuate because of changes in market prices, other than those arising from interest rate risk or currency risk, whether those changes are caused by factors specific to the individual investment or factors affecting all securities traded in the market.

All investments have a risk of loss of capital. The maximum risk resulting from the investments is determined by the fair value of the instruments, which total \$174,426,797 at December 31, 2021 (2020 - \$154,762,753). A one percent change (1%) in market risk (holding all variables constant) will impact the fair value of these instruments by approximately \$1,744,000 (2020 - \$1,548,000).

December 31, 2021

#### 11. Financial instruments (continued)

(b) Credit risk

Credit risk on financial instruments is the risk of financial loss occurring because of default or insolvency of a counterparty on its obligations to the Plan. The Plan's credit risk is primarily attributable to the underlying assets of the HRM Master Trust. Credit risk is mitigated through the management of the HRM Master Trust assets with generally accepted parameters of safety and prudence, using a diversified investment program. Investments in the HRM Master Trust must adhere to specific limitations as outlined in the Halifax Regional Municipality's Statement of Investment Policies and Procedures for the Defined Benefit Pension Plan ("the Statement of Investment Policies and Procedures").

(c) Liquidity risk

Liquidity risk is the risk of not being able to meet the Plan's cash requirements in a timely and cost-effective manner. Liquidity requirements are managed through income generated from investments and monthly contributions made by members and the employer. The sources of funds are used to pay pension benefits, make additional investments, and fund operating expenses. The Plan's primary future liabilities include the accrued benefit obligation of the Plan. The Plan's main asset, the investment in the HRM Master Trust, is liquid as cash is available to make required payments.

The following are the contractual maturities of financial liabilities:

Payments due year ending December 31, 2021

|                          |             | Total         | Less than<br>1 year | 1 - 3<br>years | 4 - 5 years | After 5<br>years |
|--------------------------|-------------|---------------|---------------------|----------------|-------------|------------------|
| Payables and accruals    | \$ 60       | 0 <u>,109</u> | \$ 60,109           | \$<br>         | \$          | \$               |
| Payments due yea         | ir ending l | December      | · 31, 2020          |                |             |                  |
|                          |             |               | Less than           | 1 - 3          |             | After 5          |
|                          |             | Total         | 1 year              | <br>years      | 4 - 5 years | years            |
| Payables and<br>accruals | \$ 30       | ),508         | \$ 30,508           | \$             | \$          | \$               |

December 31, 2021

#### 11. Financial instruments (continued)

#### Fair value disclosure

The financial instruments recognized at fair value on the statement of financial position must be classified as one of three fair value hierarchy levels. This hierarchy groups financial assets and liabilities into three levels based on the significance of inputs used in measuring the fair value of the financial assets and liabilities. The fair value hierarchy has the following levels:

- Level 1: quoted prices (unadjusted) in active markets for identical assets or liabilities;
- Level 2: inputs other than quoted prices included within Level 1 that are observable for the asset or liability, either directly or indirectly (i.e., as prices) or indirectly (i.e., derived from prices); and
- Level 3: inputs for the asset or liability that are not based on observable market data (unobservable inputs).

The level within which the financial asset or liability is classified is determined based on the lowest level of significant input to the fair value measurement. The financial assets and liabilities measured at fair value in the statement of financial position are grouped into the fair value hierarchy as follows:

Financial assets at fair value as at December 31, 2021

|             | $\leq$ | Level 1 | Level 2        | Level 3 | Total          |
|-------------|--------|---------|----------------|---------|----------------|
| Assets      |        |         |                |         |                |
| Pooled fund | \$     |         | \$ 174,426,797 | \$      | \$ 174,426,797 |
|             |        |         |                |         |                |

Financial assets at fair value as at December 31, 2020

|             | <br>Level 1 | Level 2        | Level 3 | Total          |
|-------------|-------------|----------------|---------|----------------|
| Assets      |             |                |         |                |
| Pooled fund | \$          | \$ 154,762,753 | \$      | \$ 154,762,753 |

There were no transfers between the three levels between December 31, 2020 and December 31, 2021.

The methods and valuation techniques used for the purpose of measuring fair value are unchanged compared to the previous reporting period.

December 31, 2021

#### 12. Capital management

The Plan defines its capital as the surplus of the Plan, as determined annually based on the fair value of net assets and actuarial liabilities, provided by the actuarial valuation prepared by the Plan's independent actuary (note 5).

The overall objectives in investing the assets of the Plan are to ensure sufficient liquidity to support its financial obligations, to continue to provide benefits in the best interest of its members, to remain financially self-sufficient and to preserve and enhance the value of capital through adequate diversification in high quality investments and achieve the highest investment return that can be obtained with the assumption of an acceptable degree of risk. The Plan holds units with the HRM Master Trust which has formal policies and procedures that establish asset mix, require diversification within different categories, set a limit on the exposure to individual investments and provides a requirement to use A-rated counterparties.

#### 13. Subsequent event

Since December 31, 2021, there have been a number of factors affecting economic activity including the lingering effects of COVID-19, increased inflation, rising interest rates, and the Russia-Ukraine conflict, which are causing material disruptions to businesses around the world and significant volatility and weakness in the global equity markets.

As at April 30, 2022, the fair value of the Plan's investments declined by 4.61%, or approximately \$7,970,000 since December 31, 2021. Currently the Plan does not foresee a significant impact to future operations or its ability in continuing to make benefit payments.



| TO:           | Becky Kent, B.A., Chair, and Members of the Halifax Regional<br>Water Commission Board, as Trustees of the Halifax Regional<br>Water Commission Employees' Pension Plan |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SUBMITTED BY: | Louis de Digitally signed by Louis de Montbrun<br>Date: 2022.06.17<br>12:06:07 -03'00'                                                                                  |
|               | Louis de Montbrun, CPA, CA                                                                                                                                              |
| APPROVED:     | Director, Corporate Services / CFO<br>Cathie Digitally signed by Cathie<br>O'Toole Date: 2022.06.17<br>12:54:18 -03'00'                                                 |
|               | Cathie O'Toole                                                                                                                                                          |
|               | General Manager                                                                                                                                                         |
| DATE:         | June 16, 2022                                                                                                                                                           |
| SUBJECT:      | Halifax Regional Water Commission Employees' Pension Plan - Actuarial Valuation, January 1, 2022                                                                        |

### <u>ORIGIN</u>

Nova Scotia Pension Benefits Act (the "Act"), and pursuant to the motion by the Halifax Regional Water Commission Board (the "Board") January 27, 2022, as follows:

"That the Halifax Water Board approve the attached actuarial valuation assumptions, to be used in conducting the January 1, 2022 actuarial valuation of the Halifax Regional Water Commission Employees' Pension Plan (the "Plan")."

### RECOMMENDATION

It is recommended the Board approve the recommendations contained in the "Report on Actuarial Valuation (hereinafter called the "Valuation") as at January 1, 2022", including:

1. Changing the employer and employees' rate of pension current service contributions effective immediately, upon updating the payroll software to accommodate, made retroactive to January 1, 2022,

and

2. Endorse the release the Actuarial Report to the Pension and Benefits Committee, and to all employee groups.

### BACKGROUND

Section 53(1) of the Pension Benefits Regulations requires defined benefit pension plans to file an actuarial valuation report a minimum of every three years.

### DISCUSSION

At the January 27, 2022, meeting of the Board was asked to approve the assumptions to be used in the January 1, 2022 Valuation for the Halifax Regional Water Commission Employees' Pension Plan (the "Plan"). A major change with respect to economic assumptions compared to the January 1, 2019 Valuation was the increase in the interest (discount) rate from 5.80% to 6.35%, which saw the removal of a 0.60% implicit margin for conservatism incorporated in the previous Valuation. This action was made available due to new funding Regulations within the Act, now requiring defined benefit plans to add an explicit level of conservatism or "Provision for Adverse Deviation" (PfAD) to the going concern liabilities of the Plan. The PfAD is based on the riskiness of the asset mix of the Plan, and for the January 1, 2022 Valuation, the PfAD is reported at 7%. The Board approved the assumptions to be used in the January 1, 2022 Valuation.

The Halifax Water Pension & Benefit Committee met with the Plan's actuary Eckler Ltd at a meeting on May 11, 2022, and reviewed the preliminary results of the Actuarial Valuation as at January 1, 2022.

On June 16, 2022, the Plan's actuary, Eckler Ltd., released its "Report on the Actuarial Valuation as at January 1, 2022" (see attached). A summary of the financial results can be found immediately following the Table of Contents of the full report, the highlights of which are outlined below:

### **Going Concern Financial Position:**

As outlined in Table 1 below, the Plan has seen a significant improvement from the last Valuation, having gone from a surplus position of \$2.1 million in 2019 to a surplus of \$28.4 million in 2022 2019, resulting in a funded ration on a going concern basis of 119.6%. The surplus reported in 2019 was the first for the Plan since 2000, and improvements to the Plan are directly attributed to the Plan re-designed in January 2016 with the intent to improve the Plan's financial position and sustainability over the long-term. Another contributing factor is the improved investment performance of the Halifax Regional Municipality Pension Plan Master Trust, in which the Plan's funds are co-mingled.

### Table 1

| Going Concern Financial Position            | January 1, 2019 | January 1, 2022 |
|---------------------------------------------|-----------------|-----------------|
| Going concern value of assets               | \$126,429,100   | \$172,968,400   |
| Going concern liability                     | (124,371,400)   | (135,206,900)   |
| Provision for adverse deviations ("PfAD")   | N/A             | (9,405,000)     |
| Going concern excess / (unfunded liability) | \$2,057,700     | \$28,356,500    |
| Required PfAD                               | N/A             | 7.0%            |

### **Solvency Financial Position:**

The Plan received a solvency funding exemption effective June 1, 2015, however the calculation of the solvency ratio is still relevant. Under the Act, should the solvency ratio fall below the 85% threshold, the Plan would be required to file an annual cost certificate in addition to a Valuation every three (3) years. As reported in Table 2 below, the solvency ratio for the Plan as at January 1, 2022 is 105.0%, therefore the next Valuation is not required until January 1, 2025.

#### Table 2

| Solvency Financial Position                                 | January 1, 2019 | January 1, 2022 |
|-------------------------------------------------------------|-----------------|-----------------|
| Market value of assets                                      | \$126,429,100   | \$172,968,400   |
| Estimated wind-up expenses                                  | (250,000)       | (350,000)       |
| Solvency assets                                             | \$126,179,100   | \$172,618,400   |
| Solvency liabilities x %* for measuring solvency deficiency | (129,681,300)   | (140,056,500)   |
| Solvency excess / (deficiency)                              | (\$3,502,200)   | \$32,561,900    |
| Solvency concerns ratio                                     | 0.975           | 1.050           |

\* 85% at January 1, 2022, 100% at previous valuations

### **Funding Requirements:**

Funding requirements resulting from the January 1, 2022 Valuation are described below, and summarized in Table 3 below.

- Current Service Contributions
  - The combined current service rates will decrease to 19.20% from 20.68%, which includes a margin of 7.0% representing the PfAD. Employees' contributions in 2022 will be 9.60% of pensionable earnings, which will be matched by the Halifax Water. Prior to January 1, 2022, employees' and Halifax Water each contributed 10.34% of pensionable earnings.
- As a result of the Plan reporting an actuarial surplus on a going concern basis, unfunded liability special payments are not required over the next three (3) year period.

### Table 3

| Funding Requirements (annualized)                                                          | ng Requirements (annualized) January 1, 2 |              |  |
|--------------------------------------------------------------------------------------------|-------------------------------------------|--------------|--|
|                                                                                            | % of Payroll                              | \$           |  |
| Estimated contributory payroll for 2022 service                                            |                                           | \$34,166,800 |  |
| Total value of benefits for active Members                                                 | 19.20%                                    | \$6,558,600  |  |
| Employee contributions (from active Members)                                               | 9.60%                                     | \$3,279,300  |  |
| Matching employer contributions                                                            | 9.60%                                     | \$3,279,300  |  |
| Minimum special payments in 2022 towards amortization of<br>unfunded actuarial liabilities |                                           | \$0          |  |
| Total employer cost in 2022                                                                |                                           | \$3,279,300  |  |

### **Communications:**

The communication strategy with respect to the Plan (and Valuation) will include the release of the Valuation to the Pension and Benefits Committee, and to all employee groups. This will be supplemented with scheduled Plan information sessions, schedule virtually or in-person, at various Halifax Water facilities in August and September 2022. The purpose of the information sessions is to provide an overview of the Plan and the pension promise to its members, an update on the financial position of the Plan, and inform of any upcoming changes to pension legislation in Nova Scotia affecting the Plan.

### **ATTACHMENT**

Report on the Actuarial Valuation as at January 1, 2022

| Report Prepared by: | ared by: | t Pre | Report |
|---------------------|----------|-------|--------|
|---------------------|----------|-------|--------|

Digitally signed by Allan Campbell Date: 2022.06.17 12:15:29 -03'00'

Allan Campbell, B.Comm, CPA, CMA Manager, Finance, 902-266-8655

# HALIFAX REGIONAL WATER COMMISSION EMPLOYEES' PENSION PLAN

## REPORT ON THE ACTUARIAL VALUATION AS AT JANUARY 1, 2022

(REGISTRATION NO. 0344614)

**JUNE 2022** 

**PREPARED BY:** 



1969 UPPER WATER STREET, SUITE 503 HALIFAX, NOVA SCOTIA B3J 3R7

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| С    | PLAUSIBLE ADVERSE SCENARIOS                                             | 24   |
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| Е    | SUMMARY OF PLAN PROVISIONS                                              |      |
| F    | EMPLOYER CERTIFICATION                                                  |      |



### SUMMARY OF RESULTS

| Going Concern Financial Position            | January 1, 2019 | January 1, 2022 |
|---------------------------------------------|-----------------|-----------------|
| Going concern value of assets               | \$126,429,100   | \$172,968,400   |
| Going concern liability                     | (124,371,400)   | (135,206,900)   |
| Provision for adverse deviations ("PfAD")   | N/A             | (9,405,000)     |
| Going concern excess / (unfunded liability) | \$2,057,700     | \$28,356,500    |
| Required PfAD                               | N/A             | 7.0%            |

| Solvency Financial Position                                 | January 1, 2019 | January 1, 2022 |
|-------------------------------------------------------------|-----------------|-----------------|
| Market value of assets                                      | \$126,429,100   | \$172,968,400   |
| Estimated wind-up expenses                                  | (250,000)       | (350,000)       |
| Solvency assets                                             | \$126,179,100   | \$172,618,400   |
| Solvency liabilities x %* for measuring solvency deficiency | (129,681,300)   | (140,056,500)   |
| Solvency excess / (deficiency)                              | (\$3,502,200)   | \$32,561,900    |
| Solvency concerns ratio                                     | 0.975           | 1.050           |
|                                                             |                 |                 |

\* 85% at January 1, 2022, 100% at previous valuations

| Wind-up Financial Position     | January 1, 2019 | January 1, 2022 |
|--------------------------------|-----------------|-----------------|
| Market value of assets         | \$126,429,100   | \$172,968,400   |
| Estimated Wind-up expenses     | (250,000)       | (350,000)       |
| Wind-up assets                 | \$126,179,100   | \$172,618,400   |
| Total wind-up liabilities      | (177,459,700)   | (222,913,200)   |
| Wind-up surplus / (deficiency) | (\$51,280,600)  | (\$50,294,800)  |
| Transfer ratio                 | 71.2%           | 77.6%           |

| Funding Requirements (annualized)                                                          |              | January 1, 2022 |
|--------------------------------------------------------------------------------------------|--------------|-----------------|
|                                                                                            | % of Payroll | \$              |
| Estimated contributory payroll for 2022 service                                            |              | \$34,166,800    |
| Total value of benefits for active Members                                                 | 19.20%       | \$6,558,600     |
| Employee contributions (from active Members)                                               | 9.60%        | \$3,279,300     |
| Matching employer contributions                                                            | 9.60%        | \$3,279,300     |
| Minimum special payments in 2022 towards amortization of<br>unfunded actuarial liabilities |              | \$0             |
| Total employer cost in 2022                                                                |              | \$3,279,300     |
|                                                                                            |              |                 |

### SECTION I INTRODUCTION AND PURPOSE OF VALUATION

At the request of the Halifax Regional Water Commission, we have completed an actuarial valuation of the *Halifax Regional Water Commission Employees' Pension Plan* as at January 1, 2022. The last actuarial valuation was performed as of January 1, 2019.

The purposes of this actuarial valuation are as follows:

- to determine the financial position of the Plan on going concern, solvency and hypothetical wind-up bases;
- to establish the minimum and maximum contributions to the Plan until the next valuation; and
- to meet the statutory filing requirements under the Nova Scotia Pension Benefits Act and the Income Tax Act.

In this report, we have first provided the valuation results, along with an actuarial opinion with recommended funding levels for use until the next valuation. The data, actuarial assumptions and methodology used in valuing both the assets and the actuarial liabilities are provided by way of appendices for ease of reference.

The intended users of this report are the Halifax Regional Water Commission, the Nova Scotia Superintendent of Pensions and the Canada Revenue Agency. This report is not intended or necessarily suitable for purposes other than those listed above. Any party reviewing this report for other purposes should have their own qualified professional assist in their review to ensure that the party understands the assumptions, results and uncertainties inherent in our estimates.

The next valuation of the Plan must be completed as at a date no later than January 1, 2025.

#### Reliance

We have relied on the asset information in the financial statements provided by the Plan sponsor. We have also relied on the Plan sponsor to provide all relevant data and to confirm the pertinent Plan terms.

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### SECTION II PLAN CHANGES AND SUBSEQUENT EVENTS

The previous valuation was prepared as at January 1, 2019. There have been no amendments or changes to the Plan between the last actuarial valuation and this valuation effective January 1, 2022.

A detailed description of the current provisions of the Plan is contained in Appendix E, at the end of this report.

#### **Actuarial Assumptions**

There have been changes to the going concern assumptions since the last valuation. We have increased the discount rate assumption to 6.35% p.a. from 5.80% p.a. used at the previous valuation to reflect the current expectation of the long-term rate of return on Plan assets, and to remove the margin for adverse deviations that was previously included. We have also changed the interest rate assumed on employee contributions from 4.0% p.a. to 2.5% p.a., and the percentage married assumption from 100% to 85% to better reflect actual Plan experience.

The solvency assumptions have been changed to reflect market conditions at the valuation date. We have also increased assumed wind-up expenses from \$250,000 to \$350,000.

The actuarial assumptions used in the valuation are provided in Appendix B.

The Actuarial Standards Board (ASB) published amendments to the CIA Standards of Practice (Section 3500: practice-specific standards for pension commuted values) on January 24, 2020 with an effective date of August 1, 2020. On April 6, 2020, the ASB announced it had decided to delay the effective date of the new Standard of Practice to be a date no earlier than December 1, 2020. The effect of this new Standard of Practice has been incorporated into this valuation.

We are not aware of any events subsequent to the valuation date that would have a material impact on the results of this valuation.

### SECTION III FINANCIAL POSITION OF THE PLAN

#### A. Going Concern Basis: Financial Position as at January 1, 2022

In accordance with the Regulations under the Nova Scotia Pension Benefits Act ("the Regulations"), going concern valuations with effective dates on or after December 31, 2019 must reflect an explicit provision for adverse deviations ("PfAD"), which is to be applied to the going concern liabilities. A PfAD of 7.0% was determined – more information on the determination of the PfAD is provided in Appendix B of this report.

The valuation balance sheet shown below summarizes going concern liability figures and the corresponding asset values (rounded to the nearest \$100) as of January 1, 2022 and as at January 1, 2019 for comparative purposes.

|                                                                      | January 1, 2019 | January 1, 2022          |
|----------------------------------------------------------------------|-----------------|--------------------------|
| Going concern assets                                                 |                 | 100 × 100                |
| Market value of assets                                               | \$126,429,100   | \$172,968,400            |
| Going concern actuarial liabilities                                  |                 |                          |
| Active Members                                                       | \$64,565,300    | \$64,894,100             |
| LTD Members                                                          | 3,947,600       | 4,318,300                |
| Pensioners (i.e., retired Members receiving a pension)               | 50,685,100      | 60,390,000               |
| Survivor pensions                                                    | 3,497,600       | 3,8 <mark>9</mark> 9,300 |
| Deferred pensions & benefit payments in transit                      | 1,127,800       | 855,500                  |
| Additional voluntary contributions<br>(includes conversion accounts) | 548,000         | 849,700                  |
| Total going concern actuarial liabilities                            | \$124,371,400   | \$135,206,900            |
| PfAD = 7.0% of actuarial liabilities (excluding AVCs)                | n/a             | 9,405,000                |
| Total going concern actuarial liabilities including PfAD             | \$124,371,400   | \$144,611,900            |
| Going concern excess / (unfunded liability)                          | \$2,057,700     | \$28,356,500             |
|                                                                      |                 |                          |

#### FINANCIAL POSITION – GOING CONCERN BASIS

As shown above, the January 1, 2022 actuarial valuation has revealed a going concern excess in the amount of \$28,356,500. This compares to a going concern excess at the previous valuation of \$2,057,700.

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#### Sensitivity Analysis

In accordance with the Canadian Institute of Actuaries' Standards of Practice, below we show the impact on the going concern actuarial liability as at January 1, 2022 of a one percentage point drop in the discount rate assumption (i.e., from 6.35% per annum to 5.35% per annum) with all other assumptions unchanged.

#### **GOING CONCERN SENSITIVITY**

|                                                          | Impact 1% Drop |
|----------------------------------------------------------|----------------|
| Total Going Concern Actuarial Liability (excluding PfAD) | \$160,040,100  |

The change would have the impact of increasing the plan liabilities by \$24,833,200, or 18.4% as at January 1, 2022.

#### **Reconciliation of Going Concern Financial Position**

The reconciliation provides an independent cross-check of the calculations performed, and also determines the chief reasons leading to the change in the surplus and/or unfunded liabilities (deficiencies) that have occurred since the previous valuation date.

Although a complete analysis down to the final dollar can be made, such an analysis requires the processing of a considerable amount of detailed data relating to the Plan; the expense of which would not normally be justified unless there were special circumstances. However, it is possible to make an approximate analysis along broader lines and, under normal circumstances, this type of analysis will produce meaningful results.

The table below summarizes the results of our reconciliation of change in financial position over the past three years under consideration.

| <b>RECONCILIATION OF</b> | <b>GOING CONCERN</b> | <b>FINANCIAL</b> | POSITION |
|--------------------------|----------------------|------------------|----------|
|--------------------------|----------------------|------------------|----------|

| January 1, 2019 to January 1, 2022                                                       |              |  |
|------------------------------------------------------------------------------------------|--------------|--|
| Going concern excess / (unfunded liability) as at January 1, 2019:                       | \$2,057,700  |  |
| Add:                                                                                     |              |  |
| <ul> <li>Interest on going concern excess at valuation rate</li> </ul>                   | 379,200      |  |
| Investment experience                                                                    | 19,461,900   |  |
| <ul> <li>Change in the discount rate (from 5.80% p.a. to 6.35% p.a.)</li> </ul>          | 12,834,700   |  |
| <ul> <li>Salary increases lower than expected under the actuarial assumptions</li> </ul> | 1,672,700    |  |
| <ul> <li>Pension indexing less than expected under the actuarial assumptions</li> </ul>  | 1,196,400    |  |
| <ul> <li>Change in demographic assumptions (percent married)</li> </ul>                  | 813,200      |  |
| Pensioner mortality experience                                                           | 360,300      |  |
| <ul> <li>Miscellaneous sources of gain / (loss)</li> </ul>                               | 320,600      |  |
| Deduct:                                                                                  |              |  |
| Retirement experience                                                                    | (1,015,900)  |  |
| Termination experience                                                                   | (319,300)    |  |
| <ul> <li>Addition of Provision for adverse deviations (PfAD)</li> </ul>                  | (9,405,000)  |  |
| Going concern excess / (unfunded liability) as at January 1, 2022:                       | \$28,356,500 |  |

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#### B. Solvency Basis: Financial Position as at January 1, 2022

The financial position of the Plan on a solvency basis as of January 1, 2022 is as follows:

#### FINANCIAL POSITION - SOLVENCY BASIS

|                                                                                                             | January 1, 2019 | January 1, 2022              |
|-------------------------------------------------------------------------------------------------------------|-----------------|------------------------------|
| Solvency assets                                                                                             |                 |                              |
| Market value of assets as at valuation date                                                                 | \$126,429,100   | \$172,968,400                |
| Estimated wind-up expenses                                                                                  | (250,000)       | (350,000)                    |
| Total solvency assets                                                                                       | \$126,179,100   | \$172,618,400                |
| Solvency liabilities                                                                                        |                 |                              |
| Active Members                                                                                              | \$65,211,900    | \$80,338,600                 |
| LTD Members                                                                                                 | 4,801,200       | 5,993,500                    |
| Pensioners (i.e., retired Members receiving a pension)                                                      | 54,263,500      | 72,000,900                   |
| Survivor pensions                                                                                           | 3,687,000       | 4,393,100                    |
| Deferred pensions & benefit payments in transit                                                             | 1,169,700       | 1,196,500                    |
| Additional voluntary contributions<br>(includes conversion accounts)                                        | 548,000         | 849,700                      |
| Total solvency liabilities                                                                                  | \$129,681,300   | \$164,772,300                |
| Applicable percentage of solvency liabilities<br>for purposes of measuring solvency deficiency <sup>1</sup> | \$129,681,300   | \$140,056,5 <mark>0</mark> 0 |
| Solvency excess / (deficit) excluding present value of special payments                                     | (\$3,502,200)   | \$32,561,900                 |
| Present value of 5 years' worth of unfunded<br>liability special payments                                   | \$0             | \$0                          |
| Solvency excess / (deficiency)                                                                              | (\$3,502,200)   | \$32,561,900                 |

<sup>1</sup> Under Section 9 of the Regulations under the Nova Scotia Pension Benefits Act, the applicable percentage of solvency liabilities to be included for purposes of measuring a solvency deficiency is 85% at January 1, 2022, and 100% at January 1, 2019.

In accordance with Section 7(2) of the Regulations, the calculation of the solvency liabilities do not include the following liabilities:

- (a) indexing in relation to pension benefits accrued prior to June 1, 2015; and
- (b) the entitlements of a member on wind-up of the plan related to the grow-in provisions of the Pension Benefits Act (Section 97).

As shown above, the solvency valuation has revealed a solvency excess of \$32,561,900 as at January 1, 2022.

A valuation indicates solvency concerns if the ratio of solvency assets to solvency liabilities is less than 0.85, and if a pension plan that is exempt from solvency funding has solvency concerns, a cost certificate (with certain prescribed information) must be completed effective one year following the valuation date. As at January 1, 2022, the ratio of solvency assets to solvency liabilities is 1.050 (i.e., \$172,968,400 / \$164,772,300). Therefore, a cost certificate does not have to be completed as at January 1, 2023.

#### Sensitivity Analysis

In accordance with the Canadian Institute of Actuaries' Standards of Practice, below we show the impact on the solvency liability as at January 1, 2022 of a one percentage point drop in the discount rate assumption. All other assumptions were kept unchanged.

#### SOLVENCY SENSITIVITY

|                                    | Impact 1% Drop |
|------------------------------------|----------------|
| Total Solvency Actuarial Liability | \$201,064,600  |

The change would have the impact of increasing the liabilities by \$36,292,300 or 22.0% as at January 1, 2022.

#### Incremental Cost

In accordance with the Canadian Institute of Actuaries' Standard of Practice, we have estimated the incremental cost of the solvency liability as at January 1, 2022. This is the present value of the expected aggregate change in solvency liability between January 1, 2022 and the next valuation date, adjusted upwards for expected benefit payments. The next valuation is expected to be as at January 1, 2025.

In our report, we have determined the incremental cost on a solvency basis. The incremental cost was determined as the sum of (a) and (b) minus (c):

- (a) the projected solvency liability at the next valuation date for those members at the current valuation date, allowing for expected decrements, change in membership status and service accrual between the current valuation date and the next valuation date. No adjustment was made for new entrants between the two valuation dates. The resulting projected solvency liability was then discounted to the current valuation date;
- (b) the present value of the benefit payments expected to be paid between current valuation date and the next valuation date, discounted to the current valuation date; and
- (c) the solvency liability as at the current valuation date.

For purposes of calculating the solvency incremental cost, the expected decrements, as well as the expected benefit payments between the current valuation date and the next valuation date, were determined using the going concern demographic assumptions. The projected solvency liability at the next valuation date was determined using the same methods and assumptions as disclosed in Appendix B of this report. In particular, we have assumed that the discount rates will remain the same throughout the projection period and the Standards of Practice for determining Pension Commuted Values in effect at the valuation date will remain unchanged, as will the current educational guidance on the estimation of annuity purchase costs.

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The estimated incremental cost as at January 1, 2022 is \$38,829,400. The estimated incremental cost does not impact the funding requirements of the Plan under the Nova Scotia *Pension Benefits Act* and is for information purposes only.

#### C. Transfer Ratio as at January 1, 2022

The Regulations under the Nova Scotia *Pension Benefits Act* also require the determination of a "transfer ratio". This transfer ratio is used to determine whether transfers of commuted values to terminating members can be made in full, immediately. The transfer ratio is the ratio of:

- (i) the solvency assets (at market value), minus the lesser of the previous year credit balance and the sum of the minimum contributions required under the Regulations until the next valuation date (\$172,968,400 \$0), to
- (ii) the sum of the solvency liabilities and the liabilities for benefits that were excluded in calculating the solvency liabilities (i.e., the wind-up liabilities).

As at January 1, 2022 the transfer ratio was 77.6% (i.e., \$172,968,400 divided by (\$164,772,300 + \$58,140,900)).

If the transfer ratio is less than 1 then, unless certain conditions are met, a portion of a terminated member's commuted value cannot be paid in a lump sum, but instead must be held back and paid with interest within 5 years. For this plan, the portion is 22.4%. The two conditions that allow full payment of the commuted value are:

- if an additional contribution is remitted to the fund equal to the portion of the commuted value that should be held back, or
- if the aggregate of transfer deficiencies for all transfers made since the last review date does not exceed 5% of the assets of the plan at that time.

#### D. Hypothetical Wind-up Basis: Financial Position as at January 1, 2022

The financial position of the Plan on a wind-up basis as of January 1, 2022 is as follows:

#### FINANCIAL POSITION - WIND-UP BASIS

|                                                                      | January 1, 2019 | January 1, 2022 |
|----------------------------------------------------------------------|-----------------|-----------------|
| Wind-up assets                                                       | Gu du           | 51 51 5         |
| Market value of assets as at valuation date                          | \$126,429,100   | \$172,968,400   |
| Estimated wind-up expenses                                           | (250,000)       | (350,000)       |
| Total wind-up assets                                                 | \$126,179,100   | \$172,618,400   |
| Wind-up liabilities                                                  |                 |                 |
| Active Members                                                       | \$96,556,600    | \$117,379,000   |
| LTD Members                                                          | 6,369,000       | 7,540,600       |
| Pensioners (i.e., retired Members receiving a pension)               | 68,163,400      | 90,055,400      |
| Survivor pensions                                                    | 4,392,000       | 5,201,900       |
| Deferred pensions & benefit payments in transit                      | 1,430,700       | 1,886,600       |
| Additional voluntary contributions<br>(includes conversion accounts) | 548,000         | 849,700         |
| Total wind-up liabilities:                                           | \$177,459,700   | \$222,913,200   |
| Wind-up excess / (deficiency)                                        | (\$51,280,600)  | (\$50,294,800)  |

As shown above, on a wind-up basis there is a wind-up deficiency of \$50,294,800 after providing for the settlement of all accrued benefit entitlements as at January 1, 2022, and the inclusion of grow-in benefits.



### SECTION IV FUNDING REQUIREMENTS

#### A. Current Service Costs

The Plan's current service cost is the value of the benefits accruing to Members in the year following the valuation, determined on a going concern basis.

The table below summarizes the results of the Plan's current service cost for the 12-month period following January 1, 2022. According to the Plan Rules, this cost should be shared equally by the employer and the Plan members.

#### **CURRENT SERVICE COSTS**

|                                                                                | % of Payroll | \$           |
|--------------------------------------------------------------------------------|--------------|--------------|
| Estimated contributory payroll for 2022 service                                |              | \$34,166,800 |
| Total value of benefits for active Members                                     | 17.94%       | \$6,129,500  |
| Total value of benefits for active Members (including 7.0% PfAD <sup>7</sup> ) | 19.20%       | \$6,558,600  |
| Employee contributions (from active Members)                                   | 9.60%        | \$3,279,300  |
| Employer contributions                                                         | 9.60%        | \$3,279,300  |

<sup>1</sup> After discussion with the Halifax Regional Water Board of Commissioners and the Pension and Benefit Committee it was decided that the current service cost for purposes of setting contribution rates should include the PfAD.

The cost of benefits accruing (including the 7.0% PfAD) in respect of the year following the valuation date is \$6,558,600 or 19.20% of active contributory payroll. The employee and employer contributions in respect of active Members should therefore be set at a flat rate of 9.60% of earnings. The table below summarizes the Water Commission's estimated current service contributions for the three years commencing January 1, 2022, assuming pensionable earnings of \$34,166,800 for 2022 and increasing by 3.90% per annum in the years following.

| Year | Estimated Contributory Payroll | Estimated Employer Current Service Cost |
|------|--------------------------------|-----------------------------------------|
| 2022 | \$34,166,800                   | \$3,279,300                             |
| 2023 | \$35,499,300                   | \$3,407,200                             |
| 2024 | \$36,883,800                   | \$3,540,100                             |

The actual dollar amount of current service contributions for the years following the valuation date may be higher or lower than the amounts indicated above if the actual pensionable earnings are different than assumed.

#### Sensitivity Analysis

Below we show the impact on the 2022 current service cost as at January 1, 2022 of a one percentage point drop in the discount rate assumption. All other assumptions were kept unchanged.

#### **CURRENT SERVICE COST SENSITIVITY**

|                                                  | Impact 1% Drop |
|--------------------------------------------------|----------------|
| Total Current Service Cost (Including 7.0% PfAD) | \$8,492,600    |

The change in the discount rate would have the impact of increasing the current service cost by \$1,934,000 or 29.5% as at January 1, 2022. The resulting current service cost would amount to employee and employer contributions in respect of active Members of 12.43% of earnings (for a total of 24.86% of earnings).

#### **B. Special Payments**

The valuation as at January 1, 2022 continues to reveal a going concern excess. Therefore, no going concern special payments are required.

The Plan has a solvency funding exemption as per subsection 19(6) of the Regulations under the Nova Scotia Pension Benefits Act, and therefore no special payments would be required to amortize the Plan's solvency deficiency, if it had one.



### SECTION V ACTUARIAL OPINION

The following represent our primary conclusions as a result of our actuarial valuation as at January 1, 2022:

- 1. As at the valuation date there exists a Plan going concern excess of \$28,356,500.
- 2. The Plan has a solvency excess of \$32,561,900.
- 3. The cost of benefits accruing (including a 7.0% PfAD) in respect of the year following the valuation date is \$6,558,600, which amounts to 19.20% of active contributory payroll. Required employee and employer contributions are each 9.60% of payroll for each of the next three years in order to cover current year cost.
- 4. The adequacy and appropriateness of this funding level should be reviewed at the next actuarial valuation of this Plan, which should take place as of January 1, 2025 at the latest.
- 5. If the Plan were to be wound up on the valuation date, the value of Plan assets would be less than the Plan's wind-up liabilities by an amount of \$50,294,800.
- 6. The maximum employer contribution permitted in 2022 is estimated to be \$53,574,100 and is equal to the wind-up deficit of \$50,294,800 plus the expected employer current service cost of \$3,279,300.
- 7. The transfer ratio of the Plan is 77.6%.
- 8. The previous year credit balance as at January 1, 2022 was \$0.
- 9. For purposes of paragraph 147.2(2)(d) of the Income Tax Act, the excess surplus based on the going concern valuation was nil as of January 1, 2022.
- 10. We are not aware of any events that occurred between the valuation date and the date this report was completed that would have a material impact on the results of this valuation. Any investment experience occurring between the valuation date and the report date, which differs from the assumption made, is not reported on in this valuation report and will be reported on in a future valuation.

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- 11. In our opinion,
  - a. the data on which the valuation is based are sufficient and reliable for the purposes of the valuation as described in Section I;
  - b. the assumptions described herein are appropriate for the purposes of the valuation; and
  - c. the methods employed in the valuation are appropriate for the purposes of the valuation.

This report has been prepared, and our opinions given, in accordance with accepted actuarial practice in Canada. It has also been prepared in accordance with the funding and solvency standards set by the Nova Scotia Pension Benefits Act.

Nonetheless, emerging experience, differing from the assumptions, will result in gains or losses which will be revealed in future valuations.

Respectfully submitted,

Jeff Turnbull, FSA, FCIA

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Mary Kate Archibald, FSA, FCIA, CFA

HALIFAX REGIONAL WATER COMMISSION EMPLOYEES' PENSION PLAN



### APPENDIX A PLAN ASSETS

The pension plan assets are structured under a master trust arrangement whereby the Plan funds are invested in the same manner as the HRM pension fund, however, a sub-account for HRWC is tracked for administrative purposes. Plan assets are invested in a mix of fixed income, equity, real estate, infrastructure, and private equity assets. At January 1, 2022, the market value of the fund amounted to \$172,968,351.

#### **Reconciliation of Plan Assets**

A summary of pension fund transactions for the period January 1, 2019 to December 31, 2021 is summarized below:

#### **RECONCILIATION OF PLAN ASSETS**

|                                          | 2019                      | 2020          | 2021                         |
|------------------------------------------|---------------------------|---------------|------------------------------|
| January 1                                | \$126,429,106             | \$141,212,832 | \$153,367,627                |
| Employee Contributions – Current Service | 2,949,015                 | 3,142,261     | 3,271,501                    |
| Employee Contributions – Other           | 500,696                   | 104,455       | 96,943                       |
| Employer Contributions – Current Service | 2,946,847                 | 3,142,261     | 3,271,501                    |
| Employer Contributions – Other           | 0                         | 24,474        | 6,964                        |
| Net transfers                            | 9,048                     | 0             | 0                            |
| Net Investment Income                    | 13,56 <mark>5</mark> ,162 | 10,971,055    | 18,545,574                   |
| Pensions Paid                            | (4,226,855)               | (4,552,474)   | (4,744,025)                  |
| Refunds                                  | (960,187)                 | (677,237)     | (847,734)                    |
| December 31                              | \$141,212,832             | \$153,367,627 | \$172,9 <mark>6</mark> 8,351 |

#### **Performance of Plan Assets**

The net rate of return on the pension fund's assets over the past three years is shown below:

#### **ANNUALIZED RATES OF RETURN**

| Year Ending       | Net of Expenses Return |  |
|-------------------|------------------------|--|
| December 31, 2019 | 10.68%                 |  |
| December 31, 2020 | 7.74%                  |  |
| December 31, 2021 | 12.05%                 |  |
| 3-year average    | 10.14%                 |  |

The average rate of return since the last valuation was 10.14%, net of expenses.

It should be noted that these returns do not remove the impact of the timing of cash flows. They do, however, accurately reflect the actual rate of growth of the pension fund. Thus, there may be differences between these returns and the time weighted rates of return reported by the fund manager.

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### APPENDIX B ACTUARIAL METHODS AND ASSUMPTIONS

#### A. Valuation of Assets

Going concern assets are measured on a market value basis at this valuation. The table below summarizes the calculation of the actuarial asset value at January 1, 2022, rounded to the nearest \$100:

#### ACTUARIAL ASSET VALUE

|                           | January 1, 2022 |
|---------------------------|-----------------|
| Market value of assets    | \$172,968,351   |
| Contributions in transit  | 0               |
| Actuarial value of assets | \$172,968,351   |

#### **B. Going Concern Valuation**

For the purposes of a going concern valuation, we select actuarial assumptions with a long-term focus. That is, we anticipate that the Plan will continue indefinitely into the future. Actuarial assumptions are selected giving consideration to historical trends, future expectations and Plan specific experience, where possible. The assumptions chosen are expected to produce a stable pattern of funding and meet the plan sponsor's desire to minimize potential for significant shortfalls or deficits in the future.

The purpose of this part of our analysis is to determine an appropriate method and series of assumptions to make proper allowance for the Plan's future liabilities by way of payment of pensions and other benefits. In making these calculations, assumptions must be made:

- as to the probability that a particular payment will be made at a certain time (for example, depending upon whether or not the individual concerned survives to that date), and
- the expected amount of each such payment.

In order to do this, we make a series of assumptions in connection with the many factors which will have a bearing upon the future financial operation of the Plan. These include the following:

- future rates of mortality (and the corresponding life expectancies of the Plan members and their spouses),
- future rates of employee turnover (withdrawal from the Plan),
- future rates of salary increase for members of the Plan,
- the proportion of those plan members who are married (and in respect of whom a survivor's pension would be payable to that individual's surviving spouse in the event of the member's death).

Finally, we give consideration to the rate of interest that will be earned on the assets of the pension fund in future years.

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As part of our process of analysis, all of these factors have received consideration. Where applicable, we have taken into account the actual experience of this Plan. However, it should be noted that, from a statistical point of view, actual experience data developed from a single pension plan has limited validity unless the number of Plan members is very large. Therefore, it becomes necessary to take into account statistics developed from many other larger pension plans.

#### **Going Concern Discount Rate Assumption**

We have increased the discount rate assumption from 5.80% per annum (used in the January 1, 2019 actuarial valuation) to 6.35% per annum for the January 1, 2022 actuarial valuation. This increase reflects our latest expectations for the long-term rate of return on the pension fund, and the removal of the margin for adverse deviations in the determination of the discount rate.

The economic assumptions (i.e., those related to interest rates and inflation) for this valuation are based on reasonable expectations with respect to the relationships among key economic variables over the long term, as well as the expected impact of those economic variables on the investment performance of the pension fund given the fund's investment policy.

We have taken a "best estimate" approach to the determination of the discount rate, based on the expected future investment return on the assets of the pension plan. In particular, our approach consists of:

- determining the best estimate of long-term, expected future investment returns for the various asset classes in which the Plan invests;
- combining these best estimate long-term, expected future investment returns to reflect the Plan's investment policy, thereby creating an "expected" fund return that is a weighted average of the asset class returns;
- including an allowance for additional return due to active versus passive management, and the impact of rebalancing and diversification, which we have considered appropriate in the circumstance as a result of stochastic modelling specific to the Plan's target asset mix;
- and making appropriate provision for expenses.

The result of our analysis is depicted in the following table:

#### **DISCOUNT RATE**

| Development of Discount Rate                  |         |  |
|-----------------------------------------------|---------|--|
| Unadjusted "best estimate" return             | 6.25%   |  |
| Less fees <sup>1</sup>                        | (0.30%) |  |
| Plus "rebalancing and diversification effect" | 0.40%   |  |
| Less margin for adverse deviation             | (0.00%) |  |
| Equals discount rate                          | 6.35%   |  |

<sup>1</sup> Fees shown here represent operational and passive management fees. It is assumed that active management fees would be paid for through added value from active management.

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#### **Going Concern Mortality Assumption**

We have retained the mortality assumption used in the previous valuation, i.e., the CPM 2014 (Combined) mortality table projected with Scale CPM-B.

We expect to review the mortality assumption from time to time, both to reflect trends in mortality, as well as the development of new actuarial tables and standards.

#### Salary Scale Assumption

The salary scale assumption used for this valuation has remained at 3.90% per annum, the same rate as that used in the previous valuation.

#### Maximum Pension Increase Assumption

Pensions are capped by Income Tax Act Regulations at \$3,420.00 per year of service for retirements occurring in 2022. For this Plan, this maximum applies to service accrued prior to January 1, 2016. It is expected that this maximum will be increased in accordance with an average wage index from 2022 onward. For purposes of the valuation, we have assumed that the maximum pension will increase after 2022 by 3.00% per annum.

For service accrued after December 31, 2015, the maximum pension under the plan is limited to \$2,818.89 per year of service for retirements occurring in years 2022 to 2023. This limit will be increased by 1% in years thereafter.

#### **Going Concern Actuarial Methods**

The actuarial cost method used in conducting this valuation is the projected unit credit cost method. This is the same method as was used in the previous valuation.

In using this method, as a first step, a calculation is made of the liability in respect of all benefits that have accrued to members on account of service up to and including the valuation date. This represents the "accrued liability". It should be noted that this calculation takes into account projected future pay increases for each member up to and including expected retirement date.

As a completely separate process, the current year cost has been calculated (using exactly the same actuarial assumptions). This represents the additional cost of the benefits that will accrue in respect of the 12-month period following the valuation date. This is compared with the amount of the required employee contributions over that period. The difference represents the required employer contribution necessary in order for those benefits to be properly funded.

For an individual member, the funding pattern produced by the projected unit credit cost method is one that increases (both in dollar terms and as a percentage of salary) over time. However, for the group as a whole, if the average age remains constant (which can occur through the retirement of older members and the addition of new, younger members) and salary levels increase in accordance with the salary scale, the contribution rate recommended under this method will remain relatively constant. If the plan's average age increases, on the other hand, the current year cost will also increase. Such increases would be revealed in future valuations.

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#### Provision for Adverse Deviations (PfAD)

For actuarial valuations with an effective date on or after December 31, 2019, the Regulations under the Nova Scotia *Pension Benefits Act* were amended to include a PfAD when determining the going concern financial position of the plan. The PfAD is derived from the target investment portfolio of the Plan and Section 12B of the Regulations under the Nova Scotia *Pension Benefits Act*. There are two components when determining the PfAD:

- A) A flat 5%; plus
- B) A value determined under Section 12D of the Regulations, based on the Plan's combined target asset allocation for non-fixed income assets as determined under Section 12C of the Regulations.

As per Section 12B(2) of the Regulations, the value of "A" in the formula above is zero for a pension plan that is exempt from solvency funding. The following table details the calculation of the PfAD as at January 1, 2022:

| Asset Class                                                                         | Target Asset Allocation<br>Per Plan's Statement<br>of Investment Policies<br>and Procedures | Per Regulation 12C,<br>Percentage of Asset<br>Class Deemed Fixed<br>Income Assets | "Product" Used to<br>Determine Value of "C"<br>under Regulation 12C |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------------|
| Formula                                                                             | М                                                                                           | N                                                                                 | P= M x N                                                            |
| Cash                                                                                | 3.50%                                                                                       | 100%                                                                              | 3.50%                                                               |
| Universe federal bonds                                                              | 6.50%                                                                                       | 100%                                                                              | 6.50%                                                               |
| Corporate bonds                                                                     | 3.50%                                                                                       | 100%                                                                              | 3.50%                                                               |
| High yield bonds                                                                    | 2.00%                                                                                       | 50%                                                                               | 1.00%                                                               |
| EM debt                                                                             | 0.50%                                                                                       | 50%                                                                               | 0.25%                                                               |
| Mortgages                                                                           | 2.00%                                                                                       | 50%                                                                               | 1.00%                                                               |
| Private debt                                                                        | 2.50%                                                                                       | 50%                                                                               | 1.25%                                                               |
| Private debt (IG)                                                                   | 2.00%                                                                                       | 50%                                                                               | 1.00%                                                               |
| CND equity                                                                          | 4.00%                                                                                       | 0%                                                                                | 0.00%                                                               |
| US equity                                                                           | 4.50%                                                                                       | 0%                                                                                | 0.00%                                                               |
| International equity                                                                | 6.50%                                                                                       | 0%                                                                                | 0.00%                                                               |
| Global equity                                                                       | 15.00%                                                                                      | 0%                                                                                | 0.00%                                                               |
| Small cap equity                                                                    | 4.00%                                                                                       | 0%                                                                                | 0.00%                                                               |
| EM equity                                                                           | 6.00%                                                                                       | 0%                                                                                | 0.00%                                                               |
| Real estate                                                                         | 15.25%                                                                                      | 50%                                                                               | 7.63%                                                               |
| Infrastructure                                                                      | 15.25%                                                                                      | 50%                                                                               | 7.63%                                                               |
| Private Equity                                                                      | 7.00%                                                                                       | 0%                                                                                | 0.00%                                                               |
| Total                                                                               | 100.00%                                                                                     |                                                                                   |                                                                     |
| Value of "C" under Regulation 12C                                                   |                                                                                             | 33.25%                                                                            |                                                                     |
| 100% - C = "Non-fixed Income Assets" under Regulation 12C(1)                        |                                                                                             | 66.75%                                                                            |                                                                     |
| Determine Provision for A                                                           | Adverse Deviations (Regula                                                                  | tion 12B)                                                                         |                                                                     |
| Per Regulation 12D(1), table amount for 60% non-fixed income assets                 |                                                                                             | 5.00%                                                                             |                                                                     |
| Per Regulation 12D(1), table amount for 70% non-fixed income assets 8               |                                                                                             |                                                                                   | 8.00%                                                               |
| Per Regulation 12D(2), linear Interpolation = 0.3325 X 5.00% + 0.6675 X 8.00% 7.00% |                                                                                             |                                                                                   | 7.00%                                                               |

DETERMINATION OF PFAD AS PER THE REGULATIONS UNDER THE NOVA SCOTIA PENSION BENEFITS ACT

Therefore, the total PfAD for the Plan is equal to "A" + "B" = 0% + 7.00% = 7.00%.

The following table details the actuarial assumptions that have been used in the going concern valuation (including, in each case, the source of the statistics used for this purpose):

| and the second |                                                                                                                         |  |  |
|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|--|--|
| January 1, 2022                                                                                                  |                                                                                                                         |  |  |
| Interest:                                                                                                        | Pre-retirement: 6.35% per annum                                                                                         |  |  |
|                                                                                                                  | Post-retirement: 4.35% per annum for service up to January 1, 2016, 5.35% per annum for service after December 31, 2015 |  |  |
| Retirement Age:                                                                                                  | 40% at age 65                                                                                                           |  |  |
|                                                                                                                  | 60% at age Rule of 85                                                                                                   |  |  |
| Withdrawals:                                                                                                     | None                                                                                                                    |  |  |
| Salary Scale:                                                                                                    | 3.90% per annum                                                                                                         |  |  |
| Maximum Pension:                                                                                                 | For service up to January 1, 2016: \$3,420.00 in 2022                                                                   |  |  |
|                                                                                                                  | For service after December 31, 2015: \$2,818.89 in 2022                                                                 |  |  |
| Increase in Maximum Pension:                                                                                     | For service up to January 1, 2016: 3.00% per annum after 2022                                                           |  |  |
|                                                                                                                  | For service after December 31, 2015: 0.00% per annum in 2022-2023, 1.00% per annum thereafter                           |  |  |
| Percentage Married:                                                                                              | 85%                                                                                                                     |  |  |
| Spouse's Age:                                                                                                    | Males 3 yrs older                                                                                                       |  |  |
| Interest on Employee Contributions:                                                                              | 2.50% per annum                                                                                                         |  |  |
| Pre-retirement Mortality:                                                                                        | None                                                                                                                    |  |  |
| Post-retirement Mortality:                                                                                       | CPM-2014 Combined, projected with Scale CPM-B                                                                           |  |  |
| Funding Method:                                                                                                  | Projected Unit Credit                                                                                                   |  |  |

#### **GOING CONCERN VALUATION ACTUARIAL ASSUMPTIONS**

#### **C. Solvency Valuation**

The Nova Scotia *Pension Benefits Act* prescribes a solvency valuation. A solvency valuation permits the regulator to assess the solvency of the Plan should it terminate or wind-up effective on the valuation date. That is, an assessment is made as to whether the assets of the pension fund would be sufficient if no further benefits were provided and all members were paid their entitlements.

The Nova Scotia *Pension Benefits Act* was amended effective June 1, 2015. With the changes, plans are now required to include the cost of escalated adjustments (i.e., indexing) in the cost of the solvency liabilities for service accrued after the date the regulations came into force. Thus, the solvency liabilities include the cost of indexing on benefits accrued after June 1, 2015.

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For active members not eligible for immediate retirement (i.e., those under age 55), the interest rate used for calculating solvency liabilities was 2.30% per annum for the first 10 years and 3.40% per annum thereafter for service prior to June 1, 2015, 0.80% per annum for the first 10 years and 1.30% per annum thereafter for service between June 1, 2015 and December 31, 2015, and 1.30% per annum for the first 10 years and 2.30% per annum thereafter for service of the first 10 years and 2.30% per annum thereafter for service after December 31, 2015. These rates were determined in accordance with Section 3500 of the Canadian Institute of Actuaries ("CIA") Standards of Practice – Pension Commuted Values with rates in effect for the month of December 2021. The mortality assumption used was the CPM-2014 (Combined) mortality table projected with Scale CPM-B.

For retired lives and active members 55 or older, the solvency liabilities were calculated using an interest rate of 2.86% per annum for service prior to June 1, 2015, 0.86% per annum for service between June 1, 2015 and December 31, 2015, and 1.86% per annum for service after December 31, 2015. The mortality assumption used was the CPM-2014 (Combined) mortality table projected with Scale CPM-B. These assumptions represent the estimated basis for settlement of the Plan's obligations for retired lives by the purchase of insured annuities on the valuation date, and are in accordance with the Canadian Institute of Actuaries Educational Note entitled "Assumptions for Hypothetical Wind-Up and Solvency Valuations with Effective Dates on or after December 31, 2021, and no later than December 30, 2022".

Note that the solvency valuation does not make any assumptions about future pay increases or future termination of employment, since all members are assumed to terminate on the valuation date. The actuarial assumptions for the solvency valuation are described in the following table:

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|                                     | January 1, 2022                                                                                                                                       |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Interest:                           | For actives <55,                                                                                                                                      |
|                                     | <ul> <li>2.30% per annum for the first 10 years, 3.40% per annum<br/>thereafter for service prior to June 1, 2015</li> </ul>                          |
|                                     | <ul> <li>0.80% per annum for the first 10 years, 1.30% per annum<br/>thereafter for service between June 1, 2015 and<br/>December 31, 2015</li> </ul> |
|                                     | <ul> <li>1.30% per annum for the first 10 years, 2.30% per annum<br/>thereafter for service after December 31, 2015</li> </ul>                        |
|                                     | For pensioners, deferred members and actives > 55,                                                                                                    |
|                                     | <ul> <li>2.86% per annum for service prior to June 1, 2015</li> </ul>                                                                                 |
|                                     | <ul> <li>0.86% per annum for service between June 1, 2015 and<br/>December 31, 2015</li> </ul>                                                        |
|                                     | <ul> <li>1.86% per annum for service after December 31, 2015</li> </ul>                                                                               |
| Retirement Age:                     | For actives < 55, deferral to Normal Retirement Date (NRD)                                                                                            |
|                                     | For actives > 55, immediately with reductions from earlier of Rule of 85 (assuming projected age, not service) and NRD                                |
| Withdrawals:                        | Immediately                                                                                                                                           |
| Salary Scale:                       | None                                                                                                                                                  |
| Maximum Pension:                    | Per year of service up to January 1, 2016: \$3,420.00<br>Per year of service after December 31, 2015: \$2,818.89                                      |
| Increase in Maximum Pension:        | n/a                                                                                                                                                   |
| Percentage Married:                 | 85%                                                                                                                                                   |
| Spouse's Age:                       | Males 3 yrs older                                                                                                                                     |
| Interest on Employee Contributions: | n/a                                                                                                                                                   |
| Pre-retirement Mortality:           | None                                                                                                                                                  |
| Post-retirement Mortality:          | CPM-2014 Combined mortality, projected with Scale CPM-B                                                                                               |
| Funding Method:                     | Termination                                                                                                                                           |

#### SOLVENCY VALUATION ACTUARIAL ASSUMPTIONS



#### **D. Wind-up Valuation**

The wind-up valuation liability assumptions are the same as the solvency valuation with the exception of the following:

- The wind-up valuation must account for the value of pension benefit indexing for all service.
- The wind-up valuation must account for the grow-in provisions of the Pension Benefits Act, where grow-in
  implies that on wind-up, for a member whose age plus service total more than 55, membership is assumed to
  continue past the valuation date for purposes of determining early retirement benefits.

|                                     | January 1, 2022                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Interest:                           | For actives <55:<br>0.80% per annum for the first 10 years, 1.30% per annum thereafter<br>for service prior to January 1, 2016<br>1.30% per annum for the first 10 years, 2.30% per annum thereafter<br>for service after December 31, 2015                                                                                                                                                                                                                                                            |
|                                     | For pensioners, deferred members and actives > 55:<br>0.86% per annum for service prior to January 1, 2016<br>1.86% per annum for service after December 31, 2015                                                                                                                                                                                                                                                                                                                                      |
| Retirement Age:                     | For actives < 55 points (points = age plus service), deferral to<br>Normal Retirement Date (NRD)<br>For actives > 55 points, 50% deferral to whichever of i) or ii) produces<br>the greater value, where i) is the earliest unreduced retirement date<br>using projection of both age and service, and ii) is the earliest reduced<br>retirement date, with appropriate Plan early retirement reductions; and<br>50% at earliest unreduced retirement date using projection of both age<br>and service |
| Withdrawals:                        | Immediately                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Salary Scale:                       | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Maximum Pension:                    | Per year of service up to January 1, 2016: \$3,420.00<br>Per year of service after December 31, 2015: \$2,818.89                                                                                                                                                                                                                                                                                                                                                                                       |
| Increase in Maximum Pension:        | n/a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Percentage Married:                 | 85%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Spouse's Age:                       | Males 3 yrs older                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Interest on Employee Contributions: | n/a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Pre-retirement Mortality:           | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Post-retirement Mortality:          | CPM-2014 Combined mortality, projected with Scale CPM-B                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Funding Method:                     | Termination                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

#### WIND-UP VALUATION ACTUARIAL ASSUMPTIONS

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#### APPENDIX C PLAUSIBLE ADVERSE SCENARIOS

A plausible adverse scenario is considered to be one that will occur in the short term (immediately to one year) with a likelihood of occurring between 1 in 10 and 1 in 20 based on the opinion of the actuary. The purpose of the following scenarios is to illustrate the impact on the Plan's financial position of the following adverse but plausible assumptions relative to the best estimate assumptions selected for the Plan's going concern valuation. The purpose of disclosing these results is to demonstrate the sensitivity of the funded status and annual current service cost between January 1, 2022 and January 1, 2025 to certain key risk factors affecting the Plan. The results of the scenarios selected are shown in the table below, with a description of each scenario following.

|                                                    | Goina Concern                 | Plausibl               | Plausible Adverse Scenario Results<br>at January 1, 2022 |                   |  |  |  |
|----------------------------------------------------|-------------------------------|------------------------|----------------------------------------------------------|-------------------|--|--|--|
|                                                    | Results at<br>January 1, 2022 | Interest<br>rate risk* | Deterioration of<br>Asset Values*                        | Longevity<br>Risk |  |  |  |
| Going concern assets                               | 172,968,400                   | 173,936,000            | 152,904,000                                              | 172,968,400       |  |  |  |
| Going concern liabilities                          | 135,206,900                   | 140,887,900            | 135,206,900                                              | 137,608,400       |  |  |  |
| PfAD on going concern liabilities                  | 9,405,000                     | 9,802,700              | 9,405,000                                                | 9,573,100         |  |  |  |
| Total going concern liabilities plus PfAD          | 144,611,900                   | 150,690,600            | 144,611,900                                              | 147,181,500       |  |  |  |
| Going concern excess /<br>(unfunded liability)     | 28,356,500                    | 23,245,400             | 8,292,100                                                | 25,786,900        |  |  |  |
| Current service cost (incl. PfAD)                  | 6,558,600                     | 6,992,500              | 6,558,600                                                | 6,629,100         |  |  |  |
| Change in going concern<br>liabilities plus PfAD   |                               | 6,078,700              |                                                          | 2,569,600         |  |  |  |
| % change in going concern<br>liabilities plus PfAD |                               | 4.20%                  |                                                          | 1.78%             |  |  |  |
| Change in current service cost                     |                               | 433,900                |                                                          | 70,500            |  |  |  |
| % change in current service cost                   |                               | 6.62%                  |                                                          | 1.07%             |  |  |  |
| Discount rate                                      | 6.35%                         | 6.10%                  | 6.35%                                                    | 6.35%             |  |  |  |
| PfAD                                               | 7.00%                         | 7.00%                  | 7.00%                                                    | 7.00%             |  |  |  |
| Life expectancy (in years)<br>for a retiree age 65 | 23                            | 23                     | 23                                                       | 24                |  |  |  |

\* Scenario shown represents the median of the worst 10% of stochastic simulations.

#### **Interest Rate Risk**

This scenario illustrates the sensitivity of the funded status of the Plan and current service cost to an immediate change in the market interest rates underlying fixed income investments.

In order to assess the impact of a decrease in interest rates of a magnitude consistent with a 1 in 10 likelihood of occurring, we have used the same stochastic model that is used to determine the going concern discount rate (see Appendix B). The stochastic model is based on 5,000 simulations of projected financial variables, including long-term yields on fixed income investments and asset class returns. Our long-term best estimates for these variables, and the going concern discount rate are based on the median values of these 5,000 simulations.

To determine the sensitivity to interest rate risk, and the resulting impact on Plan assets and liabilities, we have:

- considered the hypothetical going concern discount rate over the 500 trials where fixed income yields are lowest at the one-year horizon, and
- determined the decrease in median long-term fixed income yields over the 500 trials where fixed income yields are the lowest at the one-year horizon.

Based on the above analysis, we have determined that the going concern discount rate would decrease by 25 basis points as of January 1, 2022, and long-term yields on fixed income investments would decrease by 63 basis points.

Based on the estimated duration of the Plan assets, liabilities and current service cost, we have then determined the estimated change to the Plan's funded status under the interest rate risk scenario.

#### **Deterioration of Asset Values**

This scenario illustrates the sensitivity of the funded status of the Plan to short-term shock which causes a reduction in the market value of assets, with no change to the liabilities of the Plan. This scenario is assumed not to impact the current expectation of the long-term rate of return, and consequently, the going concern discount rate.

In order to assess the impact of a decrease in asset values of a magnitude consistent with a 1 in 10 likelihood of occurring, we have used the same stochastic model that is used to determine the going concern discount rate (see Appendix B). The stochastic model is based on 5,000 simulations of projected financial returns, including long-term yields on fixed income investments and asset class returns.

To determine the sensitivity to a deterioration in asset values based on the Plan's target asset mix, we have reviewed the 500 trials where investment returns are lowest at the one-year horizon and determined that at the median scenario, the market value of assets would decrease by 11.6% as of January 1, 2022.

#### Longevity Risk

This scenario illustrates the sensitivity of the funded status of the Plan to pension plan members living longer than expected. The impact of this scenario was determined using a one-year age setback to the mortality table used for the going concern valuation as of January 1, 2022. This is a more conservative mortality assumption than currently employed.

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#### APPENDIX D MEMBERSHIP DATA

Records were submitted to us electronically by the Halifax Regional Water Commission. They indicate that the total active membership of the Pension Plan, as of January 1, 2022 was 491, including 475 full-time Members and 16 Members in receipt of long-term disability benefits from the group insurance plan. This represents a net increase of 60 since the previous valuation. Schedule D1 summarizes the changes in active membership since the last valuation.

Schedules D2 through to D4 summarize basic information for the total full-time groups for males and females. The data received contained pertinent information for each Member, such as birth date, date of employment, years of service, rates of pay and accumulated contributions plus interest.

There were 12 deferred vested Members as of the valuation date. This represents an increase of 4 since the previous valuation.

The data were reviewed by us as to accuracy and reasonableness. By comparing the data to that provided in previous years we are satisfied that the data are complete. In addition, we performed various checks of reasonableness on dates of employment, plan membership, and birth. We also compared lists of active Members with lists of inactive and retired Members to check for duplicates. In all cases, we found the data to be sufficient and reliable for the purposes of the valuation. Appendix F contains a confirmation by the Halifax Regional Water Commission as to the accuracy and completeness of the data provided.

Data in respect of retired Members and survivors were submitted to us electronically as well. Again, the data were checked for reasonableness and completeness. The data were found to be sufficient and reliable for the purposes of the valuation.

Schedules D5 and D6 summarize pensioner data. The total number of retirees receiving payments from the fund as of the valuation date was 129. There were 32 survivors receiving survivors' benefits from the fund. The changes in the number of individuals receiving pensions since the last valuation are summarized in Schedule D1.

#### SCHEDULE D1 - RECONCILIATION OF MEMBERSHIP

| Active (including LTD)    | Males | Females | Total      |
|---------------------------|-------|---------|------------|
| Number at January 1, 2019 | 302   | 129     | <b>431</b> |
| Plus:                     |       |         |            |
| New Entrants              | 82    | 56      | 138        |
| Return to Active          | 1     | 0       | 1          |
| Less:                     |       |         |            |
| Retirements               | 23    | 4       | 27         |
| Terminations*             | 24    | 27      | 51         |
| Deaths                    | -1    | 0       | 1          |
| Number at January 1, 2022 | 337   | 154     | 491        |

\* Note that terminations include those that have moved to deferred pensioner status.

| Pensions in Pay                        |  | Pensioners |    | Survivors |   | Total   |     |  |
|----------------------------------------|--|------------|----|-----------|---|---------|-----|--|
|                                        |  | M          | F  |           | Μ | F       |     |  |
| Number at January 1, 2019              |  | 87         | 27 |           | 3 | 28      | 145 |  |
| Plus:                                  |  |            |    |           |   |         |     |  |
| New Retirees                           |  | 23         | 4  |           | - | -       | 27  |  |
| New Retirees due to Marriage Breakdown |  | 0          | 0  |           | - | final - | 0   |  |
| New Survivors                          |  | -          | -  |           | 1 | 5       | 6   |  |
| Less:                                  |  |            |    |           |   |         |     |  |
| Deaths                                 |  | 9          | 3  |           | 1 | 4       | 17  |  |
| Number at January 1, 2022              |  | 101        | 28 |           | 3 | 29      | 161 |  |

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#### SCHEDULE D2 - SALARY AGE / SERVICE DISTRIBUTION FOR ACTIVE MEMBERS

| Age         | Service         | 0-9        | 10-19      | 20-29             | 30-39   | Total      |
|-------------|-----------------|------------|------------|-------------------|---------|------------|
|             | Sum of salaries | 1,920,934  | -          | -                 |         | 1,920,934  |
| 20-29       | Member count    | 32         | -          |                   |         | 32         |
| - B-P       | Average salary  | 60,029     | - 1 I      | 1 - 1 - 1 - 1 - 1 | - E     | 60,029     |
|             | Sum of salaries | 9,105,197  | 1,800,619  | -                 | -       | 10,905,816 |
| 30-39       | Member count    | 131        | 26         |                   |         | 157        |
| -21         | Average salary  | 69,505     | 69,255     | -                 | -       | 69,464     |
|             | Sum of salaries | 4,879,052  | 5,675,901  | 823,236           | -       | 11,378,188 |
| 40-49       | Member count    | 75         | 72         | 11                |         | 158        |
|             | Average salary  | 65,054     | 78,832     | 74,840            | -       | 72,014     |
|             | Sum of salaries | 2,821,920  | 3,396,147  | 1,617,540         | 360,345 | 8,195,953  |
| 50-59       | Member count    | 38         | 46         | 18                | 5       | 107        |
|             | Average salary  | 74,261     | 73,829     | 89,863            | 72,069  | 76,598     |
|             | Sum of salaries | 364,518    | 1,077,821  | 323,600           | -       | 1,765,939  |
| 60-69       | Member count    | 4          | 13         | 4                 |         | 21         |
|             | Average salary  | 91,129     | 82,909     | 80,900            | Too     | 84,092     |
| Total sala  | aries           | 19,091,621 | 11,950,487 | 2,764,376         | 360,345 | 34,166,830 |
| Total mer   | mber count      | 280        | 157        | 33                | 5       | 475        |
| Average     | salary          | 68,184     | 76,118     | 83,769            | 72,069  | 71,930     |
| Average age |                 | 43.3       |            |                   |         |            |

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| Age        | Service         | 0-9       | 10-19               | 20-29        | 30-39       | Total      |
|------------|-----------------|-----------|---------------------|--------------|-------------|------------|
|            | Sum of salaries | 584,573   | 2000 . <del>.</del> | - 25         |             | 584,573    |
| 20-29      | Member count    | 10        |                     | - 11 - 11 -  |             | 10         |
|            | Average salary  | 58,457    | -                   | - 11 -       | -           | 58,457     |
| 11 I.      | Sum of salaries | 3,047,338 | 533,756             | <del>.</del> |             | 3,581,094  |
| 30-39      | Member count    | 45        | 8                   | 1 - C-       | - 1 an      | 53         |
|            | Average salary  | 67,719    | 66,719              | 1 1          | -           | 67,568     |
| di ji      | Sum of salaries | 1,549,699 | 1,816,842           | 356,997      | t d f-i     | 3,723,538  |
| 40-49      | Member count    | 25        | 23                  | 5            | 1           | 53         |
|            | Average salary  | 61,988    | 78,993              | 71,399       | -           | 70,255     |
|            | Sum of salaries | 582,677   | 1,298,996           | 384,385      | 73,852      | 2,339,910  |
| 50-59      | Member count    | 9         | 18                  | 4            | 1           | 32         |
|            | Average salary  | 64,742    | 72,166              | 96,096       | 73,852      | 73,122     |
| s de       | Sum of salaries | - 15 -    | 162,369             | - 25         | I           | 162,369    |
| 60-69      | Member count    | -         | 2                   | -            | 1           | 2          |
|            | Average salary  |           | 81,185              | fal Fa       | - Initial - | 81,185     |
| Total sala | aries           | 5,764,287 | 3,811,963           | 741,382      | 73,852      | 10,391,484 |
| Total mer  | nber count      | 89        | 51                  | 9            | 1           | 150        |
| Average    | Average salary  |           | 74,744              | 82,376       | 73,852      | 69,277     |
| Average    | age             | 42.7      |                     |              |             |            |

#### SCHEDULE D3 - SALARY AGE / SERVICE DISTRIBUTION FOR ACTIVE MEMBERS - FEMALE ONLY

#### SCHEDULE D4 - SALARY AGE / SERVICE DISTRIBUTION FOR ACTIVE MEMBERS - MALE ONLY

| Age                | Service         | 0-9        | 10-19     | 20-29     | 30-39   | Total      |
|--------------------|-----------------|------------|-----------|-----------|---------|------------|
|                    | Sum of salaries | 1,336,361  |           | -         | -       | 1,336,361  |
| 20-29              | Member count    | 22         |           | -         | -       | 22         |
|                    | Average salary  | 60,744     | t Pal-    |           | -       | 60,744     |
|                    | Sum of salaries | 6,057,859  | 1,266,863 | -         | -       | 7,324,722  |
| 30-39              | Member count    | 86         | 18        |           |         | 104        |
|                    | Average salary  | 70,440     | 70,381    | an Earl   | -       | 70,430     |
|                    | Sum of salaries | 3,329,353  | 3,859,059 | 466,239   | -       | 7,654,651  |
| 40-49              | Member count    | 50         | 49        | 6         | -       | 105        |
|                    | Average salary  | 66,587     | 78,756    | 77,706    | -       | 72,901     |
|                    | Sum of salaries | 2,239,244  | 2,097,151 | 1,233,155 | 286,493 | 5,856,042  |
| 50-59              | Member count    | 29         | 28        | 14        | 4       | 75         |
|                    | Average salary  | 77,215     | 74,898    | 88,083    | 71,623  | 78,081     |
|                    | Sum of salaries | 364,518    | 915,452   | 323,600   | -       | 1,603,570  |
| 60-69              | Member count    | 4          | 11        | 4         | -       | 19         |
|                    | Average salary  | 91,129     | 83,223    | 80,900    | -       | 84,398     |
| Total salaries     |                 | 13,327,335 | 8,138,524 | 2,022,994 | 286,493 | 23,775,346 |
| Total member count |                 | 191        | 106       | 24        | 4       | 325        |
| Average            | salary          | 69,777     | 76,779    | 84,291    | 71,623  | 73,155     |
| Average a          | age             | 43.5       |           |           |         |            |

| ٨  |          | ,<br>,   | Females         |        | Males           | Total  |         |
|----|----------|----------|-----------------|--------|-----------------|--------|---------|
|    | Age      | Number   | Monthly Pension | Number | Monthly Pension | Number | Pension |
|    | 55-59    | 2        | 9,355           | 15     | 65,525          | 17     | 74,880  |
|    | 60-64    | 9        | 31,433          | 17     | 56,315          | 26     | 87,747  |
|    | 65-69    | 9        | 25,897          | 27     | 70,727          | 36     | 96,624  |
|    | 70-74    | 3        | 7,157           | 18     | 40,914          | 21     | 48,071  |
|    | 75-79    | 2        | 2,820           | 18     | 48,578          | 20     | 51,398  |
|    | 80-84    | 3        | 3,172           | 5      | 13,820          | 8      | 16,993  |
|    | 85-89    |          |                 | 1      | 4,913           | 1      | 4,913   |
| Тс | tal:     | 28       | 79,834          | 101    | 300,792         | 129    | 380,626 |
| A١ | verage A | ge: 68.6 |                 |        |                 |        |         |

Average Monthly Pension: 2,951

#### SCHEDULE D6 - SURVIVORS

| A                    |                   | Females        |             | Males           | Total  |         |
|----------------------|-------------------|----------------|-------------|-----------------|--------|---------|
| Age                  | Numbe             | r Monthly Pens | sion Number | Monthly Pension | Number | Pension |
| 60-64                | 1                 | 999            |             | Π.=             | 1      | 999     |
| 65 <mark>-</mark> 69 | 5                 | 4,981          |             |                 | 5      | 4,981   |
| 70-74                | 7                 | 8,960          | 2           | 1,359           | 9      | 10,319  |
| 75-79                | 8                 | 9,074          | 2           | 1,099           | 10     | 10,173  |
| 80-84                | 0                 | 0              |             |                 | 0      | 0       |
| 85-89                | 5                 | 4,231          |             |                 | 5      | 4,231   |
| 90-94                | 1                 | 2,816          |             |                 | 1      | 2,816   |
| 95-99                | 1                 | 552            |             |                 | 1      | 552     |
| Total:               | 28                | 31,613         | 4           | 2,458           | 32     | 34,071  |
| Average A            | Average Age: 76.9 |                |             |                 |        |         |
|                      |                   |                |             |                 |        |         |

**Average Monthly Pension: 1,065** 



#### APPENDIX E SUMMARY OF PLAN PROVISIONS

#### **Plan Summary**

This pension plan is one of the type which is described as a "best average salary" plan.

This means that each member's retirement pension is calculated as a specified percentage of his or her average salary during the best seven years of membership in the plan. For this Plan, the specified percentage is 2% for each year of credited service under the Plan.

The plan also provides for early retirement with full benefits whenever a member's age <u>plus</u> years of service total at least 85 (provided the member has attained age 55); for the payment of a pension to the surviving spouse of a deceased member; and for provision of a disability pension.

#### **Effective Date**

January 1, 1972

#### **Eligibility**

All employees (Full-time and Part-time) are eligible to join the Plan on their date of employment.

#### **Normal Retirement Date**

The Normal Retirement Date of a member shall be the first of the month coincident with or next following the 65<sup>th</sup> birthday.

#### **Early Retirement Dates**

Members may retire within the ten years prior to Normal Retirement Date. A reduction to the pension, reflecting the earlier start date, will apply. An unreduced pension is available to Members retiring with the "Rule of 85" (see below).

#### **Delayed Retirement**

Members who continue in employment past Normal Retirement Date continue to accrue benefits under the Plan and begin to receive a pension on actual retirement date.

#### **Contributions**

| Employee - | Required | =    | Member required contributions are equal to one half of the current service cost.                                                                                                  |
|------------|----------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|            | Optional | =    | Additional voluntary contributions to the plan are permitted.                                                                                                                     |
| Employer   |          | - 22 | Employer contributions are equal to the balance of current service costs not covered by employee contributions, plus special payments required to fund any going concern deficit. |

#### **Retirement Benefits**

#### Normal Retirement

An annual pension payable in monthly installments based on the member's best earnings averaged over the highest seven consecutive years of earnings. The basic benefit would be 2% of the member's best average salary times years of pensionable service.

Notwithstanding the above, in respect of pensionable service prior to January 1, 2016, the best average earnings used in determination of the benefit should not be less than the average of the best five consecutive years of earnings paid to the employee in years prior to 2016.

#### Early Retirement

The amount of pension payable is the actuarial equivalent of a pension payable on the earliest date that the member could have retired without a reduction of benefits.

#### Rule of 85

A member may retire earlier than his Normal Retirement Date, providing he has attained age 55, any time after the first day of the month following the date upon which the sum of his age plus years of Service with the Commission totals 85. He shall receive a pension of an annual amount equal to that stated above under Normal Retirement Pension.

#### **Normal Form of Pension**

Single Members: single life pension guaranteed for ten years (amount payable in respect of pre-1992 benefits is the actuarial equivalent of a pension payable to a member with a Spouse).

Members with a Spouse: 60% joint and last survivor pension with payments reducing upon member's death.

#### **Maximum Pension**

The total annual pension payable from the Plan upon retirement, death or termination of employment cannot exceed the sum of A plus B, where A is the product of

- (a) The number of years of Pensionable Service prior to January 1, 2016, and
- (b) The lesser of
  - (i) The Defined Benefit Limit for the year, and
  - (ii) 2% of the average best three consecutive years of Compensation paid

#### and

#### B is the product of

- (c) The number of years of Pensionable Service after December 31, 2015, and
- (d) The lesser of
  - (i) \$2,818.89 in years 2016 through 2023, increasing by 1% per annum in years thereafter, and
  - (ii) 2% of the average best three consecutive years of Compensation

ACTUARIAL VALUATION AS AT JANUARY 1, 2022 HALIFAX REGIONAL WATER COMMISSION EMPLOYEES' PENSION PLAN

#### **Death Benefits**

Death Before Retirement

In respect of credited service prior to June 1, 1998

- Single Members The beneficiary is entitled to receive the total amount of the member's contributions plus interest compounded annually to the end of the month in which death occurs.

   The value of the death benefit in respect of service after December 31, 1987 must not be less than the commuted value of the member's deferred vested benefit.
- Members with a Spouse A lifetime pension equal to 60% of the member's accrued pension shall be payable monthly to the member's surviving spouse commencing on the first day of the month following the member's death, provided that the spouse satisfies the eligibility requirements. The value of the survivor pension in respect of service after December 31, 1987 must not be less than the commuted value of the member's deferred vested benefit.

#### In respect of credited service after June 1, 1998

The commuted value of the Member's accrued pension.

#### Death After Retirement

Members Receiving the Normal Form of Benefits continued for Married Members -

Sixty percent of the member's monthly payments will be to the member's surviving spouse, provided that the spouse satisfies the eligibility requirements.

Members Receiving the Normal Form of Benefits for Single Members -

The monthly payments will be continued to the beneficiary until a total of 120 monthly payments have been made to the member and beneficiary.

Members Receiving Optional Forms of Benefits -

Death benefits will be payable in accordance with the optional form of pension elected.

#### **Termination Benefits**

Subject to any statutory limitations, a member may elect to receive either:

- (a) A paid-up deferred pension commencing on the member's Normal Retirement Date in an amount equal to the pension accrued to date of termination, or
- (b) Transfer the value of benefit to the member's new employer's pension plan, a Retirement Savings Plan, or purchase a deferred annuity.

#### **Disability Benefits**

If the member qualifies for benefits under the long-term disability plan, the Commission shall make the required contributions so that the employee will continue to accrue additional pension benefits right through to age 65 if disability continues until then. A disabled employee who does not qualify for LTD benefits may be eligible to receive a disability pension from this plan.

A member who is Totally and Permanently Disabled, as defined by the Canada Revenue Agency, and not in receipt of LTD benefits may retire at any time prior to Normal Retirement Date and receive a Disability Pension. The Disability Pension shall be equal to the member's accrued pension without reduction for early retirement.

A member who is considered totally and permanently disabled by the Commission but not as defined by the Canada Revenue Agency may be eligible for an improved early retirement pension at any time prior to Normal Retirement Date. The amount of pension is the member's accrued benefit subject to the Canada Revenue Agency's minimum early retirement reduction requirements.

#### **Cost-of-Living Adjustments**

Cost-of-living adjustments will be determined as follows:

- i) the lesser of 2% and the percentage increase in the Consumer Price Index during the preceding calendar year, in respect of the portion of pension associated with Credited Service prior to January 1, 2016.
- ii) the lesser of 1% and the percentage increase in the Consumer Price Index during the preceding calendar year, in respect of the portion of pension associated with Credited Service after December 31, 2015.

These adjustments will apply to pensions being paid directly from the Fund, as well as deferred vested benefits. The Plan also provides additional increases on an ad hoc basis.



#### **EMPLOYER CERTIFICATION APPENDIX F**

On behalf of the Halifax Regional Water Commission, I hereby certify that the employee data provided to Eckler Ltd. for the purposes of the actuarial valuation of the Halifax Regional Water Commission Employees' Pension Plan as at January 1, 2022 are accurate and complete.

Heather Britten Name

Signature

Quality Assurance Officer

June 16, 2022

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| TO:           | Becky Kent, B.A., Chair and Members of the Halifax Regional Wate<br>Commission Board |  |  |  |  |  |
|---------------|--------------------------------------------------------------------------------------|--|--|--|--|--|
| SUBMITTED BY: | Reid<br>Campbell<br>Date: 2022.06.14<br>19:19:37 -03'00'                             |  |  |  |  |  |
|               | Reid Campbell, P. Eng.                                                               |  |  |  |  |  |
|               | Director, Engineering & Technology Services                                          |  |  |  |  |  |
| APPROVED:     | Cathie Digitally signed by Cathie O'Toole Date: 2022.06.17<br>12:55:11 -03'00'       |  |  |  |  |  |
|               | Cathie O'Toole, MBA, FCPA, FCGA, ICD.D, General Manager                              |  |  |  |  |  |
| DATE:         | May 5, 2022                                                                          |  |  |  |  |  |
| SUBJECT:      | Bissett Lake Pump Station Component Upgrade                                          |  |  |  |  |  |

#### **ORIGIN**

2021/22, 2022/23 & 2023/24 Capital Budgets and operational requirement to maintain system integrity.

#### **RECOMMENDATION**

The Halifax Water Board approve the Bissett Lake Pump Station Component Upgrade project for a total project cost of \$6.8 million (including net HST).

#### BACKGROUND

The Bissett Lake wastewater pump station is a wetwell/drywell station located at 54 Atwood Crescent in Cole Harbour. The original station was constructed in the early 1970's and has a design capacity of approximately 440 l/s, conveyed by three extended shaft dry-pit pumps. The station received partial mechanical/electrical upgrades in the early 1990's and this equipment is nearing the end of its useful lifecycle and requires replacement.

A future requirement (2041) for additional capacity at the Bissett Lake pump station was identified in the East Region Wastewater Infrastructure Plan (IMP). The IMP also identifies several other required infrastructure upgrades to provide the additional capacity.

#### DISCUSSION

The upgrades proposed as part of this project are required now to keep the system operational in a safe and efficient manner until the required capacity upgrades identified for 2041. The design of these upgrades considers the planned future capacity increase recommended by the IMP. Work at the station will include replacement of mechanical and electrical equipment, repairs and the correction of other deficiencies identified through the investigation and design process.

In August 2020, Engineering Services were awarded to WSP Canada Inc. The design report has since been completed and the drawings and specifications are nearing the tender stage. Based on the most recent pre-tender construction estimate by WSP of \$5,500,000, the estimated total project cost is \$6,800,000. The project cost estimate is attached. Funding in the amount of \$50,000 was previously approved to initiate design phase services.

This project has not yet been tendered. Approval for this project is being sought at this stage as a cost mitigation strategy to reduce the time from tender closing to award. This is consistent with advice received from the Construction Association of Nova Scotia and directly from contractors. Industry feedback has indicated that lengthy award periods can compound issues with supply chain delays and volatile pricing leading to higher bids to address these risks. Obtaining funding approval in advance of tendering will result in a shorter timeframe for award thus help to mitigate this effect.

Notwithstanding this strategy, current market conditions are resulting in volatile pricing which is difficult to predict. After tender closing, should project costs exceed funding allocated in the approval being sought, Halifax Water will evaluate the new project cost and make a determination whether it is prudent to proceed with the project. If the decision is to proceed, Halifax Water staff will seek an expedited approval for an increase in funding from the Halifax Water Board and the NSUARB.

#### **BUDGET IMPLICATIONS**

Funding for this project in the amounts of \$1,000,000, \$4,000,000 and \$500,000 were planned for the 2021/22, 2022/23 and 2023/24 Capital Budgets respectively. Together with the previously approved \$50,000, the total funding planned for this project was \$5,550,000. Based on the most recent pre-tender cost estimate, this results in a funding shortfall of \$1,250,000 and this shortfall will be added to the \$500,000 already allocated in the 2023/24 Capital Budget. This funding implementation plan will support the cash flow requirements of this project as construction will extend into 2023.

The proposed expenditure meets the "NO REGRETS- UNAVOIDABLE NEEDS" approach of the 2012 Integrated Resource Plan. The proposed work meets the NR-UN criteria of "Required to ensure infrastructure system integrity and safety".

#### **ALTERNATIVES**

There are no recommended alternatives.

#### **ATTACHMENTS**

- Project Location Sketch
- Project Cost Estimate
- Consultant Preliminary Design Report

| Report Prepared by:    | Muy Rice                                                                                  |  |  |  |  |  |  |
|------------------------|-------------------------------------------------------------------------------------------|--|--|--|--|--|--|
|                        | Greg Rice, Wastewater Stormwater Infrastructure Engineer<br>Phone: 902-476-3520           |  |  |  |  |  |  |
| Financial Reviewed by: | Louis de Digitally signed by Louis<br>de Montbrun<br>Date: 2022.06.16<br>21:12:40 -03'00' |  |  |  |  |  |  |
|                        | Louis de Montbrun, CPA, CA<br>Director, Corporate Services/CFO                            |  |  |  |  |  |  |

### Bissett Lake Pump Station Upgrade Project Cost Estimate

| Item                                            | Total Cost  |
|-------------------------------------------------|-------------|
| Construction (See attached Engineer's estimate) | \$5,515,107 |
| Consultant Costs (Construction Phase)           | \$155,000   |
| Construction Contingency (10% of above)         | \$567,011   |
| Consultant Costs (Design Phase)                 | \$153,000   |
| Sub-total                                       | \$6,390,118 |
| Net HST (4.286%)                                | \$273,880   |
| Sub-total                                       | \$6,663,998 |
| Halifax Water Staff and Related Expenses        | \$50,000    |
| Sub-total                                       | \$6,713,998 |
| Interest & Overhead (1%)                        | \$67,140    |
| Total Project Cost Estimate                     | \$6,800,000 |

| PROJECT: | Bissett Wastewater Pumping Station |            |                |  |
|----------|------------------------------------|------------|----------------|--|
| DONE BY: | WSP Project Team                   | PROJ. NO.: | 201-08639-00   |  |
| SUBJECT: | Pre-Tender Capital Cost Estimate   | DATE:      | March 23, 2022 |  |

#### **CAPITAL COST ESTIMATE**

|          |                                                           |     |      | MATER   | IAL     | Ι     | NSTALLATIO | N      | TOTAL     | SUB         |
|----------|-----------------------------------------------------------|-----|------|---------|---------|-------|------------|--------|-----------|-------------|
| SPEC     |                                                           |     |      | UNIT    | TOTAL   | % OF  | or UNIT    | TOTAL  | MAT'L &   | TOTAL       |
| DIV      |                                                           |     |      | COST    | COST    | MAT'L | COST       | COST   | INSTALL.  | COST        |
| No       | DESCRIPTION OF ITEM                                       | ΟΤΥ | UNIT | (\$)    | (\$)    | (%)   | (\$)       | (\$)   | (\$)      | (\$)        |
| Division | 1 - General Requirements                                  |     |      |         |         |       |            |        |           |             |
|          | Mobilization/Demobilization                               | 1   | LS   | 15,000  | 15,000  |       |            | 0      | 15,000    |             |
|          | Bonds & Insurance (\$20 / \$1,000)                        | 1   | LS   | 79,564  | 79,564  |       |            | 0      | 79,564    |             |
|          | Temporary Facilities (\$1,000 / Month)                    | 6   | ea.  | 1,000   | 6,000   |       |            | 0      | 6,000     |             |
|          | Project Admin and Management (\$4,000 / Month)            | 6   | ea.  | 4,000   | 24,000  |       |            | 0      | 24,000    |             |
|          | Submittals and Closeout Documents                         | 1   | LS   | 10,000  | 10,000  |       |            | 0      | 10,000    |             |
|          | Commissioning & Training                                  | 1   | LS   | 10,000  | 10,000  |       |            | 0      | 10,000    |             |
|          | Overhead and Profit (20%)                                 | 20  | %    | 795,635 | 795,635 |       |            | 0      | 795,635   |             |
|          | Sub Markup (15%)                                          | 15  | %    | 596,726 | 596,726 |       |            | 0      | 596,726   |             |
|          |                                                           |     |      |         |         |       |            |        |           |             |
| TASK T   | OTAL COST                                                 |     |      |         |         |       |            | Total: | 1,536,925 | \$1,536,930 |
| Division | 2 - Existing Conditions                                   |     |      |         |         |       |            |        |           |             |
|          | Temporary Bypass Pumping (\$45k / Week)                   | 12  | ea.  | 45,000  | 540,000 | 0     |            | 0      | 540,000   |             |
|          |                                                           |     |      |         |         |       |            |        |           |             |
| TASK T   | OTAL COST                                                 |     |      |         |         |       |            | Total: | 540,000   | \$540,000   |
| Division | 3 - Concrete                                              |     |      |         |         |       |            |        |           |             |
|          | General Concrete Repairs                                  | 1   | LS   | 5,000   | 5,000   | 0     |            | 0      | 5,000     |             |
|          | Existing Concrete Removal for Pump Access Hatches         | 1   | LS   | 5,000   | 5,000   | 0     |            | 0      | 5,000     |             |
|          | Structural Strengthening for New Openings for Pump Access | 1   | LS   | 10,000  | 10,000  | 0     |            | 0      | 10,000    |             |
|          | Electrical Panel and Generator Concrete Bases             | 1   | LS   | 5,000   | 5,000   | 0     |            | 0      | 5,000     |             |
|          | Pump Bases and Pipe Supports in Pump Room                 | 1   | LS   | 3,500   | 3,500   | 0     |            | 0      | 3,500     |             |
|          | New Bypass Pipe Penetration                               | 1   | LS   | 2,500   | 2,500   | 0     |            | 0      | 2,500     |             |
|          |                                                           |     |      |         |         |       |            |        |           |             |
| TASK T   | OTAL COST                                                 |     |      |         |         |       |            | Total: | 31,000    | \$31,000    |
| Division | 4 - Masonry                                               |     |      |         |         |       |            |        | -         |             |
|          | Masonry Wall in Electrical Room & Washroom                | 1   | LS   | 10,000  | 10,000  | 0     |            | 0      | 10,000    |             |
|          |                                                           |     |      |         |         |       |            |        |           |             |
| TASK T   | OTAL COST                                                 |     |      |         |         |       |            | Total: | 10,000    | \$10,000    |
| Division | 5 - Metals                                                |     |      |         |         |       |            |        |           |             |
|          | Miscellaneous Metals                                      | 1   | LS   | 20,000  | 20,000  | 30    |            | 6,000  | 26,000    |             |
|          | Pipe Supports, etc.                                       | 1   | LS   | 7,500   | 7,500   | 30    |            | 2,250  | 9,750     |             |
|          |                                                           |     |      |         |         |       |            |        |           |             |
| TASK T   | OTAL COST                                                 |     |      |         |         |       |            | Total: | 35,750    | \$35,750    |
| Division | 6 - Wood, Plastics and Composites                         |     |      |         |         |       |            |        |           |             |
|          | New FRP Wet Well Platforms with guardrails                | 1   | LS   | 7,500   | 7,500   | 30    |            | 2,250  | 9,750     |             |
|          |                                                           |     |      |         |         |       |            |        |           |             |
| TASK T   | OTAL COST                                                 |     |      |         |         |       |            | Total: | 9,750     | \$9,750     |

| Division | 8 - Openings                                                       |          |     |                                               |         |    |        |         |           |
|----------|--------------------------------------------------------------------|----------|-----|-----------------------------------------------|---------|----|--------|---------|-----------|
|          | New Access Doors                                                   | 3        | ea. | 3,000                                         | 9,000   | 0  | 0      | 9,000   |           |
|          | New Pump Access Hatches                                            | 2        | ea. | 5,000                                         | 10,000  | 0  | 0      | 10,000  |           |
|          |                                                                    |          |     |                                               |         |    |        |         |           |
| TASK T   | OTAL COST                                                          |          |     |                                               |         |    | Total: | 19,000  | \$19,000  |
| Division | 9 - Finishes                                                       |          |     |                                               |         |    |        |         |           |
|          |                                                                    |          |     |                                               |         |    |        |         |           |
|          |                                                                    |          | L   | <u> </u>                                      |         |    | 1 1    |         |           |
| TASK T   | OTAL COST                                                          |          |     |                                               |         |    | Total: | 0       | \$0       |
| Division | 22 - Plumbing                                                      |          |     |                                               |         |    |        | ۴       |           |
|          | Sump Pump (Explosion-proof type)                                   | 1        | ea. | 8,000                                         | 8,000   | 30 | 2,400  | 10,400  |           |
|          | Washroom                                                           | 1        | LS  | 5,000                                         | 5,000   | 30 | 1,500  | 6,500   |           |
|          | Mechanical Removals and Demolitions                                | 1        | LS  | 15,000                                        | 15,000  | 0  | 0      | 15,000  |           |
|          | 150 DIA Wet Well Vent, S.S.                                        | 1        | ea. | 4,000                                         | 4,000   | 75 | 3,000  | 7,000   |           |
|          | Thermal Insulation                                                 | 1        | LS  | 5,000                                         | 5,000   | 35 | 1,750  | 6,750   |           |
|          | Miscellaneous Supports and Hangers                                 | 1        | LS  | 20,000                                        | 20,000  | 35 | 7,000  | 27,000  |           |
|          | Core Drilling (Floor & Walls)                                      | 8        | ea. | 500                                           | 4,000   | 0  | 0      | 4,000   |           |
|          | ·                                                                  |          |     |                                               |         |    |        |         |           |
| TASK T   | OTAL COST                                                          |          |     |                                               |         |    | Total: | 76,650  | \$76,650  |
| Division | 23 - Heating, Ventilating, Air Conditioning (HVAC)                 |          |     |                                               |         | •  | 1      |         |           |
|          | Station Fans (Electrical Room)                                     | 1        | ea. | 10,000                                        | 10,000  | 35 | 3,500  | 13,500  |           |
|          | Station Fans (Wet Well)                                            | 2        | ea. | 10,000                                        | 20,000  | 35 | 7,000  | 27,000  |           |
|          | Station Fans (Dry Well)                                            | 2        | ea. | 8,000                                         | 16,000  | 35 | 5,600  | 21,600  |           |
|          | Duct Inline Filter c/w Pressure Gauge-Switch                       | 1        | ea. | 5,000                                         | 5,000   | 35 | 1,750  | 6,750   |           |
|          | Ductwork, Dampers, Louvers & Grilles (Dry Well)                    | 1        | LS  | 35,000                                        | 35,000  | 35 | 12,250 | 47,250  |           |
| ┃        | Ductwork, Dampers, Louvers (Wet Well)                              | 1        | LS  | 50,000                                        | 50,000  | 35 | 17,500 | 67,500  |           |
|          | Damper Actuators (Dry Well)                                        | 2        | ea. | 1,500                                         | 3,000   | 35 | 1,050  | 4,050   |           |
| <b> </b> | Damper Actuators (Wet Well)                                        | 2        | ea. | 4,500                                         | 9,000   | 35 | 3,150  | 12,150  |           |
| <b> </b> | Unit Heaters (Electrical Room)                                     | 2        | ea. | 5,000                                         | 10,000  | 35 | 3,500  | 13,500  |           |
| <b> </b> | Unit Heaters (Dry Well)                                            | 3        | ea. | 5,000                                         | 15,000  | 35 | 5,250  | 20,250  |           |
| ┃        | Unit Heaters (Wet Well)                                            | 4        | ea. | 12,000                                        | 48,000  | 35 | 16,800 | 64,800  |           |
| ┣───     | HVAC Controls                                                      | 1        | LS  | 20,000                                        | 20,000  | 50 | 10,000 | 30,000  |           |
| ┣───     | Programming and System Integration including FAT and SAT           | 1        | LS  | 25,000                                        | 25,000  | 0  | U      | 25,000  |           |
|          | HVAC TAB                                                           | 1        | LS  | 6,000                                         | 6,000   | 0  | 2 400  | 6,000   |           |
|          | Sump Pump (Explosion-proof type)                                   | 1        | ea. | 8,000                                         | 8,000   | 30 | 2,400  | 10,400  |           |
|          | Washroom & Water main entrance modification                        | 1        | LS  | 8,000                                         | 8,000   | 30 | 2,400  | 10,400  |           |
|          | Mechanical Removals and Demonitoris                                | 1        |     | 15,000                                        | 13,000  | 75 | 2 000  | 7 000   |           |
|          | Thermal Inculation                                                 | 1        | ea. | 4,000                                         | 4,000   | /5 | 3,000  | 7,000   |           |
|          | Missellen cous Summerts and Hencom                                 | 1        |     | 3,000                                         | 3,000   | 33 | 1,730  | 0,730   |           |
|          | Care Drilling (Elaan & Walla)                                      | 0        | Lo  | 20,000                                        | 20,000  | 55 | 7,000  | 27,000  |           |
|          |                                                                    | 0        | ea. | 500                                           | 4,000   | 0  | 0      | 4,000   |           |
| TASKT    | OTAL COST                                                          | <u> </u> | ļ'  | <b>ا</b> ــــــــــــــــــــــــــــــــــــ |         | L  | Total: | 430 000 | \$430.000 |
| Division | 26 Electrical                                                      |          |     |                                               |         |    | 10101: | 439,900 | \$439,900 |
| DIVISION | 20 - Electrical<br>Electrical General Requirements (Miscellaneous) | 1        | 15  | 10.000                                        | 10.000  | 0  |        | 10.000  | 1         |
|          | Temporary service                                                  | 1        | IS  | 10,000                                        | 10,000  | 25 | 25,000 | 125,000 |           |
|          | Electrical Systems Analysis                                        | 1        | IS  | 10,000                                        | 10,000  | 25 | 23,000 | 10,000  |           |
|          | Demolition of Electrical Systems                                   | 1        | LS  | 30,000                                        | 30,000  | 0  | 0      | 30,000  |           |
|          | Basic Electrical Equipment & Materials                             | 1        | LS  | 125,000                                       | 125,000 | 25 | 31 250 | 156 250 |           |
| -        | Underground Duct Systems and Access Holes                          | 1        | LS  | 200,000                                       | 200,000 | 25 | 50,000 | 250,000 |           |
| -        | Conduit and Cable tray Systems                                     | 1        | LS  | 12 000                                        | 12 000  | 25 | 3 000  | 15 000  |           |
| 1        | Contain and Cache day Systems                                      | -        | 10  | 12,000                                        | 12,000  | 25 | 5,000  | 15,000  | j j       |

| Wire and Cables                                                     | 1 | LS   | 5,000   | 5,000   | 25 |          | 1,250  | 6,250     | 1           |
|---------------------------------------------------------------------|---|------|---------|---------|----|----------|--------|-----------|-------------|
| Electrical Boxes                                                    | 1 | LS   | 2,000   | 2,000   | 25 |          | 500    | 2,500     | 1           |
| Wiring Device                                                       | 1 | LS   | 8,000   | 8,000   | 25 |          | 2,000  | 10,000    | 1           |
| Standby Diesel Generator Set                                        | 1 | ea.  | 240,000 | 240,000 | 25 |          | 60,000 | 300,000   | 1           |
| Auto Transfer Switch                                                | 1 | LS   | 20,000  | 20,000  | 25 |          | 5,000  | 25,000    | 1           |
| Control Devices                                                     | 1 | LS   | 10,000  | 10,000  | 25 |          | 2,500  | 12,500    | 1           |
| Grounding                                                           | 2 | LS   | 12,000  | 24,000  | 25 |          | 6,000  | 30,000    | 1           |
| Low Voltage Motor Control Centres                                   | 1 | LS   | 250,000 | 250,000 | 25 |          | 62,500 | 312,500   | 1           |
| Variable Frequency Drives                                           | 3 | ea.  | 40,000  | 120,000 | 25 |          | 30,000 | 150,000   | 1           |
| Active Harmonic Filter                                              | 1 | ea.  | 50,000  | 50,000  | 25 |          | 12,500 | 62,500    | 1           |
| Lighting Equipment                                                  | 1 | LS   | 30,000  | 30,000  | 25 |          | 7,500  | 37,500    |             |
| Mixer Soft starters                                                 | 3 | ea.  | 15,000  | 45,000  | 25 |          | 11,250 | 56,250    | 1           |
| Surge Protection Device (SPD) (1-200kA, 2-80kA)                     | 1 | LS   | 5,000   | 5,000   | 25 |          | 1,250  | 6,250     | 1           |
| TASK TOTAL COST                                                     |   |      |         |         |    |          | Total: | 1,607,500 | \$1,607,500 |
| Division 31 - Earthwork                                             |   |      |         |         |    |          |        |           |             |
|                                                                     |   |      |         |         |    |          |        |           |             |
|                                                                     |   |      |         |         |    |          |        |           | 1           |
|                                                                     |   |      |         |         |    |          |        |           | 1           |
| TASK TOTAL COST                                                     |   |      |         |         |    |          | Total: | 0         | \$0         |
| Division 32 - Exterior Improvements                                 |   | -    |         |         |    |          |        |           |             |
| Landscaping (including Grading, Asphalt, and Curbs)                 | 1 | LS   | 25,000  | 25,000  | 0  |          | 0      | 25,000    | 1           |
| Sediment and Erosion control                                        | 1 | LS   | 5,000   | 5,000   |    |          |        | 5,000     | 1           |
| Excavation (Bypass Connection)                                      | 1 | LS   | 5,000   | 5,000   |    |          |        | 5,000     | 1           |
| Tree Protection                                                     | 1 | LS   | 5,000   | 5,000   |    |          |        | 5,000     | 1           |
|                                                                     |   |      |         |         |    |          |        |           | 1           |
| TASK TOTAL COST                                                     |   |      |         |         |    |          | Total: | 40,000    | \$40,000    |
| Division 40 -Process Interconnection                                | r |      |         |         | 1  | <b>r</b> |        |           |             |
| Station Piping                                                      | 1 | LS   | 35,000  | 35,000  | 50 |          | 17,500 | 52,500    | 1           |
| Process Valves                                                      | 1 | LS   | 65,000  | 65,000  | 30 |          | 19,500 | 84,500    |             |
| RPU Panel Construction                                              | 1 | LS   | 80,000  | 80,000  | 0  | 1,000    | 1,000  | 81,000    | 1           |
| Coordination and Communication for the RPU Panel                    | 1 | LS   | 10,000  | 10,000  | 0  |          | 0      | 10,000    | 1           |
| Gas Detection System including instruments, panel ,lights ,horns    | 1 | LS   | 30,000  | 30,000  | 30 |          | 9,000  | 39,000    | 1           |
| Door/Hatch Contacts                                                 | 1 | LS   | 2,000   | 2,000   | 30 |          | 600    | 2,600     | 1           |
| Pressure Transmitter                                                | 1 | LS   | 3,000   | 3,000   | 30 |          | 900    | 3,900     | 1           |
| Pressure Gauges                                                     | 6 | each | 500     | 3,000   | 30 |          | 900    | 3,900     | 1           |
| Float Switches                                                      | 3 | each | 600     | 1,800   | 30 |          | 540    | 2,340     | 1           |
| Main - Programming and System Integration including FAT's and SAT's | 1 | LS   | 30,000  | 30,000  | 0  |          | 0      | 30,000    |             |
| Power Monitoring and Pump Protection Relays                         | 1 | LS   | 8,500   | 8,500   | 30 |          | 2,550  | 11,050    | 1           |
| Level Sensor and Transmitter                                        | 1 | ea.  | 3,500   | 3,500   | 50 |          | 1,750  | 5,250     | 1           |
| Demolition and Removals                                             | 1 | LS   | 6,000   | 6,000   | 50 |          | 3,000  | 9,000     | 1           |
|                                                                     |   |      |         |         |    |          |        |           | l           |
| TASK TOTAL COST                                                     |   |      |         |         |    |          | Total: | 335,040   | \$335,040   |
| Division 41 - Material Processing and Handling Equipment            |   |      |         |         |    | I        |        |           |             |
| Monorail Beam                                                       | 1 | LS   | 7,500   | 7,500   | 30 |          | 2,250  | 9,750     |             |
| Electric Chain Hoist                                                | I | LS   | 78,036  | 78,036  | 30 |          | 23,411 | 101,447   |             |
|                                                                     |   |      |         |         |    |          |        | 111.00    |             |
| TASK TOTAL COST                                                     |   |      |         |         |    |          | Total: | 111,197   | \$111,197   |

| Division | 43 - Process Gas and Liquid Handling    |       |       |                                       |             |                       |             |         |             |
|----------|-----------------------------------------|-------|-------|---------------------------------------|-------------|-----------------------|-------------|---------|-------------|
|          | Remove Existing Pumps, Pipes and Valves | 1     | LS    | 15,000                                | 15,000      | 0                     | 0           | 15,000  |             |
|          | Install New Pumps                       | 3     | ea.   | 181,382                               | 544,146     | 30                    | 163,244     | 707,390 |             |
|          |                                         |       |       | <u> </u>                              |             |                       |             |         | I           |
| TASK 7   | OTAL COST                               |       |       |                                       |             |                       | Total:      | 722,390 | \$722,390   |
|          |                                         |       |       |                                       |             |                       |             | TOTAL   | \$5,515,107 |
|          | NOTES                                   |       |       | SUMM                                  | ARY         |                       |             |         |             |
| 1        |                                         |       |       | DIV 1                                 | GENERAL RE  | QUIREMENTS            |             |         | \$1,536,930 |
|          |                                         |       |       | DIV 2                                 | EXISTING CO | NDITIONS              |             |         | \$540,000   |
| 1        |                                         |       |       | DIV 3                                 | CONCRETE    |                       |             |         | \$31,000    |
|          |                                         |       |       | DIV 4                                 | MASONRY     |                       |             |         | \$10,000    |
|          |                                         |       |       | DIV 5                                 | METALS      |                       |             |         | \$35,750    |
|          |                                         |       |       | DIV 6 WOOD , PLASTICS AND COMPOSITES  |             |                       |             |         | \$9,750     |
|          |                                         |       |       | DIV 7 THERMAL AND MOISTURE PROTECTION |             |                       |             |         | \$0         |
|          |                                         |       |       | DIV 8                                 | OPENINGS    |                       |             |         | \$19,000    |
|          |                                         |       |       | DIV 9                                 | FINISHES    |                       |             |         | \$0         |
|          |                                         |       |       | DIV 22                                | PLUMBING    |                       |             |         | \$76,650    |
|          |                                         |       |       | DIV 23                                | HVAC        |                       |             |         | \$439,900   |
|          |                                         |       |       | DIV 26                                | ELECTRICAL  |                       |             |         | \$1,607,500 |
|          |                                         |       |       | DIV 31                                | EARTHWORK   | •                     |             |         | \$0         |
| No       | REVISION                                | DATE  |       | DIV 32                                | EXTERIOR IM | PROVEMENTS            |             |         | \$40,000    |
| 0        | Pre-Tender Cost Estimate                | 2022- | 03-23 | DIV 40                                | PROCESS INT | ERCONNECTION          |             |         | \$335,040   |
| 1        |                                         |       |       | DIV 41                                | MATERIAL HA | ANDLING ANF HANDLING  | ; EQUIPMENT |         | \$111,197   |
| 2        |                                         |       |       | DIV 43                                | PROCESS GAS | S AND HANDLING EQUIPM | /IENT       |         | \$722,390   |
| 3        |                                         |       |       | TOTAL                                 |             |                       |             |         | \$5,515,107 |
| 4        |                                         |       |       | ENGINEERING                           | AND CONTINC | JENCY                 |             |         | \$0         |
| 5        |                                         |       |       | TAXES AND OT                          | HER ITEMS   |                       |             |         | \$716,964   |
|          |                                         |       |       | TOTAL                                 |             |                       |             |         | \$6,232,070 |

#### HALIFAX WATER

## BISSETT LAKE WASTEWATER PUMP STATION (WWPS) UPGRADES BISSETT LAKE WWPS

JULY 30, 2021



## vsp



### BISSETT LAKE WASTEWATER PUMP STATION (WWPS) UPGRADES BISSETT LAKE WWPS

HALIFAX WATER

PRELIMINARY DESIGN REPORT (1.0)

PROJECT NO.: 201-08639-00 DATE: JULY 2021

WSP 100 COMMERCE VALLEY DRIVE WEST THORNHILL, ON, CANADA L3T 0A1

WSP.COM

## wsp

July 16, 2021

Greg Rice Project Manager Halifax Water 450 Cowie Hill Rd Halifax, NS B3K 5M1

Dear Sir:

Subject: Bissett Lake WWPS 60% Design Report Client ref.: P21.2020

We are pleased to submit the 60% Design Report for the Bissett Lake Wastewater Pump Station (WWPS).

We look forward to moving ahead into 60% Design for the Bissett Lake WWPS. Should you have any questions, please do not hesitate to contact the undersigned.

Kind regards,

Kevin O'Leary

WSP ref.: 201-08639-00

100 COMMERCE VALLEY DRIVE WEST THORNHILL, ON, CANADA L3T 0A1

### QUALITY MANAGEMENT

| ISSUE/REVISION | FIRST ISSUE   | REVISION 1 | REVISION 2 | REVISION 3 |
|----------------|---------------|------------|------------|------------|
| Remarks        |               |            |            |            |
| Date           | July 30, 2021 |            |            |            |
| Prepared by    | Maira Rafiq   |            |            |            |
| Signature      |               |            |            |            |
| Checked by     | Irwin Tong    |            |            |            |
| Signature      |               |            |            |            |
| Authorised by  | Kevin O'Leary |            |            |            |
| Signature      |               |            |            |            |
| Project number | 201-08639-00  |            |            |            |
| Report number  | 2.0           |            |            |            |

### SIGNATURES

PREPARED BY

Maira Rafiq Project Coordinator

**REVIEWED BY** 

Irwin Tong, P.Eng. Project Engineer

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### PRODUCTION TEAM

#### CLIENT

| Project Manager               | Greg Rice      |
|-------------------------------|----------------|
| WSP                           |                |
| Project Manager               | Pat Lewis      |
| Deputy Project Manager        | Kevin O'Leary  |
| Station Design Technical Lead | Dean Whittaker |
| Pump Station Designer         | Irwin Tong     |

### EXECUTIVE SUMMARY

This report outlines the upgrades and repairs to the Bissett Lake Wastewater Pump Station as indicated in the Terms of Reference for RFP P21.2020.

The major process upgrades to the pumping station consist of replacement of the existing pumps, process valves, and piping, installation of station by-pass line in the dry well and stainless steel cleaning line in the wet well. In addition to the abovementioned upgrades, review of the station capacity and layout to account for the addition of new pump in future, as well as, review and assessment of all existing electrical, mechanical and instrumentation systems at the station is included in scope of this project.

The existing extended shaft pumps will be replaced with dry pit submersible pumps with close coupled motors. The existing valves, and discharge piping in the Dry Well will also be replaced as part of the station upgrades. The proposed new pump discharge piping will be modified from the existing to allow for inclusion of new pump and process valves.

Two new hatches and a monorail hoist will be provided on the main level to allow for removal of the pumps, from the pump room, up into the main levels, and directly out through a new double access door to outside the station. Further structural modifications include reworking of the layout of the main level to physically separate the new Electrical Room from the Dry Well/Pump Room (Class 1 Division 2). This will allow for declassification of the Electrical Room, per NFPA 820 (2020), without the need for ventilation.

Currently there are two fans in the Wet Well and one in the Dry Well. As part of the upgrades, new fans will be installed to provide ventilation for the Dry Well, while new fans will also be provided to ventilate the Wet Well. The ventilation systems will run based on an Operator controlled button located at the access doors, with controls to automatically engage the ventilation systems if space temperature reaches a set value, or if hazardous gas levels reach setpoint value.

The existing electrical distribution system will be replaced, which includes panels, conduits and wiring, and lighting equipment. The security system and fire alarm system will also be replaced. The existing generator is 545kW and will be replaced with 600kW set to run the required load. Due to limited space available in the existing generator room, the new 600kW generator will be installed in a new generator enclosure, which will be located adjacent to the holding tank, as shown on site plan included in Appendix C. The main incoming transformer from NS power is 1000kVA and shall remain.

The construction cost estimate, +/- 25% for the upgrades to the station total is **\$5,248,690**.

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#### **APPENDICES**

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- **B** EQUIPMENT DATA SHEETS
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## **1 PROJECT DESCRIPTION**

### 1.1 BACKGROUND

The Bissett Lake Wastewater Pumping Station (WWPS) is located at 54 Atwood Crescent in Cole Harbour. The facility includes below grade Wet Well and Dry Well, and a superstructure which allows access to the Wet Well and Dry Well.

The station was originally constructed in the early 1970's, with partial mechanical/ electrical upgrades completed early 1990's, and currently has three (3) extended shafts pumps in the Dry Well which delivers the design capacity of approximately 440 L/s.

The mechanical equipment includes ventilation for both the Dry Well and Wet Well through supply and exhaust fans, as well as an existing water service to the station, complete with 25mm backflow preventer and metering device and a sump pump located within the Dry Well.

The station has a level transmitter (LIT), and two (2) float switches, in the Wet Well and flowmeter located in the Dry Well and has combustible gas detection for the Wet Well. Currently, the station is not equipped with a pressure transmitter.

The existing electrical system consists of main breaker, equipment breakers, bubbler panel, distribution panel, pump starters, variable frequency drives (VFDs), lighting transformer and panel, and transfer switch. The main control panel (PLC) is located within the Dry Well superstructure, with the electrical panels. The station has a permanent standby generator on main floor of the pump station.

### 1.2 OBJECTIVES / SCOPE OF WORK

WSP's general scope of work for this project includes:

- Review and confirmation of the existing field conditions, pumping station layout, existing equipment;
- Design of emergency by-pass pumping connection to increase service capability from the facility, and review and development of the station by-pass plan during construction;
- Replace three existing extended shaft pumps with three new dry pit submersible pumps, while considering the
  installation of fourth pump in future to meet the ultimate capacity needs of the system. All new pumps shall be
  equipped with VFDs.;
- Replace the existing lifting equipment for new pump selection;
- Replace all process valves and piping within the station;
- Install stainless steel cleaning line in the wet well;
- Inspect existing structural and process/mechanical equipment installed in wet well and replace, if required;
- Determine current area classifications, and design new energy efficient HVAC systems to meet NFPA 820 (2020) requirements;
- Review of the electrical classification to determine viability of reduction of the electrical classification, and update station layout as required to declassify the Electrical Room;
- Update and replace electrical equipment, including the generator. Generator will be sized for the three (3) new pumps;
- Install a pre-fabricated sound attenuated weather-proof generator enclosure adjacent to the holding tank;
- Review of the station's instrumentation and controls (I&C) and determine required upgrades, including review of upgrade to the overflow monitoring system;
- Obtaining all necessary approvals and permits prior to Tendering, including building permit;
- Perform Life Cycle Cost Analysis to support the alternatives review and equipment selection;
# 1.3 APPLICABLE GUIDELINES AND STANDARDS

- Nova Scotia Building Code;
- American National Standards Institute (ANSI)
- NFPA 820 (2020);
- American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE);
- Canadian Electrical Code
- National Electrical Manufacturers Association (NEMA)
- CAN / CSA

# **2 LOCATION PLAN**

# 2.1 SITE PLAN

The station is located at 54 Attwood Crescent in Cole Harbour (Refer to Figure 2-1 below). The facility includes the below grade Dry Well and Wet Well, as well as the above Dry Well superstructure which contains the pump motors, standby diesel generator, electrical & control panels.



Figure 2-1: Bissett Lake SPS Site Plan (Source: Google Earth)

# **3 SITE SERVICES**

The following sections provide a brief description of the existing site services.

## 3.1 MUNICIPAL WATER SUPPLY

The Bissett Lake WWPS is currently equipped with a 25mm dia. potable water line.

Refer to Section Error! Reference source not found. for details on changes to the water supply system.

# 3.2 MUNICIPAL WASTEWATER SUPPLY

Due to the station's location, it is assumed that the drainage area to the station consists of a combination of residential and commercial/institutional contributors.

The inlet to the Wet Well is a 750mm dia. sewer. The station currently overflows to a holding tank via a 750mm dia overflow pipe. During high flow events, the holding tank overflows to the environment at an elevation of 33.3 m (109.0 ft), as shown in Figure 3-1.

The Bissett WWPS is equipped with two forcemains; 400 mm Asbestos Cement (AC) and 500 mm Ductile Iron (DI). As shown is Figure 3-1, the forcemains exits the station at two different locations and both forcemains into a surge tank located at the head of the Eastern Passage pressure sewer system.



**Figure 3-1 Existing Site Overview Diagram** 

# 3.3 POWER SUPPLY

The station is fed from NS power pad mount transformer to a 1200Amps switchboard. The incoming transformer is 1000kVa, secondary voltage 600vac,3phase. The station currently has an automatic transfer switch with a connection panel for a permanent generator sized 545kW, 600vac, 3phase.

# **4 BASIC DESIGN DATA**

# 4.1 BASIC DESIGN DATA

WSP reviewed Bisset WWPS flow monitoring data provided by Halifax Water to confirm Station's Capacity. The peak flow was recorded on April 14<sup>th</sup>, 2020 as 444 L/s (1598.57 m3/hr) with two pumps (Pump 1 and Pump 2) running. The design flow for the station was therefore selected as 444L/s, which also matches the firm capacity of the existing station. Table 4-1, provides design data for Bisset WWPS.

#### Table 4-1Bisset WWPS Design Data

| Station Layout   | Wet Well / Dry Well Sewage Pumping Station                                   |
|------------------|------------------------------------------------------------------------------|
| Station Capacity | 440 L/s @ 45 m TDH, 3 Total Pumps (Duty 2, Standby 1) with 2 Pumps           |
|                  | providing Firm Capacity and provision for $4^{\rm th}$ pump to increase firm |
|                  | capacity of the station                                                      |
| Forcemain        | 400mm Forcemain, approx. 2952 m                                              |
|                  | 500mm Forcemain, approx. 2722 m                                              |
| Overflow         | Feeds into a holding tank located on site                                    |
| Generator        | 600kW Diesel Standby                                                         |

## 4.2 COMPLETE PRELIMINARY DESIGN CALCULATIONS

Refer to Appendix A for Preliminary Design Calculations.

# **5 CONCEPTUAL LAYOUT**

# 5.1 STATION LAYOUT PLANS

The existing Dry Well Pump Room houses all the process pumps and valves. All the electrical and control panels are located within the Dry Well superstructure. Refer to Appendix C for preliminary design site drawings.

# 5.2 EQUIPMENT LOCATION AND ORIENTATION

The general layout for the pumps and suction piping will remain mostly unchanged, however the orientation of the common discharge piping will be modified to improve ease of pump removal. The major upgrades will include replacement of all process piping, valves and pumps, and separation of electrical room from the wet well to maintain an unclassified area in the electrical room by adding a dividing wall to provide a separate pump removal room and relocation of the washroom. The existing station HVAC and lifting system for pump removal will also be replaced.

For details on the pump, piping and panel layouts, refer to the preliminary design drawings in Appendix C, and Figure 5-1 and Figure 5-2 below.









**Proposed Station Layout** 

#### 5.3 PROCESS AND PIPING MODIFICATIONS

#### 5.3.1 EXISTING PUMPS

The station is currently equipped with three (3) pumps located in the Dry Well Pump Room. The pumps operate on a duty/standby operation. Based on the Halifax Water Condition Assessment of the Bissett Lake 16-inch Asbestos-Cement Forcemain report 2017, all three pumps are rated for 5200gpm (328 L/s) at 88ft (27m) TDH. The pump motors are 150hp running at 1200 rpm.

#### 5.3.2 PROPOSED PUMPS AND PIPING

The three (3) existing pumps will be replaced with three (3) dry pit submersible pumps.

Xylem and KSB are the preferred pump manufacturers. ABS (Suzler) pumps were also considered during the preliminary design stage but were disqualified due size of the proposed pumps and limited space available in the pump access room. The Xylem pump is being used as the design basis, as it has the greatest electrical supply requirements. The motor of the selected pump from Xylem is 210kW. The firm capacity of the station will be the total station capacity with the largest pump out of service, or 440L/s. Based on the proposed new internal piping layout in Appendix C and the available forcemain plan & profile drawings, the TDH for the pumps will be 45.98m. The headloss calculations are based on the 500dia. forcemain is only for backup/parallel operation. The details for the proposed and existing pumps are shown in Table 5-1 below:

|                             | EXISTING PUMPS | PROPOSED    | PROPOSED ABS      | PROPOSED KSB  |
|-----------------------------|----------------|-------------|-------------------|---------------|
|                             |                | XYLEM PUMPS | Pumps             | PUMPS         |
| No. of Pumps                | 3              | 3           | 3                 | 3             |
| Model                       | N/A            | NT 3312/765 | VED 205M CB2      | KRTK 250-403/ |
|                             | IN/ A          | 3~670       | ALL DOM-CD2       | 1554XNG-D     |
| Station Firm Capacity (L/s) | N/A            | 440         | 440               | 440           |
| Station TDH (m)             | N/A            | 45.98       | 4 <del>5.98</del> | 45.98         |
| Capacity per Pump (L/s)     | 328            | 374         | <del>374</del>    | 350           |
| Head per Pump (m)           | 27             | 40.28       | <del>40.28</del>  | 32.24         |
| NPSH (m) Single Pump        | N/A            | 6.2         | <del>6.0</del>    | 7.5           |
| Impeller Diameter (mm)      | N/A            | 485         | 4 <del>87</del>   | 375           |
| RPM                         | N/A            | 1190        | <del>1180</del>   | 1781          |
| Suction (mm)                | N/A            | 350         | <del>300</del>    | 350           |
| Discharge (mm)              | N/A            | 300         | <del>300</del>    | 250           |
| Motor Power (kW)            | 112            | 208.8       | <del>185</del>    | 144.67        |
| Amps                        | N/A            | 266         | 222               | 170           |
| Hydraulic Efficiency (%)    | N/A            | 75          | 84.4              | 80.5          |

#### Table 5-1 Proposed Pump Details

In addition to the replacement of the pumps, the piping and valves in the Dry Well/Pump Room will be replaced. All new process piping will be stainless steel Sch10S. All pump suction valves will be stainless steel knife gate valves, discharge valves will be stainless steel plug valves, and the check valves will be rubber flapper check valves.

The design flow will be matched by three new dry-pit submersible pumps. Provision for installation of a fourth pump has been included in the design to allow for future increase in PS firm capacity. The fourth pump could be of similar size or smaller, depending on the increase in firm capacity of the station.

Currently, the station is not equipped with a bypass-connection. As part of the process upgrades, an emergency by-pass pumping line will also be provided in the dry well to increase service capability from the facility.

The existing internal layout of the station will be updated to allow for ease of pump removal. To allow for safe and efficient removal of pumps, the current electrical room will be divided into electrical room and pump access room. The pump access room will be equipped with two access hatches to allow for removal of pumps and all other dry well equipment. Refer to Preliminary Design Drawings in Appendix C.

It is to be noted here that, all equipment, fixtures, ductwork and junction boxes will be placed above highest possible flood level in the dry well.

#### 5.3.3 WET WELL CONFIGURATION

The station Wet Well is shown in Figure 5-1. The wet well is equipped with an inlet pipe (which diverges into two spiral slope areas for comminutors) pump suction pipes, overflow pipe, exhaust fan and high and low level floats. The wet well can be accessed via metal staircase that lands over an intermediate platform.

Halifax water requested the following modifications in the wet well.

- Provide new laser level transmitter;
- Provide stainless steel cleaning line in the wet well to allow for cleaning of the wet well from grade via vac truck.



#### 5.3.4 OVERFLOW PIPING

#### Figure 5-3 Existing Wet Well Layout

The station is equipped with an adjacent storage chamber. The wastewater from Bissett Lake WWPS overflows to the holding tank via a 750mm dia overflow pipe. During high flow events, the holding tank overflows to the environment at an elevation of 33.3 m (109.0 ft). The configuration of the compete pumping station and overflow system will be reviewed and confirmed with Halifax Water prior to Detailed Design.

## 5.4 BUILDING DESIGN

#### 5.4.1 AREA CLASSIFICATION SCHEDULE

#### Table 5-2 New Area Classification Summary

| Station Room                  | Current<br>Classification | Proposed<br>Classification | Note for Proposed Classification                                                                                                                                                                                        |
|-------------------------------|---------------------------|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Electrical /<br>Controls Room | Class 1, Zone 2           | Unclassified               | With the Electrical / Control Room physically separated from any classified area, it will be unclassified per NFPA 820 (2020).                                                                                          |
| Dry Well / Pump<br>Room       | Class 1, Zone 2           | Class 1, Zone 2            | Current ventilation in dry well is not-continuous at 6 air<br>changes per hour (ACH). A minimum ventilation rate of 6<br>air changes per hour (ACH) will be required as per Table<br>4.2.2 - Row 17 of NFPA 820 (2020). |
| Wet Well                      | Class 1 Zone 1            | Class 1 Zone 1             | Assuming the station services a sanitary sewer / combined<br>system, per NFPA 820 (2020) Table 4.2.2 Row 16 - As the<br>ventilation system is not continuous, it does not reduce<br>the classification of the area.     |

#### 5.4.2 STRUCTURAL/ARCHITECTURAL MODIFICATIONS

The existing Electrical/Control/Pump Motor Room will be separated into three (3) areas: Stairwell to Pump Room, Pump Access Room, and the Electrical/Control Room. Modifications will include updates to masonry walls, addition of 2 x 1500mmx1500mm pump access hatches, addition of fall arrest anchor points near hatches, and addition of new access doors (1 x Electrical Control Room, 1 x Pump Access Room). A new monorail will be provided in the Pump Access Room for pump removal. The new lifting device will allow for direct removal of the pump from the Pump Room, up through the new hatches into the Pump Access Room, and then out of the station through the new double doors.

Due to the orientation of roof at main level, limited vertical height is available in pump removal room for the removal of fourth (future) pump. After reviewing several options for pump removal, including updating motor sizes, dismantling pump and motor etc., WSP is proposing to install the monorail beam upto the center of the Access Hatch 2, as shown in drawing xxx. This will provide extra vertical distance as compared to the monorail beam installed all the way to the West wall of the pump removal room. That being said, the ABS (Suzler) pump proposed during the preliminary design stage still exceeds the available vertical height in pump removal room, therefore, ABS pumps after discussion with the Halifax Water were disqualified.

#### 5.4.3 MISCELLANEOUS STRUCTURAL MODIFICATIONS & REPAIRS

The following structural / architectural elements will be reviewed:

- Provide new concrete bases/supports for pumps, piping, and electrical panels/equipment;
- Fuel Storage Tank Structure Addition With the existing storage tank being relocated, WSP will review with Halifax Water potentially removing this structure.
- Stairs and Platform within the Pump Room Review condition and potential for rehabilitation or replacement;
- Provide new FRP platform and stairs in the wet well.

#### 5.4.4 SITE WORKS & LANDSCAPING

With the proposed relocation of the fuel storage tank to outside of the station, and requirement for fuel line and electrical ductbank running from the fuel tank to the station, the driveway will be rehabilitated.

# 6 ELECTRICAL SYSTEM

## 6.1 GENERAL CODES AND PRACTICES

The electrical design will follow the requirements stipulated in the latest edition of the Canadian Electrical Code. Other applicable standards from the Nova Scotia Building Code, CAN/CSA will also be used as a reference for the electrical design.

#### 6.2 EXISTING ELECTRICAL SYSTEM

The electrical system is fed from existing NS power pad mount transformer sized 1000kVa, secondary voltage 600vac, 3-phase. The main switchboard is 1200amps, 600vac, 3-phase. The backup emergency power supply is provided from a permanent generator (545kW) via an automatic transfer switch.

#### 6.2.1 MAIN SINGLE LINE DIAGRAM

Refer to Appendix C for the Main Single Line Diagram drawings.

#### 6.2.2 ELECTRICAL EQUIPMENT LAYOUT

The electrical equipment such as service entrance breaker & power quality meter, surge protection device, feeder breakers, ATS, etc. will be contained within the MCC and located along the west wall of the Electrical Room. The VFD's for the three pumps will be located in the electrical room. Refer to Appendix C for the Electrical Equipment Layout drawings.

#### 6.2.3 ELECTRICAL LOADS

The electrical design for the pumping station will be based on the total load requirements of all equipment proposed within the station. The main loads are three (3) pumps at 220 kW each.

#### 6.2.4 POWER DISTRIBUTION AND MOTOR CONTROL CENTRE

The new pumping station distribution system will be 600V, 1200A, 3-phase, 60 Hz. Motor Control Centre (MCC) to be fed from the pad mount transformer. The new MCC will be installed in the electrical Room, and will contain the electrical main circuit breaker, surge protective device (SPD), PQM II (power quality meter), feeder breakers, and 600V-120/208V 3 phase transformer will be installed integrated or line-up with the MCC.

It is not expected that a bulk power factor correction will be required as the pumps will be equipped with variable frequency drives (VFDs).

The new starters for all Pumps shall be VFDs complete with external bypass option to allow for operation of the pump during VFD failure, fault or maintenance. Line and load reactors will be used to ensure the Power Quality of the supply network and/or to limit the pollution generated by one or more harmonic loads.

600V-120/208V step down transformer and lighting panel board will supply 120/208V, 1-phase/3-phase power to ancillary loads, such as lighting, receptacles, sump pump, and instrumentation/control equipment.

In addition to the installation/ replacement of the above mentioned electrical equipment, Halifax Water also requested to install Power Monitoring Module with capability to read data. The Power Monitoring Module will be provided in the main switchboard.

#### 6.2.5 LIGHTING AND POWER

The equipment installed will comply with the Electrical Code Regulations being for Class 1, Group D, Zone 1 for the Wet Well, Zone 2 for the Dry Well/Pump Room, and unclassified for the Electrical Room.

All lighting fixtures will be LED type (120V) mounted on ceiling and/or walls with accessible switches close to the access. All interior lighting will be switch-controlled and exterior lighting will be controlled by separate switch with timer (time of day). Number and location of exterior/site lighting will be reviewed during Detailed Design.

Emergency battery and remote lights will be provided as per Code requirements and exit signs will be provided as per Building Code requirements.

Receptacles (120 V) are provided inside Dry Well and Wet Well for convenience.

#### 6.3 MOTOR SCHEDULE

The existing pumps will be replaced with dry pit submersible pumps. The replacement motors will be rated as follows:

- Service Factor: 1.15
- Duty: Continuous
- Frequency: 60Hz
- Insulation Class: H to IEC 34-1
- Motor Enclosure: IP68
- Temperature Class: T3
- VFD rated

# 7 EMERGENCY STANDBY POWER

# 7.1 EMERGENCY STANDBY POWER REQUIREMENTS

A new 600kWkVA generator is proposed to maintain/operation during a power outage. The generator will operate automatically, based on available utility voltage. The control of the generator start will be through a new ATS with bypass isolation. This ATS will be on the load side of the main breaker and utility metering.

The generator will be located outside in a weatherproof, sound attenuated enclosure (65dBA @ 7m) adjacent to the holding tank, as shown on Site Plan included in Appendix C. The enclosure for the outdoor unit will be equipped with a sub-base fuel tank with capacity to run the generator for a maximum period of 48 hours. The generator will come with a second breaker on generator in case of load bank (Posi-Lok) use.

The new standby diesel generator is sized to accommodate the full station load with both duty pumps operating and no load shedding.

Pump motor sizing was reviewed further with suppliers to reduce station loads and potentially allow for continued use of the existing 545kW generator, as the existing generator is relatively new and still in good condition. However, since the new motors are relatively larger in size, the existing 545kW generator will not be able to run the two new duty pumps at the same time. Furthermore, WSP will review the storage time available within the station wet well and holding tank to assess the feasibility of running only one (1) pump on bypass generator.

# 8 HEATING AND VENTILATION AND PLUMBING

# 8.1 GENERAL

Facility upgrades for the pumping station will include heating and ventilation upgrades. The systems and equipment will be selected and designed to meet all applicable codes and design standards, including the National Fire Protection Association (NFPA), American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE), the National Building Code (NBC) and the Canadian Electrical Code. The features that are being considered integrate ventilation requirements for operator safety for the various classified and non-classified areas with the goal of minimizing energy demands.

All heating and ventilation equipment and materials will be new.

Controls for building HVAC will not be provided through SCADA. Instead, only alarms for HVAC will go through SCADA. Confirmation of fan operation will be provided through airflow switches in the ducts.

## 8.2 WET WELL HEATING AND VENTILATION

The Wet Well in the pumping station is classified as a Class 1, Group D, Zone 1 hazardous location as per NFPA 820 (Table 4.2.2 Row 16) and the Canadian Electrical Code. As such, all equipment selected for the installation in this area shall be in compliance with this classification.

The existing Wet Well exhaust fan is located on the upper level of the wet well and includes a passive intake. The equipment is aged and heavily corroded. The fan will be replaced with both a supply and exhaust fans and will be located on the station superstructure roof.

The Wet Well will be serviced by variable speed exhaust and supply fans. The fans will be fabricated from a corrosion resistant material; fibreglass reinforced plastic and will have explosion proof electrical components. The Wet Well area will remain as Class 1 Zone 1. All equipment in the Wet Well will be rated for a classified area. The fans will operate at maximum speed during occupancy of the Wet Well (occupancy switch), high temperature, or on a high gas alarm, and will operate at a reduced speed otherwise.

The Wet Well fan will operate through a wall-mounted switch located at the Wet Well entrance and will operate at maximum speed when the button is pressed. Prior to occupancy and after the button is pressed, the Operator will need to wait for a period of at least 8-10 minutes to have the area purged. The fans will exhaust air at a rate of not less than 12 (ACH). Based on space volume the exhaust fan will be sized to exhaust 1,950cfm of air from the space. The supply fan will provide 1,800cfm of fresh air to the space. After the purge, the fans will continue operation until a timer (set to 4h by default) runs down and the room is no longer occupied. At this point the fan will operate a low speed (1 ACH).

All plenums and ductwork will be constructed of 316 stainless steel which exhibits excellent corrosion resistant properties.

During the unoccupied period, the Wet Well fans will not operate unless a gas alarm, or high temperature alarm, is activated.

Presently there is an electrical radiant heater on the upper level of the Wet Well. This heater appears to be heavily corroded. One new 10kW heater will be added in the wet well space as part of this project to prevent freezing of the new hose bibb in the Wet Well.

# 8.3 DRY WELL HEATING AND VENTILATION

The Dry Well consists of a below grade structure (Pump Room). The Dry Well is a Class 1, Zone 2 area as per NFPA 820 (Table 4.2.2 Row 17) and the National Electrical Code as ventilation is not continuous at 6ACH. As such, all equipment selected for installation in this room will be rated for a classified environment.

The Dry Well existing ventilation system consists of a fan ducted down to the lower level. The fan is located in the Wet Well and ducted through the Electrical Room. Intake air is drawn through a louvre into the electrical Room and transfer to the Wet Well via grating on the floor. There are electric unit heaters located on each level of the Dry Well.

The Dry Well will be serviced by a supply fan and exhaust fan that will provide 100% fresh air to the upper and lower Dry Well rooms via an air supply duct. The fans will be fabricated from aluminum and include 316 stainless steel or FRP constructed air ducts and grilles to promote optimal air distribution.

The new Dry Well ventilation system will not penetrate Wet Well or Electrical spaces. It will be controlled through a wallmounted switch located at the Dry Well entrance and will start operation when the button is pressed. The fans will exhaust air at a rate of not less than 6 (ACH). Based on space volume the supply fan will supply 1,300cfm of outside air to the dry well. The exhaust fan will exhaust 1,200cfm of air from the space. The fans will continue operation until a timer (set to 4h by default) runs down and the room is no longer occupied. The fans will also be controlled to start if space temperature increases above setpoint, or if hazardous gas is detected.

In order to maintain 12°C in the Dry Well, heating of the Dry Well will be maintained electric unit heaters. Three 10kW electric units heaters will be located throughout the space. These heaters will be rated for Class 1, Zone 2 installation. The unit heater will be the corrosive resistance wash-down style.

## 8.4 ELECTRICAL ROOM CONDITIONING

There is a relatively new York split system unit providing temperature control for the Electrical Room. Equipment serving other spaces will be removed from the Electrical Room and separations will be patched and repaired. The existing split system unit appears to be in good condition and is of adequate size, so will be reused and relocated as required to serve the upgraded Electrical Room.

# 8.5 HEATING AND VENTILATION EQUIPMENT SCHEDULE

The following table provides the new pumping station heating and ventilation equipment:

#### Table 8-1 Heating and Ventilation Equipment

| Item                    | TAG #           | Capacity                                  |                                                              | Туре                                      | Construction                                                              |
|-------------------------|-----------------|-------------------------------------------|--------------------------------------------------------------|-------------------------------------------|---------------------------------------------------------------------------|
| DRY WELL                |                 |                                           |                                                              |                                           |                                                                           |
| Supply Fan              | SF-1            | 1,300 cfm at 0.5"SP;<br>120VAC/1ph, 1/3HP | 00 cfm at 0.5"SP;<br>DVAC/1ph, 1/3HP Centrifugal, in-line    |                                           |                                                                           |
| Exhaust Fan             | EF-1            | 1,200cfm at 0.5"SP; 120VAC/1ph,<br>1/3HP  |                                                              |                                           | Galvanized<br>aluminum                                                    |
| Wall Louver, air supply | LV-1            | 32" (W) x 24" (H)                         | Sta                                                          | ationary                                  | Galvanized<br>aluminum                                                    |
| Unit Heater             | HUH-1,<br>2, 3  | 10 kW, 575 VAC/3ph.                       | Wa<br>Re                                                     | ashdown/Corrosion<br>esistant Unit Heater | Stainless steel<br>construction,<br>epoxy-coated<br>aluminum fan<br>blade |
| Ductwork                |                 | 16" DIA                                   | Aiı                                                          | r supply                                  | Galvanized steel or aluminum                                              |
| Sump Pump               | P1              | 0.56 kW 120/1                             | 0.56 kW 120/1 Submersible Pump                               |                                           |                                                                           |
| WET WELL                |                 |                                           |                                                              |                                           |                                                                           |
| Exhaust Fan             | EF-2            | 1,950cfm at 0.5"SP; 600VAC/3 ph, 3/4HP    | ,                                                            | Centrifugal,<br>explosion proof           | FRP                                                                       |
| Supply Fan              | SF-1            | 1,800cfm at 0.5" SP; 600VAC/3 ph<br>3/4HP | 1,800cfm at 0.5" SP; 600VAC/3 ph,Centrifugal3/4HPexplosion p |                                           | FRP                                                                       |
| Unit Heater             | HTR-<br>4,5,6,7 | 10 kW, 600 V/3ph.                         |                                                              | Compact<br>explosion-proof<br>unit heater | Stainless steel construction                                              |
| Ductwork                |                 | 18" DIA                                   |                                                              | Air supply                                | 316SS                                                                     |
| Ductwork                |                 | 18" DIA                                   | DIA Air<br>exh                                               |                                           | 316SS                                                                     |

## 8.6 WATER SERVICE AND DRAINAGE

The water service is supplied through the existing 25mm diameter service complete with backflow preventer, and provides services to the pump seal water system, hose bibs, emergency shower, and washroom.

With the updates to the layout within the upper level dry well, the washroom will be relocated. As per section 7.1, the existing generator is being replaced and relocated to outside the station, therefore, the proposed location for the new washroom is within the current generator room.

# 9 FIRE ALARM AND SECURITY SYSTEM

## 9.1 FIRE ALARM SYSTEM

It was confirmed by Halifax Water that fire alarm system at this station is not required.

## 9.2 SECURITY SYSTEM

Condition of the existing security alarm system will be reviewed with Halifax Water prior to Detailed Design. With updates to the station access doors, there will be replacement of door contacts at building entry points.

# **10 MITIGATING MEASURES**

# **10.1 PROPOSED MITIGATING MEASURES**

The only upgrade which would affect the environment is the new standby diesel generator. The generator will be designed as such to minimize the noise levels as well as air emissions to conform with NSE requirements.

# **10.2 CONSTRUCTION CONSIDERATIONS**

Pumping station operation shall take precedence over all construction activities. The scope of this project involves removal and replacement of the pumps and their motors, which are critical components in the operation of the pumping station. The detailed staging process, including pump removal, replacement and new discharge piping will be reviewed during the Detailed Design process.

A temporary bypass pumping system (equipped with its own generator, float system and autodialer) will be used for the duration of the pump, electrical and controls replacement. The bypass pumps will draw from the station wet well and will discharge to the new 450dia. bypass connection which discharges to the 500dia. forcemain. The bypass pumping system is to be tested prior to demolitions and will ensure that the capacity of the pumping station is maintained should any complications or issues arise during the pump replacement. Further details on the bypass pumping will be provided during Detailed Design.

Due to the station's location within the residential area, consideration will need to be given to access to the station during construction, as well as safety and security. Access to the pumping station during construction will be reviewed in detail with the Halifax Water.

Tree protection may be required during construction. The level of protection and location will be identified during Detail Design.

## **10.3 LIMITED REGULATED MATERIALS SURVEY (RMS)**

The existing RMS report completed in February 2021 (WSP) is included in Appendix G. This will be provided to the contractor in the Tender documents. The Contractor will be made responsible for all proper precautions and demolition procedures. A summary of the RMS findings is presented in the table below.

| Regulated Materials | Location                 | Findings                                                                                                                    |
|---------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Asbestos            | Dry Well                 | Asbestos was not identified in any of the materials tested during the survey                                                |
|                     | Dry Well                 | Varying concentrations of lead were identified in paints associated with                                                    |
|                     | Dry Well<br>(Basement)   | Beige paint applied to beams, pipes and ducts was identified as low level lead                                              |
| Lead                | Dry Well<br>(Main Floor) | Grey paint with blue layer underneath, applied to platform was identified as low level lead paint                           |
|                     | Dry Well                 | White paint with orange, yellow and red layers underneath applied to one interior wall is considered lead-containing paint. |

#### Table 10-1 Summary of Regulated Materials

# **11 PROCESS CONTROL SYSTEM (PCS)**

# 11.1 I/O REQUIREMENTS

All instrumentation equipment, including Panels, Floats, and Level Transmitters along with their respective associated wiring and I/O's will be developed in the Detail Design phase.

All instruments with analog signals will be based on a 4-20 mA signal. Valves that require I/O signals will have a fully opened and fully closed signal. These details will be developed during the detail design phase and presented on a P&ID drawing as well as an I/O list.

MODBUS communication will be provided for the Flowmeters, Generator and Power Monitor Meter. 20% spare I/O will be provided for each signal type (DI, DO, AI, AO).

## **11.2 COMMUNICATIONS**

Communications details to be reviewed with Halifax Water and will be detailed during Detailed Design.

# **12 INSTRUMENTATION AND CONTROL**

## **12.1 INSTRUMETATION EQUIPMENT UPGRADES**

Halifax Water requested the following instrumentation equipment to be replaced / installed at Bisset WWPS:

- Replace PLC and Control Panels
- Replace existing level measurement device in the wet well
- Provide new magnetic flowmeter in the dry well

#### **12.2 PROCESS NARRATIVE**

In AUTO mode each of the three (3) pumps are controlled based on analog feedback from the laser level transmitter installed in the Wet Well. The analog level data is sent from the Wet Well transmitter to the RPU via a hardwired 4-20 mA signal, which is scaled according to the Wet Well size (meters). Operations adjusts the operating setpoints for the well levels at the HMI control screen.

In the Backup Float mode, hardwired backup operation based on the Wet Well level switches will over-ride software control. Hardwired operation will control the pumps at fixed speed, starting at high level and stopping at low level, until manually reset by operations staff. This Backup Float control mode is intended to maintain station operations in the event of a PLC or level transmitter failure and is not intended for normal operation.

When operating in the AUTO mode, if the level in the Wet Well rises to the Duty 1 Start Level Setpoint, Duty Pump 1 is requested to start (at 60Hz speed with a built in ramp up time for the VFD of 30 seconds). Should the level in the Wet Well continue to rise to the Duty 2 Start Level Set Point (SP), the Duty 2 Pump is requested to start (at 60Hz speed with a built in ramp up time for the VFD of 30 seconds). The speed of the VFD is controlled by the level in the Wet Well. If the level rises or falls, the speed of the motor will increase or decrease proportionally until the Stop Set Point is reached. The speed of the two running duty pumps will now synchronize, varying between 60Hz and 40Hz. (Note the Stop Set Point is common for both duty pumps).

Regardless of how many duty pumps are running, if the level in the Wet Wells continues to subside and the Stop Set Point is reached, all pumps will stop simultaneously. As the level in the Wet Well recovers to the first pump setpoint, the Lead Pump (Duty Pump 1) will start and if necessary, the other duty pump will be staged in the sequence described above, as required.

It is to be noted here that only two pumps can run simultaneously due to limitations in the downstream infrastructure. A level measuring device installed in the transition chamber at the forcemain discharge point will shut off one of the two pumps that are running simultaneously at Bissett WWPS, if the level in transitions chamber reaches a certain high level. This functionality of downstream infrastructure is to be maintained when upgrading instrumentation and controls at Bissett WWPS.

# **13 APPROVALS**

# 13.1 NOVA SCOTIA ENVIRONMENT

Nova Scotia Environment (NSE) will be contacted to confirm minimum requirements are met and review status of the Municipal Waste Approval (Sewer).

#### **13.2 HALIFAX REGIONAL MUNICIPALITY - BUILDING PERMIT**

An application will be made to the Halifax Building Department during Detailed Design. The application will include Structural, Mechanical (HVAC), Plumbing and Backflow Prevention Device review services.

The duration of the permit process is typically 6 to 8 weeks. A pre-submission meeting will be held prior to submission.

# 13.3 NOVA SCOTIA POWER INCORPORATED (NSPI) APPROVALS

The existing NSP transformer service to the station is sufficient to run all the pumps (3 total), plus all other equipment without load shedding. Upgrades to the utility transformer is not anticipated, however the secondary feeder will likely need to be replaced, and temporary power may be required during construction. This will be coordinated with NSPI during Detailed Design.

# **14 COST ESTIMATES**

# 14.1 CONSTRUCTION COST ESTIMATE

The preliminary estimated cost for the upgrade and rehabilitation of the Bissett Lake Wastewater Pumping Station is provided in Appendix E.



# A 60 % DESIGN CALCULATIONS



|                                    |                                           | EQUATION                   | N USED                                                                                   |
|------------------------------------|-------------------------------------------|----------------------------|------------------------------------------------------------------------------------------|
|                                    |                                           |                            |                                                                                          |
| Total HL= <i>Static HL</i>         | L+ Major HL +Minor HL=Static Head+(L > 1) | $(10.7 \times (Q/C))^{10}$ | $1.85 \times D^{(-4.87)} + (K \times V^{2}/2g)$                                          |
| Where:                             |                                           |                            |                                                                                          |
|                                    | L = Length of Pipe                        | (m)                        |                                                                                          |
|                                    | Q = Flow Rate                             | (m3/s)                     |                                                                                          |
|                                    | C = Hazen Willams Coefficient             | -                          |                                                                                          |
|                                    | D = Pipe Diameter (Inside)                | mm                         |                                                                                          |
|                                    | K = Minor Headlosses Coefficient          | -                          |                                                                                          |
|                                    | V = Flow Velocity                         | m/s                        |                                                                                          |
|                                    |                                           | STATIC HE                  | ADLOSS                                                                                   |
|                                    |                                           | Sharle HE                  |                                                                                          |
| Dry Well Floor El.                 | 26.37 m                                   | >                          | Measure (Bluebeam) Per Dwg. Bissett Lake PS, Mechanical Elevations & Sections, Shee      |
| Wet Well Floor El.                 | 25.76 m                                   | >                          | Per Dwg. Bissett Lake PS, Mechanical Elevations & Sections, Sheet 6                      |
| Pump C/L EI.                       | 25.91 m                                   | >                          | Assume 500mm from suction to C/L per NT 3171 HT 3-454.                                   |
| Overflow Elevation                 | 33.53 m                                   | >                          | Fenco SEW-31-6-5 shows 82.60m for north sewer, but GHD PP1 shows lowest MH top as 79.35m |
| Inlet Pipe Elevation               | 29.63                                     | >                          | Measure (Bluebeam) Per Dwg. Bissett Lake PS, Mechanical Elevations & Sections, Shee      |
| Suction Pipe (400mm dia.) Inv. El. | 25.94 m                                   | >                          | Per Dwg. Bissett Lake PS, Mechanical Elevations & Sections, Sheet 6 (Measured)           |
| Forcemain Discharge Highest El.    | 46.94 m                                   | >                          | Per Dwg Phase 2 Bisset Lake P.S Forcemain, Project No, 2137, Sheet # 2                   |
| Wet Well Liquid Level (HWL)        | 28.65 m                                   | >                          | Per Dwg. Bissett Lake PS, Mechanical Elevations & Sections, Sheet 6                      |
| Wet Well Liquid Level (LWL)        | 27.13 m                                   | >                          | Per Dwg. Bissett Lake PS, Mechanical Elevations & Sections, Sheet 6                      |
| Suction Lift (HWL):                | 2.74 m                                    |                            |                                                                                          |
| Suction Lift (LWL):                | 1.22 m                                    |                            |                                                                                          |
| Discharge Lift (HWL):              | 21.03 m                                   |                            |                                                                                          |
| Discharge Lift (LWL):              | 21.03 m                                   |                            |                                                                                          |
| Total Static Head (HWL):           | 18.29 m                                   |                            |                                                                                          |
| Total Static Head (MWL):           | 19.05 m                                   |                            |                                                                                          |
| Total Static Head (LWL):           | 19.81 m                                   |                            |                                                                                          |
| 1                                  |                                           |                            |                                                                                          |
|                                    |                                           |                            |                                                                                          |
|                                    |                                           |                            |                                                                                          |
|                                    |                                           |                            |                                                                                          |
|                                    |                                           |                            |                                                                                          |
|                                    |                                           |                            |                                                                                          |
|                                    |                                           |                            |                                                                                          |



| Station Interior                                  |           |                | MAJO   | DR & MINOR HEADLOSS |          |      |        |
|---------------------------------------------------|-----------|----------------|--------|---------------------|----------|------|--------|
| Station Interior                                  | 100       |                |        |                     |          |      |        |
| C - Hazen Williams Coefficient                    | 100       | N I <i>I</i> . |        | 0.444               |          |      |        |
| Q - Flow Rate (1 Duty Pump)                       | 444.00    | ) L/s          | >      | 0.444 m3/s          |          |      |        |
| Q - Flow Rate (2 Duty Pumps)                      | 444.00    | ) L/s          | >      | 0.444 m3/s          |          |      |        |
|                                                   |           |                |        |                     |          |      |        |
|                                                   | PIPE DIA. | VELOCITY       | LENGTH |                     | Quantity | k    | f      |
| SECTION                                           | (mm)      | (m/s)          | (m)    |                     |          |      |        |
| 1. Pump Suction Pipe (600mm)                      | 597       | 1.59           |        |                     |          |      |        |
| Pipe Entrance (Bellmouth) (SS)                    |           |                | 1.4    |                     | 1        | 0.04 | 0.0170 |
| Straight Pipe (600mm dia) (SS)                    | 597       | 1.59           | 6.00   |                     |          |      |        |
| 90 Deg. Bend (600mm dia) (SS)                     |           |                | 9.1    |                     | 1        | 0.26 | 0.0170 |
| Gate Valve, Resilient Seat (600mm dia)            |           |                | 3.5    |                     | 1        | 0.10 | 0.0170 |
| Reducer, Ecentric (600mm x 400mm dia) (SS)        |           |                | 1.1    |                     | 1        | 0.03 | 0.0170 |
| 2. Pump Discharge (Horizontal) (400mm dia)        | 397       | 3.59           |        |                     |          |      |        |
| 45 Deg.Bend (400mm dia) (SS)                      |           |                | 4.9    |                     | 1        | 0.21 | 0.0170 |
| 3. Pump Discharge (Vertical) (400mm dia)          | 397       | 3.59           |        |                     |          |      |        |
| 90 Deg. Increaser Bend (400mmX500mm dia) SS       |           |                | 6.1    |                     | 1        | 0.26 | 0.0170 |
| 90 Deg. Bend (500mm dia)                          |           |                | 6.1    |                     | 1        | 0.26 | 0.0170 |
| 4. Pump Discharge (Horizontal) (500dia)           | 497       | 2.29           |        |                     |          |      |        |
| Check Valve (500mm dia)                           |           |                | 38.0   |                     | 1        | 1.30 | 0.0170 |
| Gate Valve (500mm dia)                            |           |                | 2.9    |                     | 1        | 0.10 | 0.0170 |
| 90 Deg. Bend (500mm dia)                          |           |                | 7.6    |                     | 1        | 0.26 | 0.0170 |
| 5. Pump Discharge (Vertical) (500dia)             | 497       | 2.29           |        |                     |          |      |        |
| 90 Deg. Bend (500mm dia)                          |           |                | 7.6    |                     | 1        | 0.26 | 0.0170 |
| 6. Pump Discharge Header (Horizontal) (500mm dia) | 497       | 2.29           |        |                     |          |      |        |
| Straight Pipe (500mm dia) (SS)                    | 497       | 2.29           | 18.9   |                     |          |      |        |
| Decreaser (500mmx400mm)                           |           |                | 0.9    |                     | 1        | 0.03 | 0.0170 |
| Magnetic Flowmeter (400mm)                        | 400       | 3.53           | 5.9    |                     | 1        | 0.25 | 0.0170 |
| Increaser (400mmx500mm)                           |           |                | 0.9    |                     | 1        | 0.03 | 0.0170 |
| 90 Deg. Bend                                      |           |                | 7.6    |                     | 1        | 0.26 | 0.0170 |
| 7. Pump Discharge Header (Horizontal) (500mm dia) | 497       | 2.29           |        |                     |          |      |        |
| Straight Pipe (500mm dia) (SS)                    | 497       | 2.29           | 7.7    |                     |          |      |        |
| Gate Valve (500mm Dia)                            |           |                | 2.9    |                     | 1        | 0.10 | 0.0170 |
| Station Exterior                                  | 100       |                |        |                     |          |      |        |
|                                                   | 120       |                |        |                     |          |      |        |
| Q - Flow Rate                                     | 444.00    | ) L/s          | >      | 0.444 m3/s          |          |      |        |
|                                                   |           |                |        |                     |          |      |        |
| SECTION                                           | (mm)      | (m/c)          | (m)    |                     | Quantity | k    | f      |
| 8 Eorcemain (500mm dia DI Class 52)               | 527       | 2 02           | ()     |                     |          |      |        |
| Straight Dine (500mm dia) (DI)                    | 527       | 2.03           | 30 E   |                     |          |      |        |
| Straight Fipe (500mm dia) (DI)                    | 527       | 2.03           | 28.2   |                     |          |      |        |
| 30 Deg. Rend (500mm)                              | 521       | 2.05           | 20.5   |                     | 1        | 0.10 | 0.0150 |
| So Deg. Benu (Soomin)                             |           |                | 3.5    |                     | T        | 0.10 | 0.0130 |

wsp

| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 64.0  |   |      |        |
|-----------------------------------------|-----|------|-------|---|------|--------|
| 30 Deg. Bend (500mm)                    |     |      | 3.5   | 1 | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 19.2  |   |      |        |
| 45 Deg. Bend (500mm)                    |     |      | 7.4   | 1 | 0.21 | 0.0150 |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 17.4  |   |      |        |
| 45 Deg. Bend (500mm)                    |     |      | 7.4   | 1 | 0.21 | 0.0150 |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 34.1  |   |      |        |
| 30 Deg. Bend (500mm)                    |     |      | 3.5   | 1 | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 77.1  |   |      |        |
| 30 Deg. Bend (500mm)                    |     |      | 3.5   | 1 | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 7.3   |   |      |        |
| 45 Deg. Bend (500mm)                    |     |      | 7.4   | 1 | 0.21 | 0.0150 |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 19.8  |   |      |        |
| 45 Deg. Bend (500mm)                    |     |      | 7.4   | 1 | 0.21 | 0.0150 |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 25.9  |   |      |        |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 36.6  |   |      |        |
| 30 Deg. Bend (500mm)                    |     |      | 3.5   | 1 | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 114.0 |   |      |        |
| 30 Deg. Bend (500mm)                    |     |      | 3.5   | 1 | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 117.3 |   |      |        |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 110.0 |   |      |        |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 48.8  |   |      |        |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 46.3  |   |      |        |
| 30 Deg. Bend (500mm)                    |     |      | 3.5   | 1 | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 11.9  |   |      |        |
| 30 Deg. Bend (500mm)                    |     |      | 3.5   | 1 | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 21.9  |   |      |        |
| 30 Deg. Bend (500mm)                    |     |      | 3.5   | 1 | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 102.1 |   |      |        |
| 30 Deg. Bend (500mm)                    |     |      | 3.5   | 1 | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 13.4  |   |      |        |
| 30 Deg. Bend (500mm)                    |     |      | 3.5   | 1 | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 15.8  |   |      |        |
| 30 Deg. Bend (500mm)                    |     |      | 3.5   | 1 | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 18.6  |   |      |        |
| 30 Deg. Bend (500mm)                    |     |      | 3.5   | 1 | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 18.0  |   |      |        |
| 30 Deg. Bend (500mm)                    |     |      | 3.5   | 1 | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 20.7  |   |      |        |
| 45 Deg. Bend (500mm)                    |     |      | 7.4   | 1 | 0.21 | 0.0150 |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 21.3  |   |      |        |
| 45 Deg. Bend (500mm)                    |     |      | 7.4   | 1 | 0.21 | 0.0150 |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 10.7  | - |      |        |
| 45 Deg. Bend (500mm)                    | -   |      | 7.4   | 1 | 0.21 | 0.0150 |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 34.4  | - |      |        |
| Straight Pipe (500mm dia) (DI)          | 527 | 2.03 | 31.1  |   |      |        |
| 5 · · · · · · · · · · · · · · · · · · · |     |      |       |   |      |        |

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| 45 Deg. Bend (500mm)           |     |      | 7.4   | 1 | L | 0.21 | 0.0150 |
|--------------------------------|-----|------|-------|---|---|------|--------|
| Straight Pipe (500mm dia) (DI) | 527 | 2.03 | 17.7  |   |   |      |        |
| 30 Deg. Bend (500mm)           |     |      | 3.5   | 1 | L | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI) | 527 | 2.03 | 36.9  |   |   |      |        |
| 30 Deg. Bend (500mm)           |     |      | 3.5   | 1 | L | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI) | 527 | 2.03 | 50.9  |   |   |      |        |
| 30 Deg. Bend (500mm)           |     |      | 3.5   | 1 | L | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI) | 527 | 2.03 | 36.9  |   |   |      |        |
| 30 Deg. Bend (500mm)           |     |      | 3.5   | 1 | L | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI) | 527 | 2.03 | 13.7  |   |   |      |        |
| 30 Deg. Bend (500mm)           |     |      | 3.5   | 1 | L | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI) | 527 | 2.03 | 14.0  |   |   |      |        |
| 45 Deg. Bend (500mm)           |     |      | 7.4   | 1 | L | 0.21 | 0.0150 |
| Straight Pipe (500mm dia) (DI) | 527 | 2.03 | 7.0   |   |   |      |        |
| 45 Deg. Bend (500mm)           |     |      | 7.4   | 1 | L | 0.21 | 0.0150 |
| Straight Pipe (500mm dia) (DI) | 527 | 2.03 | 26.5  |   |   |      |        |
| 45 Deg. Bend (500mm)           |     |      | 7.4   | 1 | L | 0.21 | 0.0150 |
| Straight Pipe (500mm dia) (DI) | 527 | 2.03 | 68.3  |   |   |      |        |
| 30 Deg. Bend (500mm)           |     |      | 3.5   | 1 | L | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI) | 527 | 2.03 | 57.9  |   |   |      |        |
| 30 Deg. Bend (500mm)           |     |      | 3.5   | 1 | L | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI) | 527 | 2.03 | 220.4 |   |   |      |        |
| 45 Deg. Bend (500mm)           |     |      | 7.4   | 1 | L | 0.21 | 0.0150 |
| Straight Pipe (500mm dia) (DI) | 527 | 2.03 | 127.7 |   |   |      |        |
| Straight Pipe (500mm dia) (DI) | 527 | 2.03 | 17.4  |   |   |      |        |
| Straight Pipe (500mm dia) (DI) | 527 | 2.03 | 34.1  |   |   |      |        |
| 30 Deg. Bend (500mm)           |     |      | 3.5   | 1 | L | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI) | 527 | 2.03 | 35.4  |   |   |      |        |
| 30 Deg. Bend (500mm)           |     |      | 3.5   | 1 | L | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI) | 527 | 2.03 | 99.1  |   |   |      |        |
| 30 Deg. Bend (500mm)           |     |      | 3.5   | 1 | L | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI) | 527 | 2.03 | 33.5  |   |   |      |        |
| 30 Deg. Bend (500mm)           |     |      | 3.5   | 1 | L | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI) | 527 | 2.03 | 29.3  |   |   |      |        |
| 45 Deg. Bend (500mm)           |     |      | 7.4   | 1 | L | 0.21 | 0.0150 |
| Straight Pipe (500mm dia) (DI) | 527 | 2.03 | 47.2  |   |   |      |        |
| 45 Deg. Bend (500mm)           |     |      | 7.4   | 1 | L | 0.21 | 0.0150 |
| Straight Pipe (500mm dia) (DI) | 527 | 2.03 | 18.9  |   |   |      |        |
| 30 Deg. Bend (500mm)           |     |      | 3.5   | 1 | L | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI) | 527 | 2.03 | 53.0  |   |   |      |        |
| 30 Deg. Bend (500mm)           |     |      | 3.5   | 1 | L | 0.10 | 0.0150 |
| Straight Pipe (500mm dia) (DI) | 527 | 2.03 | 240.8 |   |   |      |        |
| Straight Pipe (500mm dia) (DI) | 527 | 2.03 | 117.0 |   |   |      |        |
| 30 Deg. Bend (500mm)           |     |      | 3.5   | 1 | L | 0.10 | 0.0150 |
|                                |     |      |       |   |   |      |        |

| Force          | emain C Value                   | 120                                              | (LVVL)                                         | 10%                                           | 5.F.                                     |                                                         |                                                         |                                            |                          |
|----------------|---------------------------------|--------------------------------------------------|------------------------------------------------|-----------------------------------------------|------------------------------------------|---------------------------------------------------------|---------------------------------------------------------|--------------------------------------------|--------------------------|
| 1 Duty<br>Pump | 1. Pump Suction<br>Pipe (600mm) | 2. Pump Discharge<br>(Horizontal)<br>(400mm dia) | 3. Pump Discharge<br>(Vertical) (400mm<br>dia) | 4. Pump Discharge<br>(Horizontal)<br>(500dia) | 5. Pump Discharge<br>(Vertical) (500dia) | 6. Pump Discharge<br>Header (Horizontal)<br>(500mm dia) | 7. Pump Discharge<br>Header (Horizontal)<br>(500mm dia) | 8. Forcemain<br>(500mm dia DI<br>Class 52) | TOTAL<br>DYNAMIC<br>HEAD |
|                | 21.10                           | 4.90                                             | 12.14                                          | 48.52                                         | 7.60                                     | 34.14                                                   | 10.62                                                   | 2722.17                                    |                          |
| 0              | 0.00                            | 0.00                                             | 0.00                                           | 0.00                                          | 0.00                                     | 0.00                                                    | 0.00                                                    | 0.00                                       | 21.79                    |
| 22.20          | 0.00                            | 0.00                                             | 0.00                                           | 0.00                                          | 0.00                                     | 0.00                                                    | 0.00                                                    | 0.08                                       | 21.89                    |
| 44.40          | 0.00                            | 0.00                                             | 0.01                                           | 0.01                                          | 0.00                                     | 0.01                                                    | 0.00                                                    | 0.29                                       | 22.15                    |
| 66.60          | 0.00                            | 0.01                                             | 0.02                                           | 0.02                                          | 0.00                                     | 0.01                                                    | 0.00                                                    | 0.62                                       | 22.55                    |
| 88.80          | 0.01                            | 0.01                                             | 0.03                                           | 0.04                                          | 0.01                                     | 0.02                                                    | 0.01                                                    | 1.06                                       | 23.09                    |
| 111.00         | 0.01                            | 0.02                                             | 0.04                                           | 0.05                                          | 0.01                                     | 0.04                                                    | 0.01                                                    | 1.60                                       | 23.75                    |
| 133.20         | 0.01                            | 0.02                                             | 0.06                                           | 0.07                                          | 0.01                                     | 0.05                                                    | 0.02                                                    | 2.24                                       | 24.53                    |
| 155.40         | 0.02                            | 0.03                                             | 0.07                                           | 0.10                                          | 0.02                                     | 0.07                                                    | 0.02                                                    | 2.98                                       | 25.43                    |
| 177.60         | 0.02                            | 0.04                                             | 0.10                                           | 0.13                                          | 0.02                                     | 0.09                                                    | 0.03                                                    | 3.82                                       | 26.45                    |
| 199.80         | 0.03                            | 0.05                                             | 0.12                                           | 0.16                                          | 0.02                                     | 0.11                                                    | 0.03                                                    | 4.75                                       | 27.59                    |
| 222.00         | 0.03                            | 0.06                                             | 0.14                                           | 0.19                                          | 0.03                                     | 0.14                                                    | 0.04                                                    | 5.77                                       | 28.84                    |
| 244.20         | 0.04                            | 0.07                                             | 0.17                                           | 0.23                                          | 0.04                                     | 0.16                                                    | 0.05                                                    | 6.88                                       | 30.19                    |
| 266.40         | 0.05                            | 0.08                                             | 0.20                                           | 0.27                                          | 0.04                                     | 0.19                                                    | 0.06                                                    | 8.08                                       | 31.66                    |
| 288.60         | 0.06                            | 0.09                                             | 0.23                                           | 0.31                                          | 0.05                                     | 0.22                                                    | 0.07                                                    | 9.37                                       | 33.24                    |
| 310.80         | 0.06                            | 0.11                                             | 0.27                                           | 0.36                                          | 0.06                                     | 0.25                                                    | 0.08                                                    | 10.75                                      | 34.92                    |
| 333.00         | 0.07                            | 0.12                                             | 0.30                                           | 0.41                                          | 0.06                                     | 0.29                                                    | 0.09                                                    | 12.21                                      | 36.70                    |
| 355.20         | 0.08                            | 0.14                                             | 0.34                                           | 0.46                                          | 0.07                                     | 0.32                                                    | 0.10                                                    | 13.76                                      | 38.60                    |
| 377.40         | 0.09                            | 0.16                                             | 0.38                                           | 0.51                                          | 0.08                                     | 0.36                                                    | 0.11                                                    | 15.39                                      | 40.59                    |
| 399.60         | 0.10                            | 0.17                                             | 0.43                                           | 0.57                                          | 0.09                                     | 0.40                                                    | 0.12                                                    | 17.11                                      | 42.69                    |
| 421.80         | 0.11                            | 0.19                                             | 0.47                                           | 0.63                                          | 0.10                                     | 0.44                                                    | 0.14                                                    | 18.91                                      | 44.88                    |
| 444.00         | 0.12                            | 0.21                                             | 0.52                                           | 0.69                                          | 0.11                                     | 0.49                                                    | 0.15                                                    | 20.79                                      | 47.18                    |
| 466.20         | 0.14                            | 0.23                                             | 0.57                                           | 0.76                                          | 0.12                                     | 0.53                                                    | 0.17                                                    | 22.75                                      | 49.58                    |
| 488.40         | 0.15                            | 0.25                                             | 0.62                                           | 0.83                                          | 0.13                                     | 0.58                                                    | 0.18                                                    | 24.80                                      | 52.08                    |
| 510.60         | 0.16                            | 0.27                                             | 0.67                                           | 0.90                                          | 0.14                                     | 0.63                                                    | 0.20                                                    | 26.92                                      | 54.67                    |
| 532.80         | 0.17                            | 0.29                                             | 0.73                                           | 0.97                                          | 0.15                                     | 0.68                                                    | 0.21                                                    | 29.13                                      | 57.37                    |
| 555.00         | 0.19                            | 0.32                                             | 0.78                                           | 1.05                                          | 0.16                                     | 0.74                                                    | 0.23                                                    | 31.41                                      | 60.16                    |
| 577.20         | 0.20                            | 0.34                                             | 0.84                                           | 1.13                                          | 0.18                                     | 0.79                                                    | 0.25                                                    | 33.78                                      | 63.05                    |
| 599.40         | 0.22                            | 0.36                                             | 0.90                                           | 1.21                                          | 0.19                                     | 0.85                                                    | 0.26                                                    | 36.22                                      | 66.03                    |
| 621.60         | 0.23                            | 0.39                                             | 0.97                                           | 1.29                                          | 0.20                                     | 0.91                                                    | 0.28                                                    | 38.74                                      | 69.11                    |
| 643.80         | 0.25                            | 0.42                                             | 1.03                                           | 1.38                                          | 0.22                                     | 0.97                                                    | 0.30                                                    | 41.34                                      | 72.28                    |
| 666.00         | 0.26                            | 0.44                                             | 1.10                                           | 1.47                                          | 0.23                                     | 1.03                                                    | 0.32                                                    | 44.01                                      | 75.55                    |
| 688.20         | 0.28                            | 0.47                                             | 1.17                                           | 1.56                                          | 0.24                                     | 1.10                                                    | 0.34                                                    | 46.77                                      | 78.91                    |
| 710.40         | 0.29                            | 0.50                                             | 1.24                                           | 1.65                                          | 0.26                                     | 1.16                                                    | 0.36                                                    | 49.60                                      | 82.37                    |
| 732.60         | 0.31                            | 0.53                                             | 1.31                                           | 1.75                                          | 0.27                                     | 1.23                                                    | 0.38                                                    | 52.50                                      | 85.91                    |
| 754.80         | 0.33                            | 0.56                                             | 1.38                                           | 1.85                                          | 0.29                                     | 1.30                                                    | 0.41                                                    | 55.48                                      | 89.56                    |
| 777.00         | 0.35                            | 0.59                                             | 1.46                                           | 1.95                                          | 0.31                                     | 1.37                                                    | 0.43                                                    | 58.54                                      | 93.29                    |

| Force          | emain C Value                   | 120                                              | (HWL)                                          | 0%                                            | S.F.                                     |                                                         |                                                         |                                            |                          |
|----------------|---------------------------------|--------------------------------------------------|------------------------------------------------|-----------------------------------------------|------------------------------------------|---------------------------------------------------------|---------------------------------------------------------|--------------------------------------------|--------------------------|
| 1 Duty<br>Pump | 1. Pump Suction<br>Pipe (400mm) | 2. Pump Discharge<br>(Horizontal)<br>(250mm dia) | 3. Pump Discharge<br>(Vertical) (300mm<br>dia) | 4. Pump Discharge<br>(Horizontal)<br>(300dia) | 5. Pump Discharge<br>(Vertical) (300dia) | 6. Pump Discharge<br>Header (Horizontal)<br>(450mm dia) | 7. Pump Discharge<br>Header (Horizontal)<br>(450mm dia) | 8. Forcemain<br>(500mm dia DI<br>Class 52) | TOTAL<br>DYNAMIC<br>HEAD |
|                | 21.10                           | 4.90                                             | 12.14                                          | 48.52                                         | 7.60                                     | 34.14                                                   | 10.62                                                   | 2722.17                                    |                          |
| 0              | 0.00                            | 0.00                                             | 0.00                                           | 0.00                                          | 0.00                                     | 0.00                                                    | 0.00                                                    | 0.00                                       | 19.81                    |
| 22.20          | 0.00                            | 0.00                                             | 0.00                                           | 0.00                                          | 0.00                                     | 0.00                                                    | 0.00                                                    | 0.08                                       | 19.90                    |
| 44.40          | 0.00                            | 0.00                                             | 0.01                                           | 0.01                                          | 0.00                                     | 0.01                                                    | 0.00                                                    | 0.29                                       | 20.14                    |
| 66.60          | 0.00                            | 0.01                                             | 0.02                                           | 0.02                                          | 0.00                                     | 0.01                                                    | 0.00                                                    | 0.62                                       | 20.50                    |
| 88.80          | 0.01                            | 0.01                                             | 0.03                                           | 0.04                                          | 0.01                                     | 0.02                                                    | 0.01                                                    | 1.06                                       | 20.99                    |
| 111.00         | 0.01                            | 0.02                                             | 0.04                                           | 0.05                                          | 0.01                                     | 0.04                                                    | 0.01                                                    | 1.60                                       | 21.59                    |
| 133.20         | 0.01                            | 0.02                                             | 0.06                                           | 0.07                                          | 0.01                                     | 0.05                                                    | 0.02                                                    | 2.24                                       | 22.30                    |
| 155.40         | 0.02                            | 0.03                                             | 0.07                                           | 0.10                                          | 0.02                                     | 0.07                                                    | 0.02                                                    | 2.98                                       | 23.12                    |
| 177.60         | 0.02                            | 0.04                                             | 0.10                                           | 0.13                                          | 0.02                                     | 0.09                                                    | 0.03                                                    | 3.82                                       | 24.05                    |
| 199.80         | 0.03                            | 0.05                                             | 0.12                                           | 0.16                                          | 0.02                                     | 0.11                                                    | 0.03                                                    | 4.75                                       | 25.08                    |
| 222.00         | 0.03                            | 0.06                                             | 0.14                                           | 0.19                                          | 0.03                                     | 0.14                                                    | 0.04                                                    | 5.77                                       | 26.21                    |
| 244.20         | 0.04                            | 0.07                                             | 0.17                                           | 0.23                                          | 0.04                                     | 0.16                                                    | 0.05                                                    | 6.88                                       | 27.45                    |
| 266.40         | 0.05                            | 0.08                                             | 0.20                                           | 0.27                                          | 0.04                                     | 0.19                                                    | 0.06                                                    | 8.08                                       | 28.78                    |
| 288.60         | 0.06                            | 0.09                                             | 0.23                                           | 0.31                                          | 0.05                                     | 0.22                                                    | 0.07                                                    | 9.37                                       | 30.21                    |
| 310.80         | 0.06                            | 0.11                                             | 0.27                                           | 0.36                                          | 0.06                                     | 0.25                                                    | 0.08                                                    | 10.75                                      | 31.74                    |
| 333.00         | 0.07                            | 0.12                                             | 0.30                                           | 0.41                                          | 0.06                                     | 0.29                                                    | 0.09                                                    | 12.21                                      | 33.37                    |
| 355.20         | 0.08                            | 0.14                                             | 0.34                                           | 0.46                                          | 0.07                                     | 0.32                                                    | 0.10                                                    | 13.76                                      | 35.09                    |
| 377.40         | 0.09                            | 0.16                                             | 0.38                                           | 0.51                                          | 0.08                                     | 0.36                                                    | 0.11                                                    | 15.39                                      | 36.90                    |
| 399.60         | 0.10                            | 0.17                                             | 0.43                                           | 0.57                                          | 0.09                                     | 0.40                                                    | 0.12                                                    | 17.11                                      | 38.81                    |
| 421.80         | 0.11                            | 0.19                                             | 0.47                                           | 0.63                                          | 0.10                                     | 0.44                                                    | 0.14                                                    | 18.91                                      | 40.80                    |
| 444.00         | 0.12                            | 0.21                                             | 0.52                                           | 0.69                                          | 0.11                                     | 0.49                                                    | 0.15                                                    | 20.79                                      | 42.89                    |
| 466.20         | 0.14                            | 0.23                                             | 0.57                                           | 0.76                                          | 0.12                                     | 0.53                                                    | 0.17                                                    | 22.75                                      | 45.07                    |
| 488.40         | 0.15                            | 0.25                                             | 0.62                                           | 0.83                                          | 0.13                                     | 0.58                                                    | 0.18                                                    | 24.80                                      | 47.34                    |
| 510.60         | 0.16                            | 0.27                                             | 0.67                                           | 0.90                                          | 0.14                                     | 0.63                                                    | 0.20                                                    | 26.92                                      | 49.70                    |
| 532.80         | 0.17                            | 0.29                                             | 0.73                                           | 0.97                                          | 0.15                                     | 0.68                                                    | 0.21                                                    | 29.13                                      | 52.15                    |
| 555.00         | 0.19                            | 0.32                                             | 0.78                                           | 1.05                                          | 0.16                                     | 0.74                                                    | 0.23                                                    | 31.41                                      | 54.69                    |
| 577.20         | 0.20                            | 0.34                                             | 0.84                                           | 1.13                                          | 0.18                                     | 0.79                                                    | 0.25                                                    | 33.78                                      | 57.31                    |
| 599.40         | 0.22                            | 0.36                                             | 0.90                                           | 1.21                                          | 0.19                                     | 0.85                                                    | 0.26                                                    | 36.22                                      | 60.03                    |
| 621.60         | 0.23                            | 0.39                                             | 0.97                                           | 1.29                                          | 0.20                                     | 0.91                                                    | 0.28                                                    | 38.74                                      | 62.83                    |
| 643.80         | 0.25                            | 0.42                                             | 1.03                                           | 1.38                                          | 0.22                                     | 0.97                                                    | 0.30                                                    | 41.34                                      | 65.71                    |
| 666.00         | 0.26                            | 0.44                                             | 1.10                                           | 1.47                                          | 0.23                                     | 1.03                                                    | 0.32                                                    | 44.01                                      | 68.68                    |
| 688.20         | 0.28                            | 0.47                                             | 1.17                                           | 1.56                                          | 0.24                                     | 1.10                                                    | 0.34                                                    | 46.77                                      | 71.74                    |
| 710.40         | 0.29                            | 0.50                                             | 1.24                                           | 1.65                                          | 0.26                                     | 1.16                                                    | 0.36                                                    | 49.60                                      | 74.88                    |
| 732.60         | 0.31                            | 0.53                                             | 1.31                                           | 1.75                                          | 0.27                                     | 1.23                                                    | 0.38                                                    | 52.50                                      | 78.10                    |
| 754.80         | 0.33                            | 0.56                                             | 1.38                                           | 1.85                                          | 0.29                                     | 1.30                                                    | 0.41                                                    | 55.48                                      | 81.41                    |
| 777.00         | 0.35                            | 0.59                                             | 1.46                                           | 1.95                                          | 0.31                                     | 1.37                                                    | 0.43                                                    | 58.54                                      | 84.81                    |







# B EQUIPMENT DATA SHEETS

#### NT 3312/765 3~ 670

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Possible to be upgraded with Guide-pin® for even better clogging resistance. Modular based design with high adaptation grade.



#### Technical specification



#### Curves according to: Water, pure ,4 °C,62.42 lb/ft<sup>3</sup>,1.6891E-5 ft<sup>2</sup>/s



#### Configuration

**Motor number** N0765.000 43-56-6BC-D 280hp **Impeller diameter** 485 mm Installation type T - Vertical Permanent, Dry

Discharge diameter 300 mm

#### **Pump information**

Impeller diameter 485 mm

Discharge diameter 300 mm

Inlet diameter 350 mm

Maximum operating speed 1190 rpm

Number of blades 3

Max. fluid temperature

40 °C

| Project | Created by |           | Last update | 1/29/2021 |
|---------|------------|-----------|-------------|-----------|
| Block   | Created on | 1/29/2021 |             |           |
|         |            |           |             |           |

Materials

Grey cast iron

Impeller

# NT 3312/765 3~ 670

#### Technical specification

#### Motor - General

| Motor number                   | Phases                      | Rated speed                       | <b>Rated power</b><br>280 hp<br><b>Stator variant</b><br>5 |  |  |
|--------------------------------|-----------------------------|-----------------------------------|------------------------------------------------------------|--|--|
| N0765.000 43-56-6BC-D<br>280hp | 3~                          | 1190 rpm                          |                                                            |  |  |
| ATEX approved                  | Number of poles             | Rated current                     |                                                            |  |  |
| No                             | 6                           | 266 A                             |                                                            |  |  |
| Frequency                      | Rated voltage               | Insulation class                  | Type of Duty                                               |  |  |
| 60 Hz                          | 575 V                       | Н                                 |                                                            |  |  |
| Version code                   |                             |                                   |                                                            |  |  |
| 000                            |                             |                                   |                                                            |  |  |
| Motor - Technical              |                             |                                   |                                                            |  |  |
| Power factor - 1/1 Load        | Motor efficiency - 1/1 Load | Total moment of inertia           | Starts per hour max.                                       |  |  |
| 0.84                           | 93.5 %                      | 111 lb ft <sup>2</sup> 0          |                                                            |  |  |
| Power factor - 3/4 Load        | Motor efficiency - 3/4 Load | Starting current, direct starting |                                                            |  |  |
| 0.80                           | 94.0 %                      | 1560 A                            |                                                            |  |  |
| Power factor - 1/2 Load        | Motor efficiency - 1/2 Load | Starting current, star-delta      |                                                            |  |  |
| 0.71                           | 93.5 %                      | 519 A                             |                                                            |  |  |

FLYGT

a **xylem** brand

| Project | Created by |           | Last update | 1/29/2021 |
|---------|------------|-----------|-------------|-----------|
| Block   | Created on | 1/29/2021 |             |           |
|         |            |           |             |           |



#### NT 3312/765 3~ 670 Duty Analysis



a **xylem** brand



#### NT 3312/765 3~ 670



Duty Analysis


VFD Curve



a **xylem** brand





VFD Analysis





VFD Analysis



#### Dimensional drawing





#### **Data sheet**

Customer item no.:Bisset Lake Communication dated: 22/01/2021 Doc. no.: Bisset Lake and Autoport WWPS Quantity: 1

#### KRTK 250-403/1554XNG-D

#### **Operating data**



## Insulation class Type of protection Motor enclosure Cos phi at 4/4 load Motor efficiency at 4/4 load Motor service factor

H according IEC 34-1 XP/I/1/CD IP68 0.91 93.5 %

1.15

Control cable Number of control cables Moisture sensor

Cable length

AWG 15-10 With 10.00 m



Number: ES 8000919539 Item no.: 300 Date: 22/01/2021 Page: 1 / 6

Version no.: 1

#### Data sheet

Quantity: 1



Number: ES 8000919539 Item no.: 300 Date: 22/01/2021 Page: 2 / 6

Version no.: 1

## KRTK 250-403/1554XNG-D

Customer item no.:Bisset Lake

Communication dated: 22/01/2021

Doc. no.: Bisset Lake and Autoport WWPS

| Materials G                                                                                          |                                                                                                                          |                                                                                                                                                                                    |                                                                                                       |
|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Pump casing (101)<br>Discharge cover (163)<br>Shaft (210)                                            | Cast iron A 48 Class 35 B<br>Cast iron A 48 Class 35 B<br>Chrome steel ASTM A276                                         | Impeller wear ring (503)<br>Shaft protecting sleeve (524)                                                                                                                          | Wear resistant duplex<br>stainless steel<br>Chrome steel A 276 Type 420<br>Stainless steel A 276 Type |
| Impeller (230)<br>Bearing bracket (330)<br>O-Ring (412)<br>Casing wear ring (502.1)                  | Cast iron A 48 Class 35 B<br>Cast iron A 48 Class 35 B<br>Nitrile rubber NBR<br>Wear resistant duplex<br>stainless steel | Motor housing (811)<br>Motor cable (824)<br>Screw (900)                                                                                                                            | 316 Ti<br>Cast iron A 48 Class 35 B<br>Chloroprene rubber<br>Stainless steel A 193 B8M                |
| Packaging                                                                                            |                                                                                                                          |                                                                                                                                                                                    |                                                                                                       |
| Packaging category                                                                                   | B1 Wooden or plywood<br>case, cover provided with<br>polyproylene cellular sheet,<br>outdoor storage up to 3<br>months   | olywoodPackaging for storageIndoorded withOutdoor storage at -40°C to +50°C for up to 3 months.ular sheet,must be covered. No corrosion protection, only transpoup to 3protection. |                                                                                                       |
| Packaging for transport<br>IPPC Standard ISPM 15                                                     | Ship<br>Yes                                                                                                              |                                                                                                                                                                                    |                                                                                                       |
| Nameplates                                                                                           |                                                                                                                          |                                                                                                                                                                                    |                                                                                                       |
| Nameplates language                                                                                  | International                                                                                                            | Duplicate nameplate                                                                                                                                                                | With                                                                                                  |
| Certifications                                                                                       |                                                                                                                          |                                                                                                                                                                                    |                                                                                                       |
| <b>Hydraulic performance test</b><br>Acceptance standard<br>Quantity meas. points Q-H<br>Certificate | ISO 9906 & ANSI HI Class 1U<br>5<br>Inspection cert. 3.1 to EN<br>10204                                                  | Test participation<br>Quantity, non-witnessed<br>Quantity, witnessed                                                                                                               | Non-witnessed<br>1<br>0                                                                               |
| Installation parts                                                                                   |                                                                                                                          |                                                                                                                                                                                    |                                                                                                       |
| Installation type<br>Scope of supply<br>Installation variant<br>Material concept                     | Dry installation<br>Pump with installation parts<br>Dry<br>G                                                             | Foundation rails<br>Inlet elbow size / DN0<br>Lifting Bail                                                                                                                         | Yes<br>DN 250 / 350<br>With                                                                           |



Customer item no.:Bisset Lake Communication dated: 22/01/2021 Doc. no.: Bisset Lake and Autoport WWPS Quantity: 1

Number: ES 8000919539 Item no.:300 Date: 22/01/2021 Page: 3 / 6

Version no.: 1

#### KRTK 250-403/1554XNG-D

Speed of rotation1781 rpmFluid density1030 kg/m³Viscosity1.00 mm²/sFlow rate220.179 l/sRequested flow rate220.000 l/sTotal developed head46.02 mRequested developed head45.98 m

Efficiency75.9 %Power absorbed134.91 kWNPSH req. 3%5.60 mCurve numberK43695Effective impeller diameter375.0 mmAcceptance standardISO 9906



Quantity: 1

0

0

0

20

[kW]

40

60

80

mechanical power P2

100

120



L0

0.0

140

Number: ES 8000919539 Item no.:300 Date: 22/01/2021 Page: 4 / 6

Version no.: 1

#### KRTK 250-403/1554XNG-D

Customer item no.:Bisset Lake Communication dated: 22/01/2021

Doc. no.: Bisset Lake and Autoport WWPS

#### Motor data Motor manufacturer KSB Starting mode Direct-on-line starting Power cable 155N AWG 3-4 Motor size Motor construction type KSB Sub. motor Number of power cables 2 Motor material Grey cast iron EN-GJL-250 Power cable Ø min. 26.8 mm Efficiency class not classified Power cable Ø max. 28.8 mm Rated voltage 575 V Control cable AWG 15-10 Frequency 60 Hz Number of control cables 1 Motor power 144.67 kW Ctrl. cable diameter, min. 15.9 mm Rated current 170.0 A Ctrl. cable diameter. max. 16.9 mm Rated speed 1780 rpm Cable standard CSA Starting current ratio 10.00 1/h 6.6 Switching frequency Curve data The no-load point is not a guarantee point within the meaning of IEC 60034 0.0 % 25.0 % 50.0 % 75.0 % 100.0 % Load P2 0.00 kW 36.17 kW 72.33 kW 108.50 kW 144.67 kW 1790 rpm n 1800 rpm 1795 rpm 1785 rpm 1780 rpm P1 5.75 kW 41.20 kW 78.30 kW 116.30 kW 154.80 kW 131.0 A 170.0 A 42.4 A 61.0 A 92.0 A Т Eta 0.0 % 87.8 % 92.4 % 93.3 % 93.5 % 0.14 0.68 0.85 0.89 0.91 cos phi 1800 [rpm] 1780 0 20 [kW] 40 60 80 100 120 140 160 1.6 -160 -P1 300 140 -140 1.4 250 120 -120 -1.2 200 100 -1.0 -100 eta cos phi -0.8 -80 80 150 60 0.6 ·60 100 40 -0.4 -40 [A] [kW] [1] [%] 50 20 0.2 -20

#### Installation plan

Customer item no.:Bisset Lake Communication dated: 22/01/2021 Doc. no.: Bisset Lake and Autoport WWPS Quantity: 1

#### KRTK 250-403/1554XNG-D



Number: ES 8000919539 Item no.:300 Date: 22/01/2021 Page: 5 / 6

Version no.: 1



1) Foundation rails are not part of our standard s

2) Suction elbow available as accessory

Dimensions in mm

Drawing is not to scale

#### Motor

Motor manufacturer Motor size Motor power Number of poles Speed of rotation Motor enclosure KSB 155N 144.67 kW 4 1780 rpm IP68

#### Connections

Inlet elbow size / DN0DN 250 / 350Suction flange pump drilledASME B 16.1 / NPS 10 /according to(DN1)ASME 150 lb / FFDischarge flange pump drilledASME B 16.1 / NPS 10 / CLaccording to(DN2)125 / FFSuction nozzle drilled acc. to ASME 150 lb with tapped blind holes

Weight net Pump, Motor, Cable Total

1645 kg 1645 kg

#### **Connect pipes without stress or strain!** Dimensional tolerances for shaft axis height: DIN 747 Dimensions without tolerances, middle tolerances to:

ISO 2768-m

For auxiliary connections see separate drawing.

#### Installation plan



Number: ES 8000919539

Item no.:300

Version no.: 1

Date: 22/01/2021 Page: 6 / 6

Customer item no.:Bisset Lake Communication dated: 22/01/2021 Doc. no.: Bisset Lake and Autoport WWPS Quantity: 1

#### KRTK 250-403/1554XNG-D

Connection dimensions for pumps: Dimensions without tolerances - welded parts: Dimensions without tolerances - gray cast iron parts: Dimensions without tolerances - stainless steel parts: EN735 ISO 13920-B ISO 8062-CT11 ISO 8062-CT12



# C 60 % DESIGN DRAWINGS

# **BISSETT LAKE WASTWATER PUMP STATION**

**ISSUED FOR 60% DESIGN REVIEW** 2021/07/23

|                 | DRAWING LIST - COVER SHEET                  |
|-----------------|---------------------------------------------|
| SHEET<br>NUMBER | SHEET NAME                                  |
| G000            | COVER SHEET                                 |
| C101            | CIVIL - SITE PLAN                           |
| P101            | PROCESS - DEMOLITION PLAN                   |
| P102            | PROCESS - DEMOLITION SECTIONS               |
| P103            | PROCESS - PROCESS FLOW DIAGRAM              |
| P104            | PROCESS - PROCESS PLAN                      |
| P105            | PROCESS - SECTION - 1                       |
| P106            | PROCESS - SECTION - 2                       |
| P107            | PROCESS - DETAILS                           |
| S101            | STRUCTURAL - RENOVATION FLOOR PLAN          |
| S102            | STRUCTURAL - SECTIONS AND DETAILS           |
| M001            | MECHANICAL - HVAC / PLUMBING LEGENDS AND SO |
| M101            | MECHANICAL - HVAC DEMO                      |
| M102            | MECHANICAL - PLUMBING DEMO                  |
| M103            | MECHANICAL - HVAC NEW                       |
| M104            | MECHANICAL - PLUMBING NEW                   |
| M105            | MECHANICAL - MISCELLENAOUS SECTIONS         |

**DRAWING LIST - COVER SHEET** 

SHEET NAME

# SHEET NUMBER

| M106 | MECHANICAL - SCHEMATICS |
|------|-------------------------|
| M107 | MECHANICAL - DETAILS    |

| E001 | ELECTRICAL - LEGEND |
|------|---------------------|
|      |                     |

- ELECTRICAL SITE PLAN E002
- E101 ELECTRICAL POWER DEMO
- ELECTRICAL LIGHTING DEMO E102
- ELECTRICAL POWER NEW E103
- ELECTRICAL LIGHTING NEW E104
- **ELECTRICAL SINGLE LINE DIAGRAM** E105
- ELECTRICAL SCHEMATIC E106
- ELECTRICAL SCHEMATIC E107
- E108 ELECTRICAL SCHEMATIC
- ELECTRICAL SCHEMATIC E109

## ELECTRICAL DETAILS E110

□111

# CHEDULES

| E111         | ELECTRICAL DETAILS                         |
|--------------|--------------------------------------------|
| <b>I</b> 001 | I & C - PROCESS & INSTRUMENTATION LEGEND   |
| 1002         | I & C - PROCESS & INSTRUMENTATION DIAGRAM  |
| 1003         | I & C - MISCELLANEOUS P&ID                 |
| 004          | I & C - CONTROL SCHEMATIC                  |
| 1005         | I & C - TYPICAL DOUBLE DOOR CONTROL PANEL  |
| 1006         | I & C - TYPICAL POWER DISTRIBUTION CONTROL |
| 1007         | I & C - RTU AND CONTROL ARCHITECTURE       |
| <b>1</b> 008 | I & C - STANDARD DETAILS                   |
| 1009         | I & C - STANDARD DETAILS                   |

|                      |                                       | ]                          |                                          |             |       |     |
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| KE'                  | Y PLAN:                               |                            |                                          |             |       |     |
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| 1                    | ISS                                   | UED FOR 60% REVIEW         | 1                                        | 2021/07/30  | MM    | IT  |
| NO.                  |                                       | DESCRIPTION                |                                          | DATE        | DRAWN | CHI |
|                      | 1                                     | LI                         |                                          |             | for   | T   |
|                      | C                                     | 14                         |                                          | Idll<br>Jot | ld2   |     |
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|                      |                                       |                            | TMEN                                     | IT          |       |     |
| I                    |                                       | DEPAR                      |                                          |             |       |     |
| PROJE                | CT:                                   | DEPAR<br>BISSETT L         | .AKE                                     | WWPS        | 6     |     |
| PROJE                | CT:                                   | DEPAR<br>BISSETT L<br>COVE | <b>.AKE</b><br>R SHEET                   | <b>WWPS</b> | 5     |     |
| PROJE                | CT:<br>VN                             | DEPAR<br>BISSETT L<br>COVE | <b>.AKE</b><br>R SHEET                   | <b>WWPS</b> | 3     |     |
| DRAW<br>CHEC         | NN MM<br>CKED IT<br>ROVED             | DEPAR<br>BISSETT L<br>COVE | AKE<br>R SHEE<br>SCALE<br>DATE           | <b>WWPS</b> | 5     |     |
| DRAW<br>CHEC<br>PROJ | VN MM<br>CKED IT<br>ROVED<br>FECT NO. | DEPAR<br>BISSETT L<br>COVE | AKE<br>R SHEET<br>SCALE<br>DATE<br>8639- | <b>WWPS</b> | 5     |     |

\_ PANEL



|                    | <b>A</b> . |                     |         |                                   |                    |             |            |
|--------------------|------------|---------------------|---------|-----------------------------------|--------------------|-------------|------------|
|                    |            | KE                  | Y PLAN: |                                   |                    |             |            |
| OVERFLOE @ ±109.0' |            |                     |         |                                   |                    |             |            |
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|                    |            | 1<br>NO.            | ISS     | UED FOR 60% REVIEW<br>DESCRIPTION | 2021/07/30<br>DATE | MM<br>DRAWN | IT<br>CHKD |
|                    |            | PROJE               | CT:     |                                   | Hali<br>Wate       | fay<br>er   | K          |
|                    |            |                     |         | CIVIL - SITE F                    | E VVVPS            |             |            |
|                    |            | DRAW                | /N MM   | SCAL                              | <sup>E</sup> NTS   |             |            |
|                    |            | APPR<br>PROJ<br>DWG | ECT NO. | DATE<br>201-0863<br>C101          | 9-00               |             |            |





Ground Level At Elevation 33.430 m - DEMOLITION



2 Basement 02 At Elevation 25.376 m - DEMOLITION P102 1:50





















HRWC - A1 DWG FILENAME: BIM 360://201-08639-00 - Bissett Lake and Autoport SPS - R20/201-08639-MEP-BSL\_APSPS\_v20.rvt

- 90 DEG 400ØX500Ø INCREASER BEND (TYP OF 3)

- PUMP ACCESS HATCH 1500mm x 1500mm

- 500Ø SUCTION KNIFE GATE VALVE (TYP. OF 4)

- 500Ø DISCHARGE PIPE

KEY PLAN:

ISSUED FOR 60% REVIEW

PRELIMINARY DESIGN DESCRIPTION

PROJECT:

DRAWN

checked IT

PROJECT NO.

DWG NO.

MM

APPROVED Approver

ENGINEERING

DEPARTMENT

**BISSETT LAKE WWPS** 

PROCESS - SECTION - 2

DATE

201-08639-00

P106

SCALE 1 : 50

2021/07/30 MM IT

Halifax Water

 2021/03/24
 VLN
 MR

 DATE
 DRAWN
 CHKD





AIR RELEASE GAUGE AND DRAIN CONNECTION N.T.S

| KE                                          | Y PLAN:                                                |                                                             |                                                  |                           |              |      |
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| 1                                           |                                                        |                                                             |                                                  | 2021/07/30                | <u>Г</u> ЛГЛ | IT   |
| NO.                                         |                                                        | DESCRIPTION                                                 |                                                  | DATE                      | DRAWN        | СНКД |
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|                                             |                                                        |                                                             |                                                  | ΝG                        |              |      |
| 1                                           |                                                        | ENGINE<br>DEPAR <sup>-</sup>                                | TMEN                                             | IT                        |              |      |
| PROJE                                       | ECT:                                                   | ENGINE<br>DEPAR                                             |                                                  | IT                        |              |      |
| PROJE                                       | ECT:                                                   | ENGINE<br>DEPAR <sup></sup><br>BISSETT L                    | TMEN                                             | IT<br>WWPS                | 5            |      |
| PROJ                                        | ECT:                                                   | ENGINE<br>DEPAR<br>BISSETT L<br>PROCESS                     | TMEN<br>AKE                                      | IT<br>WWPS                | 5            |      |
| PROJE                                       | ECT:                                                   | ENGINE<br>DEPAR <sup>-</sup><br><b>BISSETT L</b><br>PROCESS | TMEN AKE S - DETA Scale                          | IT<br>WWPS<br>MLS         | 5            |      |
| DRAU                                        | ect:<br><sup>WN</sup> MM<br><sup>CKED</sup> IT         | ENGINE<br>DEPAR <sup>-</sup><br>BISSETT L<br>PROCESS        | S- DETA                                          | IT<br>WWPS<br>MLS         | 5            |      |
| PROJE<br>DRAV<br>CHE<br>APPE<br>PRO         | ECT:<br>WN MM<br>ECKED IT<br>ROVED                     | ENGINE<br>DEPAR<br>BISSETT L<br>PROCESS                     | S- DETA                                          | IT<br>WWPS<br>AILS        | <b>;</b>     |      |
| PROJE<br>DRAV<br>CHE<br>APPE<br>PRO.<br>DWG | ECT:<br>WN MM<br>CKED IT<br>ROVED<br>JECT NO.<br>5 NO. | ENGINE<br>DEPAR<br>BISSETT L<br>PROCESS<br>201-08           | AKE<br>AKE<br>S - DETA<br>SCALE<br>DATE<br>3639- | IT<br>WWPS<br>AILS<br>NTS | <b>;</b>     |      |



HRWC – A1 <u>DWG\_FILENAME:</u> \\SV118DATA01\Summerside\_Projects\2020\201



1. THE CONTRACTOR MUST PERFORM ALL WORK IN ACCORDANCE WITH THE LATEST EDITION OF THE NATIONAL BUILDING CODE OF

2. ALL REFERENCES TO CODES AND STANDARDS ARE TO BE CONSIDERED AS BEING FROM THE LATEST EDITION OF THE APPLICABLE

3. THE CONTRACTOR SHALL EXAMINE ALL DRAWINGS AND CHECK ALL DIMENSIONS AGAINST SITE CONDITIONS. THE CONTRACTOR IS 5. TO REPORT ANY DISCREPANCIES BEFORE

4. CONTRACTOR IS RESPONSIBLE TO CHECK 6. AND VERIFY ALL DIMENSIONS AND ELEVATIONS ON SITE, AND CO-ORDINATE WITH ARCH. DRAWINGS. IF ANY DISCREPANCY, CONTRACTOR SHALL NOTIFY THE ENGINEER AND THE OWNER BEFORE PROCEEDING WITH THE WORK.

5. IF THERE IS ANY DISCREPANCY BETWEEN THE MECHANICAL. AND STRUCTURAL DRAWINGS AND SPECIFICATIONS, THE MOST STRINGENT CONDITIONS SHALL GOVERN.

7. THE CONTRACTOR AND ITS SUBCONTRACTOR(S) MUST CONSIDER THAT THE WORK DEPENDS ON SITE CONDITIONS. THEY ARE REQUIRED TO COMPLETE THE WORK IN KEEPING WITH THE PRACTICES OF THEIR TRADE.

8. ONLY THE MAIN OPENINGS ARE SHOWN ON THE DRAWINGS. VERIFY DIMENSIONS AND CO-ORDINATE ALL OPENINGS WITH THE DRAWINGS OF THE OTHER PROFESSIONALS. ADVISE THE STRUCTURAL ENGINEER OF ALL CHANGES OR

9. THE CONTRACTOR IS TO DESIGN, INSTALL AND MAINTAIN ALL TEMPORARY SUPPORTS AND BRACING AS REQUIRED FOR STABILITY AND

-08639-00 BISSETT LAKE AND AUTOPORT SPS\5.0 Drawings\5.2 Structural\5.2.1 Working\201-08639-00 BISSETT LAKE WWPS.rvt

| CONC              | CRETE:                                                                                                                                                                                        |                                                                                         |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1.<br>2.          | ALL CONCRETE WORK SHALL BE IN ACCORDANCE<br>WITH THE LATEST EDITION OF CAN/CSA A23.1/A23.2.<br>MINIMUM COMPRESSIVE STRENGTH FOR CONCRETE<br>AT 20 DAVID OLIVIU DE 25 MD - ALL CONCRETE OLIVIU |                                                                                         |
|                   | CONTAIN 5-8% AIR ENTRAINMENT. SLUMP AT POINT<br>OF PLACING TO BE 50 TO 75 mm. WATER CEMENT                                                                                                    |                                                                                         |
| 3.                | RATIO TO BE EQUAL TO 0.45.<br>DEFORMED REINFORCING STEEL TO CAN/CSA-G30.18                                                                                                                    |                                                                                         |
| 4.                | WITH MINIMUM YIELD STRENGTH OF 400 MPa.<br>CONCRETE COVER TO REINFORCING STEEL SHALL<br>BE 50 mm ON FORMED SIDES 40mm FOR SI ABS AND                                                          |                                                                                         |
| 5.                | 75 mm ON SIDES PLACED DIRECTLY AGAINST SOIL.<br>ADHESIVE ANCHORS: HILTI HIT-TZ RODS c/w HILTI HIT                                                                                             |                                                                                         |
|                   | HY-200 CHEMICAL ADHESIVE. INSTALL ANCHORS IN ACCORDANCE WITH MANUFACTURER'S WRITTEN                                                                                                           |                                                                                         |
| 6.                | INSTRUCTIONS.<br>USE 25 mm CHAMFER STRIPS ON ALL EXTERNAL<br>CORNERS                                                                                                                          | KFY PLANI                                                                               |
| 7.                | DO NOT FIELD BEND OR FIELD WELD<br>REINFORCEMENT.                                                                                                                                             |                                                                                         |
| 8.                | PRIOR TO PLACING CONCRETE, OBTAIN ENGINEER'S<br>WRITTEN APPROVAL OF REINFORCING MATERIAL<br>AND PLACEMENT.                                                                                    |                                                                                         |
|                   |                                                                                                                                                                                               |                                                                                         |
| <u>MASC</u><br>1. | ALL CONCRETE BLOCK WALLS SHALL BE OF                                                                                                                                                          |                                                                                         |
|                   | STANDARD CONCRETE MASONRY UNITS TYPE A TO CSA-A165. CLASSIFICATION H/15/A/M (UNLESS                                                                                                           |                                                                                         |
| 2                 | NOTED OTHERWISE). ALL MASONRY UNITS SHALL<br>BE LAID DOWN IN RUNNING BOND.                                                                                                                    |                                                                                         |
| 2.<br>3.          | ALL MASONRY MORTAR FOR CONCRETE BLOCK<br>WALLS SHALL BE TYPE 'S' TO CSA A179.<br>ALL MASONRY MORTAR FOR BRICK VENEER SHALL                                                                    |                                                                                         |
| 4.                | BE TYPE 'N' TO CSA A179.<br>ALL CONCRETE GROUT SHALL HAVE A MINIMUM                                                                                                                           |                                                                                         |
| 5.                | COMPRESSIVE STRENGTH OF 20 MPa TO CSA A179.<br>ALL REINFORCING STEEL SHALL HAVE A MINIMUM                                                                                                     |                                                                                         |
| 6                 | CSA G30.18.                                                                                                                                                                                   |                                                                                         |
| о.<br>7.          | 36 BAR DIAMETERS UNLESS NOTED ON DRAWINGS.<br>HOLLOW MASONRY UNITS SHALL BE LAID WITH                                                                                                         |                                                                                         |
|                   | FACE SHELL BED AND HEAD JOINTS. IN ADDITION,<br>THE WEBS SHALL BE LAID IN A FULL BED IN ALL                                                                                                   |                                                                                         |
|                   | COURSES OF PIERS, COLUMNS AND PILASTERS<br>AND IN THE STARTING COURSE ON FOOTINGS,<br>SOLID FOUNDATION WALLS AND WHERE AD IACENT                                                              |                                                                                         |
|                   | TO CELLS OR CAVITIES THAT ARE TO BE<br>REINFORCED WITH STEEL OR FILLED WITH GROUT                                                                                                             |                                                                                         |
| 8.                | OR CONCRETE.<br>ALL INTERSECTING OR ABUTTING MASONRY MUST                                                                                                                                     |                                                                                         |
| 0                 | BE BONDED BY MASONRY BONDING UNITS, OR TIED<br>WITH METAL ANCHORS TO MEET CSA3-A371.                                                                                                          |                                                                                         |
| 9.<br>10.         | ALL CONCRETE BLOCK WALLS SHALL BE<br>REINFORCED WITH TRUSS TYPE HORIZONTAL                                                                                                                    |                                                                                         |
|                   | BLOCK REINFORCEMENT EVERY 2nd COURSE TO<br>CSA3-S304.1. 5mm DIAMETER LONGITUDINAL & 5mm                                                                                                       |                                                                                         |
|                   | DIAMETER TRANSVERSE WIRES GALVANIZED<br>AFTER FABRICATION TO ASTM 153-B2 457 gm/m2.                                                                                                           |                                                                                         |
| 11.               | UNLESS NOTED ON DRAWINGS: LOOSE LINTELS<br>FOR NON-BEARING WALLS SHALL BE AS FOLLOWS,                                                                                                         |                                                                                         |
|                   | 1-90mm X 90mm X 6mm ANGLE UP TO 1200mm<br>SPANS AND 1-125mm X 90mm X 6mm ANGLE UP TO                                                                                                          |                                                                                         |
| 12                | 1800mm SPANS FOR EVERY 100mm THICKNESS OF<br>MASONRY. END BEARING TO BE 150mm MINIMUM.                                                                                                        |                                                                                         |
| 12.               | (5) MASONRY UNITS OF CONCRETE BLOCK AND<br>FIVE (5) 50mm CUBE SPECIMENS EACH OF MORTAR                                                                                                        |                                                                                         |
|                   | AND GROUT SHALL BE TESTED IN A LABRATORY<br>FOR EACH STOREY HEIGHT OF THE BUILDING IN                                                                                                         |                                                                                         |
|                   | ACCORDANCE WITH THE FOLLOWING CSA<br>STANDARDS:<br>12.1 BRICK CAN3-482.2                                                                                                                      |                                                                                         |
|                   | 12.2 CONCRETE BLOCK A165<br>12.3 MORTAR AND GROUT A179                                                                                                                                        |                                                                                         |
| <u>STRU</u>       | CTURAL STEEL:                                                                                                                                                                                 |                                                                                         |
| 1.                | ALL STRUCTURAL STEEL SHALL CONFORM TO                                                                                                                                                         |                                                                                         |
| 2.                | 300W FOR ANGLES AND PLATES.<br>STRUCTURAL STEEL SHALL BE FABRICATED                                                                                                                           |                                                                                         |
| _                 | AND ERECTED IN ACCORDANCE WITH<br>CAN/CSA-S16.1-09.                                                                                                                                           |                                                                                         |
| 3.                | GALVANIZING: ALL STEEL SHALL BE HOT<br>DIPPED GALVANIZED AFTER FABRICATION<br>WITH ZING COATING 600 g/m2 TO CAN/CSA-                                                                          |                                                                                         |
|                   | G164-92. GALVANIZE PIPE RAILINGS AFTER<br>FABRICATION.                                                                                                                                        |                                                                                         |
| 4.                | ALL WELDING SHALL UTILIZE E480XX<br>ELECTRODES AND SHALL MEET THE LATEST                                                                                                                      |                                                                                         |
|                   | ACCORDANCE WITH CSA W59.                                                                                                                                                                      |                                                                                         |
| HOIS              | <u>TS:</u>                                                                                                                                                                                    |                                                                                         |
| 1.<br>2           | HOISTS TO BE TESTED IN ACCORDANCE WITH<br>ANSI B30.16 OVERHEAD HOIST STANDARDS.<br>HOISTS ARE TO BE LOW PROFILE LINITS                                                                        |                                                                                         |
| ۷.                | CENTER OF HOOK (IN RAISED POSITION) TO<br>BE NO MORE THAN 200mm BELOW BOTTOM                                                                                                                  | 1     ISSUED FOR 60% REVIEW     2021-07-16       NO.     DESCRIPTION     DATE     DRAWN |
| 3.                | FLANGE OF MONORAIL BEAM.<br>HOISTS ARE TO HAVE A LIFTING CAPACITY OF                                                                                                                          |                                                                                         |
| 4.                | 2 U.S. LONS (1814kg.).<br>ACCEPTABLE PRODUCT: INGERSOL-RAND<br>ULE2 ULTRA-LO SERIES, MODEL NUMBER ULE                                                                                         |                                                                                         |
|                   | 020-8-6, OR APPROVED EQUAL.                                                                                                                                                                   | <b>7</b> Halifax                                                                        |
| EXTE              | RIOR DOOR AT HOIST MONORAIL:                                                                                                                                                                  | Woton                                                                                   |
| ι.                | METAL CLAD DOUBLE DOOR c/w GALVANIZED<br>STEEL FRAME. DOOR FRAME WIDTH TO BE                                                                                                                  |                                                                                         |
|                   | APPROX. 1500mm WIDE x 2000mm HIGH (R.S.O.).                                                                                                                                                   | ENGINEERING                                                                             |
| 2.                | MOUNT DOOR FRAME INTO OPENING CUT<br>THROUGH EXISTING EXTERIOR WALL, FRAME<br>TO SUIT EXISTING WALL THICKNESS AND TO                                                                          | DEPARTMENT                                                                              |
|                   | INCLUDE ALL FLASHINGS REQUIRED TO FORM<br>A WEATHER-TIGHT SEAL AROUND DOOR                                                                                                                    |                                                                                         |
| 3.                | FRAME.<br>EXTERIOR METAL-CLAD SOLID CORE DOUBLE                                                                                                                                               | DISSEII LARE WWY75                                                                      |
|                   | DOUR (2 LEAF X 762 WIDE) TO BE CUSTOM<br>FABRICATED TO FIT AROUND MONORAIL BEAM<br>AT TOP OF DOOR CENTER DOOR ON                                                                              | RENOVATION FLOOR PLANS                                                                  |
|                   | MONORAIL BEAM. PROVIDE ALL SWEEPS AND<br>CLOSURES TO FORM WEATHER-TIGHT SEAL                                                                                                                  |                                                                                         |
| 4.                | AROUND BEAM WHEN IN CLOSED POSITION.<br>PROVIDE ALL ACCESSORIES REQUIRED TO                                                                                                                   | DRAWN WM SCALE As indicated                                                             |
|                   | ALL HINGES, DOOR HANDLES AND LOCKING<br>DEADBOLT, ETC.                                                                                                                                        | APPROVED Approver DATE                                                                  |
| 5.                | CONTRACTOR TO PROVIDE SHOP DRAWINGS<br>TO BE APPROVED BY ENGINEER PRIOR TO                                                                                                                    | PROJECT NO. 201-08639-00                                                                |
|                   | FABRICATION.                                                                                                                                                                                  | DWG NO. <u>S101</u>                                                                     |
|                   |                                                                                                                                                                                               |                                                                                         |





1:20

| KEY PLAN:                                                           |                               |
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|                                                                     |                               |
| I         ISSUED FOR 60% REVIEW           NO.         DESCRIPTION   | 2021-07-16<br>Date Drawn Chkd |
|                                                                     |                               |
| UU                                                                  | Halifax                       |
|                                                                     | Water                         |
| ENGINE<br>DEPART                                                    | ERING<br>MENT                 |
| PROJECT:<br>BISSETT LA                                              | AKE WWPS                      |
| SECTIONS A                                                          | ND DETAILS                    |
|                                                                     | SCALE As indicated            |
| DRAWN WM                                                            | //e infaleated                |
| DRAWN     WM     S       CHECKED     WE       APPROVED     Approver | DATE                          |

## HVAC LEGEND

| DESCRIPTION                    | SYMBOL    |
|--------------------------------|-----------|
| EXHAUST DUCT UP                |           |
| EXHAUST DUCT DOWN              |           |
| RETURN DUCT UP                 |           |
| RETURN DUCT DOWN               |           |
| SUPPLY DUCT UP                 |           |
| SUPPLY DUCT DOWN               |           |
| DUCTWORK                       |           |
| INSULATED DUCTWORK             |           |
| ACOUSTICALLY LINED<br>DUCTWORK |           |
| BACKDRAFT DAMPER               | BDD       |
| BALANCING DAMPER               | BD        |
| MOTORIZED DAMPER               |           |
| AIRFLOW DIRECTION              | <b>\_</b> |
| THERMOSTAT                     | (T)       |
| HUMIDISTAT                     | (T)       |
| GAS DETECTOR                   | GD        |
| SENSOR                         | S         |
| LIGHT SWITCH                   | \$        |
| HORN                           | ⊳Ħ        |

| PLUMBING LEGEND               |                 |  |  |
|-------------------------------|-----------------|--|--|
| PORTABLE FIRE<br>EXTINGUISHER | FE              |  |  |
| BACK FLOW PREVENTER           |                 |  |  |
| WATER METER                   | — <u>M</u> —    |  |  |
| ELBOW UP                      | \$ <del>+</del> |  |  |
| ELBOW DOWN                    | E+              |  |  |
| TEE UP                        | +&+-            |  |  |
| TEE DOWN                      | +\$+            |  |  |
| CONCENTRIC REDUCER            |                 |  |  |
| GATE VALVE                    |                 |  |  |
| BALL VALVE                    |                 |  |  |
| PRESSURE REDUCING<br>VALVE    |                 |  |  |
| HOSE BIB AND RACK             |                 |  |  |
| SAFETY EYEWASH                |                 |  |  |
| CLEAN OUT                     |                 |  |  |
| HUB DRAIN                     | O <sup>hd</sup> |  |  |
| FLOOR DRAIN                   | FD FD           |  |  |
| Y-TYPE STRAINER               | -+              |  |  |

| ABBREVIATIONS          |        |  |  |  |
|------------------------|--------|--|--|--|
| DESCRIPTION            | SYMBOL |  |  |  |
| ACCESS DOOR            | AD     |  |  |  |
| ABOVE FINISHED FLOOR   | AFF    |  |  |  |
| BALANCING DAMPER       | BD     |  |  |  |
| BACKDRAFT DAMPER       | BDD    |  |  |  |
| BOTTOM OF DUCT         | BOD    |  |  |  |
| DOWN                   | DN.    |  |  |  |
| ELEVATION              | EL     |  |  |  |
| EXHAUST AIR            | E/A    |  |  |  |
| EXHAUST FAN            | EF     |  |  |  |
| ELECTRICAL DUCT HEATER | EH     |  |  |  |
| FIRE LINK DAMPER       | FLD    |  |  |  |
| HOT WATER TANK         | HWT    |  |  |  |
| LITER                  | L      |  |  |  |
| LITER PER SECOND       | L/s    |  |  |  |
| LOUVRE                 | LV     |  |  |  |
| MAKE-UP AIR UNIT       | MUA    |  |  |  |
| ON CENTRE              | OC     |  |  |  |
| OUTSIDE AIR            | O/A    |  |  |  |
| RETURN AIR             | R/A    |  |  |  |
| SUPPLY AIR             | S/A    |  |  |  |
| SUPPLY FAN             | SF     |  |  |  |
| STAINLESS STEEL        | SS     |  |  |  |
| SQUARE METER           | sq.m   |  |  |  |
| TYPICAL                | TYP.   |  |  |  |
| UNIT HEATER            | UH     |  |  |  |
|                        |        |  |  |  |

|         |          |             |              |                          |              | FAN SCHE                                          | EDULE   |                     |     |      |       |              |                               |
|---------|----------|-------------|--------------|--------------------------|--------------|---------------------------------------------------|---------|---------------------|-----|------|-------|--------------|-------------------------------|
| TAG No. | LOCATION | FUNCTION    | DUTY         | MOUNTING                 | MANUFACTURER | TYPE                                              | MODEL   | CAPACITY<br>HI / LO | ESP |      | MOTOR |              |                               |
|         |          |             |              |                          |              |                                                   |         | L/s                 | Ра  | RPM  | kW    | V/PH/Hz      |                               |
| SF-2    | DRY WELL | AIR SUPPLY  | INTERMITTENT | INTERIOR WALL<br>MOUNTED | M.K.PLASTICS | CENTRIFUGAL<br>FIBERGLASS FAN                     | CNW 200 | 611                 | 125 | 1750 | 0.25  | 120 / 1 / 60 | 1. AREA CLAS<br>2. FAN POSITI |
| EF-2    | DRY WELL | AIR EXHAUST | INTERMITTENT | EXTERIOR WALL<br>MOUNTED | M.K.PLASTICS | SIDEWALL CENTRIFUGAL<br>FIBERGLASS EXHAUST<br>FAN | RBK-15  | 564                 | 125 | 1750 | 0.25  | 600 / 3 / 60 | 1. AREA CLAS                  |
| SF-3    | WET WELL | AIR SUPPLY  | INTERMITTENT | INTERIOR WALL<br>MOUNTED | M.K.PLASTICS | CENTRIFUGAL<br>FIBERGLASS FAN                     | CNW 315 | 846                 | 125 | 1750 | 0.55  | 600 / 3 / 60 | 1. AREA CLAS<br>2. FAN POSITI |
| EF-3    | WET WELL | AIR EXHAUST | INTERMITTENT | EXTERIOR WALL<br>MOUNTED | M.K.PLASTICS | SIDEWALL CENTRIFUGAL<br>FIBERGLASS EXHAUST<br>FAN | RBK-15  | 917                 | 125 | 1750 | 0.55  | 600 / 3 / 60 | 1. AREA CLAS                  |

|         | ELECTRICAL UNIT HEATER SCHEDULE |          |              |              |       |      |              |                                                                     |  |
|---------|---------------------------------|----------|--------------|--------------|-------|------|--------------|---------------------------------------------------------------------|--|
| TAG No. | LOCATION                        | FUNCTION | DUTY         | MANUFACTURER | MODEL | PC   | OWER         | INTERLOCKS REMARKS                                                  |  |
|         |                                 |          |              |              |       | kW   | V/PH/Hz      |                                                                     |  |
| UH-1    | ELECTRICAL ROOM                 | HEATING  | INTERMITTENT | CHROMALOX    | НУН   | 4.0  | 208 / 3 / 60 | 1. AREA CLASSIFICATION: UNCLASSIFIED<br>2. C/W BUILT-IN THERMOSTAT  |  |
| UH-2    | PUMP ACCESS ROOM                | HEATING  | INTERMITTENT | CHROMALOX    | CXH-A | 10.0 | 600 / 3 / 60 | 1. AREA CLASSIFICATION: CLASS 1 DIV.2<br>2. C/W BUILT-IN THERMOSTAT |  |
| UH-3    | PUMP ACCESS ROOM                | HEATING  | INTERMITTENT | CHROMALOX    | CXH-A | 10.0 | 600 / 3 / 60 | 1. AREA CLASSIFICATION: CLASS 1 DIV.2<br>2. C/W BUILT-IN THERMOSTAT |  |
| UH-4    | DRY WELL, LOWER LEVEL           | HEATING  | INTERMITTENT | CHROMALOX    | CXH-A | 10.0 | 600 / 3 / 60 | 1. AREA CLASSIFICATION: CLASS 1 DIV.2<br>2. C/W BUILT-IN THERMOSTAT |  |
| UH-5    | DRY WELL, LOWER LEVEL           | HEATING  | INTERMITTENT | CHROMALOX    | CXH-A | 10.0 | 600 / 3 / 60 | 1. AREA CLASSIFICATION: CLASS 1 DIV.2<br>2. C/W BUILT-IN THERMOSTAT |  |
| UH-6    | WET WELL                        | HEATING  | INTERMITTENT | CHROMALOX    | CXH-A | 10.0 | 600 / 3 / 60 | 1. AREA CLASSIFICATION: CLASS 1 DIV.1<br>2. C/W BUILT-IN THERMOSTAT |  |
| UH-7    | WET WELL                        | HEATING  | INTERMITTENT | CHROMALOX    | CXH-A | 10.0 | 600 / 3 / 60 | 1. AREA CLASSIFICATION: CLASS 1 DIV.1<br>2. C/W BUILT-IN THERMOSTAT |  |
| UH-8    | STORAGE ROOM                    | HEATING  | INTERMITTENT | CHROMALOX    | НУН   | 4.0  | 208 / 3 / 60 | 1. AREA CLASSIFICATION: UNCLASSIFIED<br>2. C/W BUILT-IN THERMOSTAT  |  |
| UH-9    | DRY WELL, UPPER LEVEL           | HEATING  | INTERMITTENT | CHROMALOX    | CXH-A | 10.0 | 600 / 3 / 60 | 1. AREA CLASSIFICATION: CLASS 1 DIV.2<br>2. C/W BUILT-IN THERMOSTAT |  |

| TAG No. | LOCATION |   |
|---------|----------|---|
| LV-1    | DRY WELL | 6 |
| LV-2    | WET WELL | 6 |

# ELECTRIC WATER HEATER SCHEDULE

|                                       | MANUFACTURER                                                                                                           | MODEL  | CAPACITY |      | ELEMENTS | RECOVERY | ELECTRIC |              |  |  |
|---------------------------------------|------------------------------------------------------------------------------------------------------------------------|--------|----------|------|----------|----------|----------|--------------|--|--|
| TAG                                   |                                                                                                                        |        |          | (1.) | TOTAL    | @ 80°F   |          |              |  |  |
|                                       |                                                                                                                        |        | (USGAL)  | (L)  | (KW)     | (GPH)    | FLA      | V / P / HZ   |  |  |
| HWT-1                                 | RHEEM                                                                                                                  | EGS120 | 120      | 454  | 18       | 106      | 18       | 600 / 3 / 60 |  |  |
| NOTES:<br>HOT WATER TA<br>TEMPERATURE | NOTES:<br>HOT WATER TANK SHALL BE EQUIPPED WITH THERMOSTATIC MIXING VALVES SET AT 43°C WATER DISCHARGE<br>TEMPERATURE. |        |          |      |          |          |          |              |  |  |

# LOUVRE SCHEDULE

| SIZE                 | FUNCTION   | MANUFACTURER | MODEL | REMARKS                            |
|----------------------|------------|--------------|-------|------------------------------------|
| 00 x 760 [24" x 30"] | INTAKE AIR | HARTZEL      | FFL   | AREA CLASSIFICATION: CLASS 1 DIV.2 |
| 00 x 760 [24" x 30"] | INTAKE AIR | HARTZEL      | FFL   | AREA CLASSIFICATION: CLASS 1 DIV.1 |

## REMARKS

AREA CLASSIFICATION: CLASS 1 DIV.2 FAN POSITION: CW TH

AREA CLASSIFICATION: CLASS 1 DIV.2

AREA CLASSIFICATION: CLASS 1 DIV.1 AN POSITION: CW TH

AREA CLASSIFICATION: CLASS 1 DIV.1

KEY PLAN:

ISSUED FOR 60% REVIEW DESCRIPTION 2021/07/30 MM IT Date Drawn Chke



PROJECT:

## **BISSETT LAKE WWPS**

MECHANICAL - HVAC / PLUMBING LEGENDS AND SCHEDULES

DRAWN SL CHECKED MR APPROVED PROJECT NO. DWG NO.

DATE

<sup>SC ALE</sup> N.T.S.

201-08639-00 M001



| 1   | ISSUED FOR 60% REVIEW | 2021/07/30 | MM    | IT      |
|-----|-----------------------|------------|-------|---------|
| NO. | DESCRIPTION           | DATE       | DRAWN | C H K [ |



CALE PLOTTED: 1=1 DATE PLOTTED: 30/07/2021 2:05:24 PI





MECHANICAL - PLUMBING DEMO

| )  |
|----|
|    |
|    |
|    |
| 50 |
|    |
|    |









PROJECT:

KEY PLAN:

# **BISSETT LAKE WWPS**

MECHANICAL - HVAC NEW

DRAWN SL CHECKED MR APPROVED PROJECT NO. DWG NO.

DATE 201-08639-00 M103

SC ALE 1 : 50













| 1   | <b>ISSUED FOR 60% REVIEW</b> | 2021/07/30 | MM    | IT   |
|-----|------------------------------|------------|-------|------|
| NO. | DESCRIPTION                  | DATE       | DRAWN | CHKD |



# **BISSETT LAKE WWPS**

MECHANICAL - PLUMBING NEW

DRAWN CHECKED MR APPROVED PROJECT NO. DWG NO.

DATE 201-08639-00

scale 1 : 50

M104



HRWC - A1 <u>DWG FILENAME:</u> BIM 360://201-08639-00 - Bissett Lake and Autoport SPS - R20/201-08639-MEP-BSL\_APSPS\_v20.rvt





DWG NO.

M105

IT

2 PARTIAL SECTION M103 1:50





# ELECTRICAL ROOM (UNCLASSIFIED) SCALE: N.T.S.







EXHAUST AIR FAN

EXHAUST AIR

UH-1



<u>611 l/s</u>

32





KEY PLAN:







## UNIT HEATER SUPPORT SCALE: N.T.S.

#### WALL MOUNTED EXHAUST FAN SCALE: N.T.S.



HOSE VALVE SCALE: N.T.S.





# STANDARD ABBREVIATIONS

| EL | EC | TRICAL | SYMBO |
|----|----|--------|-------|
|    |    |        |       |

| A     | AMPERES (CONTINUOUS)              | L/S        | LITRE PER SECOND                            |                                                                                    | FIRE ALARM PULL STATION                        | A                   |
|-------|-----------------------------------|------------|---------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------------|---------------------|
| AC    |                                   | LS         | LIMIT/LEVEL SWITCH                          | $\exists \exists$                                                                  | HUMIDISTAT                                     |                     |
| AF    |                                   | MAN        | MANUAL                                      | T                                                                                  | THERMOSTAT                                     | V                   |
| ANF   | FAN COOLED                        | MCC        |                                             | ASC                                                                                | ADJUSTABLE SPEED CONTROLLER                    | ł                   |
| ANN   | DRY TYPE TRANSFORMER -            | MCP        |                                             |                                                                                    | SINGLE PHASE MOTOR STARTER                     |                     |
| AS    |                                   | M.O.       | MANUALLY OPERATED                           |                                                                                    | WITH OVERLOAD                                  | $\prec \leftarrow'$ |
| ASYM  | ASYMMETRICAL                      | M/O/A      | MANUAL-OFF-AUTOMATIC                        | P                                                                                  | SINGLE PHASE MOTOR STARTER WITH                |                     |
| AT    | AMPERE TRIP                       | MOT        | MOTOR                                       | K                                                                                  |                                                |                     |
| ATS   | AUTOTRANSFORMER REDUCED VOLTAGE   | MTD        | MOUNTED                                     | $\bigcirc$                                                                         | SELECTOR SWITCH                                |                     |
|       | STARTING OR AUTO TRANSFER SWITCH  | MTG        | MOUNTING                                    | × ¬                                                                                | DISCONNECT SWITCH ('X' DENOTES No. OF POLES)   | $\rightarrow$       |
| AWG   |                                   | MTS        | MANUAL TRANSFER SWITCH                      | CP                                                                                 | CONTROL PANEL (OR 'LP'-LOCAL PANEL)            |                     |
| BLDG  | BUILDING                          | N          |                                             |                                                                                    |                                                |                     |
| BKR   | BREAKER                           | N/A        |                                             | <b>S</b> <sup>A-10</sup>                                                           | CONNECTED TO PNL 'A' + CCT NUMBER '10')        |                     |
| °C    | DEGREE CELSIUS                    | N.O.       |                                             | <b>\$</b> <sub>3</sub>                                                             | 3 WAY SWITCH (3 WIRE)                          |                     |
| С     | CONDUCTOR                         | NP         | NAMEPLATE                                   | .s                                                                                 | INTERMEDIATE SWITCH (4 WIRE)                   | -                   |
| CCT   | CIRCUIT                           | NPT        | NATIONAL PIPE THREAD                        | $\mathbf{\Psi}_4$                                                                  | ,                                              |                     |
| ፍ     | CENTERLINE                        | NTS        | NOT TO SCALE                                | OS                                                                                 | OCCUPANCY SENSOR (INFRARED MOTION)             |                     |
| C/W   | COMPLETE WITH                     | OC         | OVERCURRENT                                 | PC                                                                                 | PHOTOCELL CONTROL                              |                     |
| CPT   |                                   | ОН         | ONTARIO HYDRO OR                            |                                                                                    |                                                |                     |
| CR    | CONTROL RELAY/CORROSION RESISTANT |            |                                             | $\bigcirc$                                                                         | SINGLE RECEPTACLE                              | ٳ                   |
| CSA   |                                   |            |                                             | $\bigcirc$                                                                         | DUPLEX RECEPTACLE                              | (<br>(              |
| USA   | ASSOCIATION                       | P          | POLE                                        |                                                                                    |                                                | <br>                |
| СТ    | CURRENT TRANSFORMER               | PB         | PUSHBUTTON                                  | ⊂ WP                                                                               |                                                | d                   |
| CTL   | CONTROL                           | PC         | PHOTOCELL CONTROL                           |                                                                                    | (WEATHER AND CORROSION PROTECTED)              |                     |
| CTD   | CURRENT TEST DEVICE               | PCV        | PRESSURE/PUMP CONTROL VALVE                 | $\overline{(\cdot)}$                                                               | THREE PHASE RECEPTACLE (FEMALE CONFIGURATION)  | ر                   |
| CU    | COPPER                            |            |                                             |                                                                                    |                                                |                     |
| DC    | DIRECT CURRENT                    | PH OR 0%%0 |                                             |                                                                                    | THREE PHASE RECEPTACLE (MALE CONFIGURATION)    | <b>D</b>            |
| D.O.  | DRAW OUT                          | PID        |                                             | $\bigcirc \dashv$                                                                  | CLOCK OUTLET                                   |                     |
| DISC  | DISCONNECT                        |            | DERIVATIVE (RATE)                           |                                                                                    | 20A-1P DUPLEX RECEPTACLE                       |                     |
| DPDT  |                                   | P & ID     | PROCESS AND                                 | $\sim$                                                                             |                                                |                     |
|       |                                   | PLC.       |                                             | $\bigcirc$                                                                         | SPECIAL OUTLET AS NOTED                        | +                   |
| EEMAC | MANUFACTURERS ASSOCIATION         |            | CONTROLLER                                  | $\bigtriangleup$                                                                   | COUNTER-TOP OR WORKBENCH HEIGHT                | $\square$           |
|       |                                   | REM        | REMOTE                                      | Ý                                                                                  |                                                | $\supset$           |
|       |                                   | PNL        | PANEL                                       | $\langle \!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!$ | SPLIT DUPLEX RECEPTACLE                        |                     |
| FIII  |                                   | RES        | RESISTOR                                    | JB                                                                                 | JUNCTION BOX (OR 'PB'-PULL BOX)                |                     |
| FM    | ENCLOSUBE                         | RTD        | RESISTANCE TEMPERATURE<br>DETECTOR          |                                                                                    |                                                | $\sim$              |
| ENCL  | EARLY MAKE (CONTACTS)             | RTU        | REMOTE TERMINAL UNIT(PLC)                   |                                                                                    | ('X' DENOTES TAG No.)                          |                     |
| EO    | ELECTRICALLY OPERATED             | SEL        | SELECTOR                                    |                                                                                    | SMOKE DETECTOR                                 |                     |
| EP    | EXPLOSION PROOF                   | SV         | SOLENOID VALVE                              |                                                                                    | ('X' DENOTES TAG No.)                          | I                   |
| ESTOP | EMERGENCY STOP                    | S/C        | SHORT CIRCUIT                               | DC                                                                                 | DOOR SWITCH/CONTACTOR<br>('X' DENOTES TAG No.) |                     |
| ETM   | ELAPSED TIME METER                | SHLD       | SHIELDED                                    |                                                                                    |                                                |                     |
| FRE   | FIBREGLASS REINF.EPOXY            | SN         | SOLID NEUTRAL                               | $(\cdot)$                                                                          | SINGLE PHASE OR DC MOTOR                       |                     |
| FVR   | FULL VOLTAGE REVERSING            | SPDT       | SINGLE POLE DOUBLE THROW                    | $\bigwedge$                                                                        |                                                |                     |
| FVNR  | FULL VOLTAGE, NON-REVERSING       | SPST       | SINGLE POLE SINGLE THROW                    |                                                                                    | THREE PHASE MOTOR                              | (V                  |
| GFI   | GROUND FAULT INTERRUPTER          | SS         |                                             | S                                                                                  |                                                | P                   |
| GFR   | GROUND FAULT CCT                  | SV         | (DIRECT OPERATED VALVE<br>(DIRECT OPERATED) | U                                                                                  | SOLENOID                                       |                     |
| GND   | GROUND                            | SW         | SWITCH                                      |                                                                                    |                                                | (k)                 |
| H/O/A | HAND-OFF-AUTOMATIC                | SYM        | SYMMETRICAL                                 | M                                                                                  | MOTORIZED (EO) VALVE                           |                     |
| HP    | HORSEPOWER                        | ТС         | SHUNT TRIP COIL or THERMOCOUPLE             |                                                                                    |                                                | (V                  |
| HTR   | HEATER                            | TDC        | TIME DELAY ON CLOSING                       | G                                                                                  |                                                | P                   |
| Hz    | HERTZ                             | TDDO       | TIME DELAY ON DROP-OUT                      |                                                                                    | FIRE ALARM BELL                                |                     |
| IEEE  | INSTITUTE OF ELECTRICAL &         | TDO        | TIME DELAY ON OPENING                       | $\vdash \blacksquare \checkmark$                                                   | PAGING LOUDSPEAKER                             | $\sum$              |
|       | INDICATION                        | TDPU       |                                             |                                                                                    | CEILING MTD PAGING LOUDSPEAKER                 | <u> </u>            |
| INST  | INSTANTANEOUS                     | TEMP       | TEMPERATURE                                 |                                                                                    |                                                |                     |
| I/O   | INPUT/OUTPUT                      |            |                                             |                                                                                    |                                                | S                   |
| I/P   | CURRENT TO PNEUMATIC              |            |                                             |                                                                                    | EMERGENCY LIGHTING UNIT,                       | 0,                  |
| ISA   | INSTRUMENT SOCIETY OF             | V          | VOLT                                        |                                                                                    | BEMOTE FLULAMPS (TWO LAMPS)                    |                     |
| 15    |                                   | VA         | VOLT-AMPERE                                 | $\bigtriangledown$                                                                 |                                                |                     |
| JR    |                                   | VAC        | VOLTS ALTERNATING CURRENT                   | $\checkmark$                                                                       | REMOTE ELO LAMIP (T LAMIP)                     |                     |
| NAIG  | CAPACITY                          | VDC        | VOLTS DIRECT CURRENT                        | $\otimes$ $\mapsto$                                                                | CEILING OR WALL MOUNTED EXIT SIGN              |                     |
| kVA   | KILOVOLTAMPERE                    | VFD        | VARIABLE FREQUENCY DRIVE                    | `F1'                                                                               | LIGHT FIXTURE TYPE `F1' (TYPICAL)              |                     |
| kHz   | KILOHERTZ                         | VT         | VOLTAGE TRANSFORMER (FORMER PT)             | A-10                                                                               | CONNECTED TO PNL 'A', CCT '10'                 | <u></u>             |
| kW    | KILOWATT                          | VTD        | VOLTAGE TEST DEVICE                         |                                                                                    | LIGHT FIXTURE TYPE H1 (TYPICAL)                |                     |
| kWh   | KILOWATT HOUR                     | W          | WIRE OR WATT                                |                                                                                    | CONNECTED TO PNL 'A', CCT '10'                 |                     |
| LA    | LIGHTNING ARRESTOR                | WP         | WEATHERPROOF                                |                                                                                    |                                                |                     |
| LB    | LATE BREAK (CONTACTS)             | 2S1W       | TWO SPEED-ONE WINDING                       | $\langle \rangle$                                                                  | UNIT MEATER                                    |                     |
| 108   |                                   | 299\M      |                                             | ~                                                                                  |                                                |                     |
| L/R   | LOCAL-REMOTE                      | XFMR       | TRANSFORMER                                 | $\langle \rangle$                                                                  |                                                |                     |
|       |                                   | ···· ·     |                                             | ICP                                                                                |                                                | ~-                  |
|       |                                   |            |                                             |                                                                                    |                                                | GE                  |

# LS LIGHTING & POWER LAYOUTS

# ELECTRICAL SYMBOLS SINGLE LINE/EL

| AS                                            | AMMETER SWITCH                                                    |                 |
|-----------------------------------------------|-------------------------------------------------------------------|-----------------|
| VS                                            | VOLTMETER SWITCH                                                  |                 |
| К                                             | KEY INTERLOCK                                                     |                 |
| $\langle \leftarrow \frown \rightarrow \succ$ |                                                                   |                 |
|                                               |                                                                   |                 |
|                                               | CIRCUIT BREAKER, MCP,MOULDED                                      | H A             |
| V                                             | ONLY' TRIPS                                                       |                 |
| $\rightarrow$                                 | CAPACITOR                                                         |                 |
|                                               | RESISTOR OR HEATER                                                |                 |
|                                               |                                                                   | _0_0_           |
|                                               | FUSE                                                              |                 |
|                                               | FUSED DISCONNECT SWITCH                                           | <u> </u>        |
|                                               |                                                                   |                 |
|                                               | SWITCH                                                            |                 |
|                                               | LIGHTNING ARRESTER                                                | `† 22<br>       |
|                                               | SOLENOID                                                          | └── ↑ 22        |
|                                               | THERMAL OVERLOAD TRIP                                             |                 |
|                                               | BATTERY                                                           | -oto-           |
|                                               | CURRENT TRANSFORMER                                               | -o_o_           |
|                                               |                                                                   |                 |
| $\square$                                     | ZERO SEQUENCE (GROUND)<br>CURRENT TRANSFORMER                     |                 |
|                                               | VOLTAGE TRANSFORMER                                               |                 |
|                                               | AUTOTRANSFORMER WITH TAPS                                         |                 |
|                                               | POWER OR DISTRIBUTION TRANSFORMER                                 |                 |
|                                               |                                                                   | ~<br>-~_~~~     |
| $\bigcap_{i=1}^{n}$                           | CONTROL POWER TRANSFORMER                                         | - <u>o</u> -to- |
|                                               | REACTOR                                                           | -0~10-          |
| DA                                            | DUAL AMMETER, THERMAL DEMAND & INSTANTANEOUS                      | -0-0-           |
| V                                             | VOLTMETER                                                         |                 |
| PF                                            | POWER FACTOR METER                                                |                 |
| (kW)                                          | KILOWATT METER                                                    | <u>A</u>        |
| Ŵ                                             | WATTMETER                                                         | R               |
| PG                                            | POWER GENERATOR, OR DG-DIESEL<br>GENERATOR OB MG-MOBILE GENERATOR | MS-*            |
| $\bigtriangleup$                              | DELTA CONNECTION                                                  | MS-*            |
| -<br>-<br>-                                   | STAR CONNECTED, GROUNDED                                          |                 |
| S/S                                           | SOFT STARTER (SINGLE LINE DIAGRAM)                                | SS              |
|                                               |                                                                   | S               |
|                                               | SOFT STARTER (SCHEMATIC CONTROL DIAGRAM)                          |                 |
|                                               |                                                                   | MOT             |
| FO A                                          | POWER CIRCUIT BREAKER:                                            | SPD             |
| MVA                                           | A - CONTINUOUS CURRENT RATING<br>MVA - INTERRUPTING RATING        | ELECTR          |
|                                               |                                                                   | <b>、</b>        |
|                                               |                                                                   | $\otimes$       |
|                                               | REFERENCED EQUIPMENT OR                                           |                 |
|                                               | FUTURE SUPPLY AND EQUIPMENT                                       |                 |
| <u>GENERA</u>                                 | L NOTES                                                           |                 |

1. THIS IS A GENERAL ELECTRICAL LEGEND SHEET. SOME DEVICES, SYMBOLS OR ABBREVIATIONS MAY NOT BE USED ON THIS PROJECT.

| LEMENTA                                        | RY CONTROL                                                                                                                                |
|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| $\boxtimes$                                    | TERMINAL BLOCK TO                                                                                                                         |
|                                                | HVAC TERMINAL                                                                                                                             |
|                                                | TERMINAL BLOCK IN                                                                                                                         |
| DI                                             | PLC INPUT/OUTPUT,<br>DISCRETE INPUT                                                                                                       |
|                                                | CONTROL/SELECTOR<br>3 POSITION, TOP                                                                                                       |
| R<br>R                                         | CONTROL/SELECTOR<br>2 POSITION, TOP                                                                                                       |
| <br>o                                          | CONTROL/SELECTOR<br>2 OR 3 POSITION, BO                                                                                                   |
|                                                | PUSHBUTTON, N.O.,<br>CONTACT                                                                                                              |
| - <u>o         o                          </u> | PUSHBUTTON, N.C.,<br>CONTACT                                                                                                              |
|                                                | PUSHBUTTON, MOM<br>WITH N.O. & N.C. CO                                                                                                    |
| <br>↑ 22°C                                     | THERMOSTAT, NORM<br>CLOSES ABOVE 22°C                                                                                                     |
| ∽<br>∽_ ↑ 22°C                                 | THERMOSTAT, NORM<br>OPENS ABOVE 22°C                                                                                                      |
|                                                | LEVEL SWITCH, CLO<br>HIGH LEVEL                                                                                                           |
| 0                                              | LEVEL SWITCH, OPE<br>HIGH LEVEL                                                                                                           |
| - To-                                          | PRESSURE SWITCH,<br>HIGH PRESSURE                                                                                                         |
|                                                | PRESSURE SWITCH,<br>HIGH PRESSURE                                                                                                         |
|                                                | FLOW SWITCH, CLOS<br>HIGH FLOW                                                                                                            |
|                                                | FLOW SWITCH, OPEN<br>HIGH FLOW                                                                                                            |
|                                                | TIME DELAY ENABLE                                                                                                                         |
|                                                | TIME DELAY DISENA                                                                                                                         |
|                                                |                                                                                                                                           |
| -0~70                                          | LIMIT/POSITION SWI                                                                                                                        |
| -~~~                                           | LIMIT/POSITION SWI                                                                                                                        |
|                                                |                                                                                                                                           |
|                                                |                                                                                                                                           |
| R                                              | PUSH TO TEST (P.T.                                                                                                                        |
|                                                | CONTACTOR, CONT                                                                                                                           |
| MS-*                                           | MS - MOTOR START<br>CR - CONTROL RELA<br>TR - TIME DELAY RE<br>(ON OR OFF TYPI<br>No SEE 'DEVICE FI<br>FOR DESCRIPTIC<br>* - RELAY NUMBER |
| - SS -                                         | SURGE SUPPRESSC                                                                                                                           |
| S                                              | SOLENOID                                                                                                                                  |
| MOT                                            | MOTOR                                                                                                                                     |
| SPD                                            | SURGE PROTECTION                                                                                                                          |
| CTRICA                                         | AL GROUN                                                                                                                                  |
| $\otimes$                                      | GROUNDING ROI                                                                                                                             |
| $\boxtimes$                                    | GROUND BOD W                                                                                                                              |

4 #12-21mmC

TIME SURFACE PRIMER

POWER MONITOR

TSP

P/M













| K E                       | Y PLAN:                              |                           |                    |                   |  |  |
|---------------------------|--------------------------------------|---------------------------|--------------------|-------------------|--|--|
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|                           |                                      |                           |                    |                   |  |  |
| <b>1</b><br>NO.           | ISSUED FOR 60% REVIEW<br>DESCRIPTION | <b>2021/07/30</b><br>Date | <b>MM</b><br>Drawn | <b>IT</b><br>Chkd |  |  |
| Halifax<br>Water          |                                      |                           |                    |                   |  |  |
| ENGINEERING<br>DEPARTMENT |                                      |                           |                    |                   |  |  |
|                           |                                      |                           |                    |                   |  |  |
| DRAW                      | ILLOTINONE I CT                      | LE 1 : 50                 |                    |                   |  |  |
| C HEU<br>APPR             | OVED DATE                            | -<br>-<br>                |                    |                   |  |  |
| PROJ<br>DWG               | 201-08639-00<br>DWG NO. E101         |                           |                    |                   |  |  |





| UH-4 UH-5<br>UH-5<br>E-STOP E-STOP E-STOP                                  |
|----------------------------------------------------------------------------|
| BASEMENT 02 AT ELEVATION<br>25.376 - ELEC - NEW<br>1:50                    |
| GROUND LEVE           3         33.430- ELEC -           E103         1:50 |



















| KEY PLAN:                                                          |                                                        |                    |            |  |  |  |
|--------------------------------------------------------------------|--------------------------------------------------------|--------------------|------------|--|--|--|
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|                                                                    |                                                        |                    |            |  |  |  |
| 1         ISSUED FOR 60% REVIEW           NO.         DESC RIPTION | <b>2021/07/30</b><br>DATE                              | <b>MM</b><br>Drawn | IT<br>Chkd |  |  |  |
| Halifax<br>Engineering                                             |                                                        |                    |            |  |  |  |
| PROJECT:<br>BISSETT LAKE                                           | DEPARTMENT<br>Project:<br><b>RISSETT I AKE W/W/D</b> S |                    |            |  |  |  |
| ELECTRICAL - LIGHTING NEW                                          |                                                        |                    |            |  |  |  |
| DRAWN SL SCALE<br>CHECKED MN DATE                                  | 1 : 50                                                 |                    |            |  |  |  |
| PROJECT NO. 201-08639-00 DWG NO. E104                              |                                                        |                    |            |  |  |  |




| LUMINAIRE SCHEDULE |              |                                 |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                              |                                  |                                                                                                                                                                     |                                  |                       |                                     |                                     |
|--------------------|--------------|---------------------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------|-------------------------------------|-------------------------------------|
| SYMBOL             | TYPE         | VOLTS                           | INPUT       | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | LAMPS                                                                                        | BALLAST                          | MANUFACTURERS                                                                                                                                                       | MOUNTING                         | KFY PLAN              |                                     |                                     |
| L1                 | LED          | 120                             | WATTS<br>61 | 1220mm (4') LED LIGHT FIXTURE, TOTALLY ENCLOSED AND GASKETED, MOULDED FIBERGLASS REINFORCED<br>POLYESTER HOUSING, BAKED WHITE FINISH, ONE PIECE, IMPACT<br>RESISTANT LATCHED ACRYLIC DIFFUSER WITH SMOOTH SURFACE, STAINLESS STEEL BRACKETS AND LATCHES<br>FOR A CORROSION-RESISTANT CONSTRUCTION, SUITABLE FOR<br>WET AND COBROSIVE LOCATION                                                                                                                                                                                                                                                                                                                                                                                                                                        | QTY TYPE<br>61W LED<br>3500K (4')                                                            | LED DRIVER                       | CATALOG NUMBER<br>1. LITHONIA LIGHTING, FEM C/L LED SERIES<br>2. HUBBELL (CLUMBIA), LXEM SERIES<br>3. C&M (THOMAS LIGHTING)<br>4. CROUSE-HINDS<br>5. APPROVED EQUAL | S PENDANT OR<br>SURFACE,<br>WALL |                       |                                     |                                     |
| L2                 | LED          | 120                             | 80          | 1220mm (4') LED LIGHT FIXTURE, IMPACT RESISTANT, UV STABILIZED FIBERGLASS REINFORCED POLYESTER<br>HOUSING, POLYCARBONATE INJECTION MOLDED LENS, STAINLESS STEEL BRACKETS AND LATCHES FOR A<br>CORROSION-RESISTANT CONSTRUCTION, SUITABLE FOR HAZARDOUS CLASS 1, ZONE 2 LOCATION.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 80W LED<br>3500K (4')                                                                        | LED DRIVER                       | 1. AZZ R-A-L, MHDS SERIES<br>2. CROUSE-HINDS, LL48 SERIES<br>3. APPROVED EQUAL                                                                                      | PENDANT OR<br>SURFACE,<br>WALL   |                       |                                     |                                     |
| L3                 | LED          | 120                             | 98          | EXPLOSION PROOF LED LIGHT FIXTURE. CORROSION-RESISTANT, COOPER-FREE ALUMINUM ALLOY HOUSIN.<br>EXPLOSION-PROOF, IMPACT AND HEAT RESISTANT GLASS TUBES, PROVIDE LAMP PROTECTION. HEAVY GAUGE<br>EXTRUDED ALUMINUM REFLEXTORS WITH HIGH GLOSS REFLEXTIVE FINISH. INCLUDING WIRE GUARD AND CLEAR<br>POLYCARBONATE SHIELD. SUITABLE FOR HAZARDOUS CLASS 1, DIVISION 1, GROUPS C, D LOCATION.                                                                                                                                                                                                                                                                                                                                                                                              | 98W LED<br>4000K (4')                                                                        | LED DRIVER<br>HIGH<br>EFFICIENCY | 1. AZZ R-A-L, SXPJ SERIES<br>2. CROUSE-HINDS<br>3. APPROVED EQUAL                                                                                                   | PENDANT OR<br>SURFACE,<br>WALL   |                       |                                     |                                     |
| L4                 | LED          | 120                             | 47          | OUTDOOR WALL PACK LED LIGHTING FIXTURE, SINGLE-PIECE DIE-CAST ALUMINUM HOUSING WITH TGIC<br>THERMOSET POWDER COAT FINISH. PRECISION-MOLDED ACRYLIC LENSES.<br>SUITABLE FOR BUILDING EXTERIOR APPLICATION.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 47W LED<br>5000K                                                                             | LED DRIVER                       | 1. LITHONIA LIGHTING, WSQ SERIES<br>2. APPROVED EQUAL                                                                                                               | WALL MOUNT                       |                       |                                     |                                     |
| L5                 | LED          | 120                             | 96          | HAZARDOUS LED LIGHTING FIXTURE, HIGH STRENGTH, CORROSION RESISTANT COPPER-FREE CAST ALUMINUM ALLOY<br>HOUSING, LOW PROFILE CLEAR GLOBE AND GUARD,<br>STAINLESS STEEL EXTERIOR HARDWARE, ULC LISTED FOR CLASS 1, DIVISION 2, GROUP C, D HAZARDOUS LOCATION.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 96W LED                                                                                      | LED DRIVER                       | 1. AZZ R-A-L, SAFR LED SERIES<br>2. COOPER CROUSE-HINDS<br>3. HUBBELL INDUSTRIAL<br>4. APPROVED EQUAL                                                               |                                  |                       |                                     |                                     |
| L6                 | LED          | 120                             | 75          | OUTDOOR LED AREA LIGHTING FIXTURE, LOW PROFILE ARCHITECTURAL AESTHETIC STYLE, SINGLE-PIECE DIE-CAST<br>ALUMINUM HOUSING, PRECISION ACRYLIC REFRACTIVE OPTICS AND FLAT GLASS LENS, ASYMMETRICAL DISTRIBUTION<br>SPREADS LIGHTING FORWARD AND ON BOTH SIDES, SUITABLE FOR ROADWAY AND AREA LIGHTING.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 75W LED<br>5000K                                                                             | LED DRIVER                       | 1. LITHONIA LIGHTING, WSQ SERIES<br>2. APPROVED EQUAL                                                                                                               | 6m ALUMINUM<br>POLE              |                       |                                     |                                     |
| 2 E1               | LED          | 120VAC<br>IN./<br>12VDC<br>OUT. | 72          | BATTERY UNIT EMERGENCY LIGHT WITH SINGLE SIDED EXIT SIGN.<br>LIGHT SOURCE_<br>1. HIGH-EFFICIENCY LED, ILLUMINATE THE GREEN RUNNING - MAN<br>2. FULLY FIELD ADJUSTABLE EMERGENCY LIGHTING HEADS ARE MR16 WHITE 12V 4W LED LAMPS.<br><u>CHARGER</u><br>FULLY AUTOMATIC ADVANCED DIAGNOSTIC MICRO-CONTROLLER. TESTS, DETECTS AND INDICATES<br>BATTERY, CHARGER CIRCUITRY, LAMPS OR LED STRIP FAILURES.<br><u>ELECTRICAL</u><br>SEALED, MAINTENANCE-FREE NICKEL-CADMIUM BATTERY, 12V 24W FOR 90 MINUTES OF EMERGENCY<br>OPERATION. SUITABLE FOR WET AND DAMP LOCATION (10^C TO 40^C)<br><u>HOUSING</u>                                                                                                                                                                                   | 4W MR16<br>LED<br>LAMP,<br>BATTERY<br>UNIT<br>12 VDC, 72W                                    | N/A                              | 1. EMERGI-LITE, MR1 LED SERIES<br>2. APPROVED EQUAL                                                                                                                 | WALL MOUNT                       |                       |                                     |                                     |
| X                  | LED          | 120VAC                          | 60          | NEMA-4X RATED HOUSING. FACEPLATES ARE MOLDED OF HEAVY-DUTY VANDAL-RESISTANT<br>POLYCARBONATE, RUGGED UV-STABILIZED THERMOPLASTIC BODY, STAINLESS<br>STEEL TAMPER-PROOF SCREWS. WHITE COLOR<br>BATTERY UNIT EMERGENCY LIGHT WITH SINGLE SIDED EXIT SIGN. RATED FOR CLASS 1, DIV 2 GROUPS B, C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3W LED                                                                                       | N/A                              | 1. EMERGI-LITE, EHC SERIES                                                                                                                                          | WALL MOUNT                       |                       |                                     |                                     |
| χ<br>Ε2            |              | IN./<br>12VDC<br>OUT.           |             | <ul> <li>&amp; D (DRY WELL)</li> <li><u>FEATURE:</u></li> <li>SEALED, VANDAL-RESISTANT FACEPLATE OF POLYCARBONATE</li> <li>TWO PICTOGRAM FILMS FOR DIRECTION SELECTION</li> <li>TWO HIGH-PERFORMANCE MR16 LED LAMPS SHIELDED BY A CLEAR POLYCARBONATE COVER</li> <li>TWO 5W LED EMERGENCY LIGHTS</li> <li>SEALED, MAINTENANCE-FREE LEAD-CALCIUM BATTERIES</li> <li>REMOTE LOAD CAPACITY</li> <li>SUITABLE FOR CLASS I DIVISION 2, GROUPS A, B, C AND D</li> <li>EXIT SIGN USES A LED LAMP ILLUMINATE THE GREEN RUNNING MAN.</li> </ul>                                                                                                                                                                                                                                               | LAMP,<br>BATTERY<br>UNIT<br>12 VDC, 60W                                                      |                                  | 2. APPROVED EQUAL                                                                                                                                                   |                                  |                       |                                     |                                     |
| 2 E3               | LED          | 120VAC<br>IN./<br>12VDC<br>OUT. | 200         | <ul> <li>BATTERY UNIT EMERGENCY LIGHT WITH SINGLE SIDED OR DOUBLE SIDED EXIT SIGN. RATED FOR CLASS 1, DIV. 1 &amp; 2, GROUPS C &amp; D</li> <li><u>FEATURE</u></li> <li>1. DIE-CAST ALUMINUM BODY WITH GREY EPOXY POWDER COAT FINISH. CLEAR, IMPACT AND HEAT RESISTANT PRISMATIC GLASS GLOBE</li> <li>2. LONG-LIFE, MAINTENANCE-FREE LEAD-CALCIUM BATTERY</li> <li>3. BATTERY CHARGER IS CURRENT LIMITED, TEMPERATURE COMPENSATED, SHORT-CIRCUIT PROOF AND REVERSE POLARITY PROTECTED</li> <li>4. EMERGENCY HEADS WITH TWIN LAMP DESIGN</li> <li>5. SELF-POWERED EXIT (COMBO) INCLUDES A TRANSFER CIRCUIT TO DRIVE FOUR REMOTE LED-BASED REMOTE EXIT SIGNS</li> <li>6. EXIT SIGN USES A LED LAMP ILLUMINATE THE GREEN RUNNING MAN.</li> <li>7. EXIT SIGN IS CSA CERTIFIED</li> </ul> | 4W LED<br>EXIT SIGN,<br>20W<br>HALONGEN,<br>BATTER UNIT<br>12 VDC,<br>200W<br>FOR 90<br>MINS | N/A                              | 1. LUMACELL. RG-X SERIES<br>2. APPROVED EQUAL                                                                                                                       | WALL MOUNT                       |                       |                                     |                                     |
| R1<br>것소           | INC./<br>LED | 12VDC                           | ; 8         | FEATURES<br>1. DOUBLE LAMP CONFIGURATIONS WITH 12V 4W MR16 WHITE LED LAMP.<br>2. FULLY GASKETED CAST ALUMINUM BACK PLATE WITH A CLEAR UV AND IMPACT RESISTANT COVER.<br>3. WHITE COLOR.<br>4. TAMPER-PROOF SCREWS AND BIT.<br>5. INSTALLATION ON A FOUR-INCH OCTAGONAL BOX<br>6. NEMA 4X RATED.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2X4W<br>MRI16<br>LED                                                                         | N/A                              | 1. EMERGI-LITE, EF39P SERIES<br>2. APPROVED EQUAL                                                                                                                   | WALL MOUNT                       | 1 ISSUED I<br>NO. DES | Ö <b>R 60% REVIEW</b><br>SC RIPTION | 2021/07/30 MM IT<br>Date drawn Chkd |
| R2<br>것스           | LED          | 12VDC                           | 8           | REMOTE LUMINAIRE ASSEMBLY WITH TWO 3W LED LAMP HEADS, RATED FOR CASS 1, DIV. 2<br>GROUPS B, C & D (DRY WELL).<br>1. REMOTE LUMINAIRE: TWO 12VDC 3W LED LAMP HEADS<br>2. MATERIAL & FINISH: REMOTE LUMINAIRE ENCLOSURE - FIBERGL ASS-REINFORCED POLYESTER<br>3. LED LAMP HEAD ASSEMBLY - EPOXY POWDER COATED STAINLESS STEEL<br>4. EXTERIOR HARDWARE - NYLON, PLASTIC COATED, AND STAINLESS STEEL<br>5. COVER GASKET - HYPALON SYNTHETIC RUBBER                                                                                                                                                                                                                                                                                                                                       | 2X4W                                                                                         | N/A                              | 1. LED N2LPS LIGHT -PARK N2RF-1222<br>2. APPROVED EQUAL                                                                                                             | WALL MOUNT                       | Z                     | J                                   | Halifax<br>Water                    |
| <b>R3</b><br>것으    | INC.         | 12VDC                           | 20          | 12V, 20W, EXPLOSION-PROOF FIXTURES, C/W TWO QUARTZ HALOGEN LAMPS. RATED FOR CLASS 1, DIV.<br>1, GROUPS C & D                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2X10W                                                                                        | N/A                              | 1. LUMACELL RG-X SERIES<br>2. APPROVED EQUAL                                                                                                                        | WALL MOUNT                       |                       | ENGINEF                             | CRING<br>4FNT                       |



PROJECT:

# **BISSETT LAKE WWPS**

ELECTRICAL SCHEMATIC

| VG NO.     | F1     | 06                      |
|------------|--------|-------------------------|
| ROJECT NO. | 201-08 | 8639-00                 |
| PROVED     |        | DATE                    |
| hecked MN  |        |                         |
| rawn Sl    |        | <sup>scale</sup> N.T.S. |
|            |        |                         |
|            |        |                         |

39-00 



E-STOP LOCAL REMOTE RESET CR2 CR3 \_\_\_\_ CR4 CR5 CR6

CLASS 1, ZONE 2





| LEGEND:     |                                       |
|-------------|---------------------------------------|
|             | TERMINAL BLOCK IN LOCAL CONTROL PANEL |
|             | TERMINAL BLOCK IN RPU PANEL           |
| $\boxtimes$ | TERMINAL BLOCK IN MCC OR VFD PANEL    |
| •           | TERMINAL IN FIELD                     |
|             | FIELD WIRING                          |
|             | WIRING INSIDE MCC OR CONTROL PANEL    |
|             | CLASSIFIED AREA OUTLINE               |



HRWC – A1 <u>DWG FILENAME:</u> BIM 360://201-08639-00 – Bissett Lake and Autoport SPS – R20/201-08639-MEP-BSL\_APSPS\_v20.rvt









| ENTRE                                             | AIR AIR HEADER EIF                                                  | R EMERGEN                   | CY INTAKE<br>ATION | SAL S           |                            | CPP CONCF                     | RETE PRESSURE PIPE                    |                     |                                       |                                   |             |                       |              |
|---------------------------------------------------|---------------------------------------------------------------------|-----------------------------|--------------------|-----------------|----------------------------|-------------------------------|---------------------------------------|---------------------|---------------------------------------|-----------------------------------|-------------|-----------------------|--------------|
|                                                   | BWS BACKWASH SUPPLY<br>BWW BACKWASH WASTE FL                        | W FLOCCULA                  | ATED WATER         | SAM S           | SODIUM BISULPHITE          | CS CARBC                      | N STEEL<br>R                          |                     |                                       | CYLINDER                          |             |                       |              |
| Р                                                 | CIA CITRIC ACID FT                                                  | W FILTERED                  | TO WASTE           | SHC S           |                            | DI DUCTII                     | E IRON                                |                     | (ELECTRIC)                            | SPRING - OPPOSED<br>SINGLE ACTING |             |                       |              |
|                                                   | CIPW CIP WASTE MC                                                   | CW MEMBRAN                  | E CLEANING         | SMF S           | SECONDARY MEMBRANE         | FRP FIBERC                    | GLASS REINFORCED                      |                     |                                       |                                   |             |                       |              |
| 1P                                                | CLG CHLORINE GAS                                                    | WATER<br>• OVERFLOV         | N                  | F<br>SUL S      | EED<br>SUILPHRIC ACID      | PE POLYE                      |                                       | S S                 | SOLENOID                              | CYLINDER SPRING - OPPOSED         |             |                       |              |
| RITE PUMP                                         | COA COAGULANT PE                                                    | RM MEMBRAN                  | E PERMEATE         | SW S            | SERVICE WATER              | PVDF POLYV                    | INYLIDENE FLUORIDE                    |                     |                                       | DOUBLE ACTING                     |             |                       |              |
|                                                   | DR DRAIN PC                                                         | OTW POTABLE V<br>V RAW WATE | WATER<br>ER        | TSC T           | RAVELLING SCREEN WASH      | SS STAINL                     | ESS STEEL                             |                     | DIAPHRAGM                             |                                   |             |                       |              |
| OR                                                |                                                                     |                             |                    | V V             | /ENT                       |                               | N TOBING                              |                     | SPRING - OPPOSED<br>(PNEUMATIC)       |                                   | key plan    | 4:                    |              |
|                                                   |                                                                     |                             | VA                 | LVE SYMBOL      | .S                         |                               |                                       |                     | NSTRUMENT LINE SYMBOI                 | S                                 |             |                       |              |
|                                                   |                                                                     |                             |                    |                 |                            |                               |                                       |                     |                                       |                                   | -           |                       |              |
|                                                   |                                                                     |                             |                    |                 |                            |                               |                                       |                     | CONNEC                                | TION TO PROCESS                   |             |                       |              |
| IR RELEASE VALVE                                  | GATE VALVE                                                          |                             | GAUGE OR           | ROOT VALVE      |                            | BACKFLOW PRE                  | VALVE<br>VENTER                       |                     |                                       |                                   |             |                       |              |
|                                                   |                                                                     |                             | KNIFE GATE         | VALVE           |                            |                               |                                       |                     |                                       | CAL SIGNAL (GENERAL)              |             |                       |              |
| OTAMETER                                          | BALL VALVE                                                          | _                           |                    |                 |                            | HYDRAULICALLY<br>PUMP CONTROL | OPERATED<br>-CHECK VALVE              |                     | HYDRAU                                | LIC SIGNAL                        |             |                       |              |
|                                                   |                                                                     | ΗŻΗ                         | BALANCING          | COCK            |                            | <b>x</b>                      |                                       |                     | CAPILLA                               | RY TUBE                           |             |                       |              |
|                                                   | BUTTERFLY                                                           |                             | CIRCUIT BA         | LANCING VALVI   | E CV                       |                               |                                       |                     | SONIC S                               | IGNAL                             |             |                       |              |
|                                                   |                                                                     |                             | THERMOST           |                 |                            |                               | JAL LINKAGE                           | -0-                 | -o-o- SOFTWA                          | RE OR DATA LINK SIGNAL            |             |                       |              |
|                                                   | GLOBE VALVE                                                         |                             | CONTROLLE          | ED VALVE        |                            | BACK REGULAT                  | OR                                    |                     | MECHAN                                | IICAL LINK                        |             |                       |              |
|                                                   |                                                                     |                             | NEEDLE VA          | ALVE            |                            | SELF CONTAINE                 | U.                                    |                     |                                       | DNNECT                            |             |                       |              |
|                                                   |                                                                     |                             | DOUBI F I F        | EAF             |                            | BACK PRESSUR                  | E REGULATOR                           |                     |                                       |                                   |             |                       |              |
|                                                   |                                                                     |                             | CHECK VAI          | LVE             |                            | WITH EXTERNAL                 | _ PRESURE                             |                     |                                       |                                   |             |                       |              |
|                                                   |                                                                     |                             | CHECK VAI          | LVE             |                            |                               |                                       |                     |                                       |                                   |             |                       |              |
|                                                   |                                                                     |                             | DEFLECTO           | R CHECK VALV    | E _                        | RELIEF VALVE                  | VACUUM                                |                     | PRIMARY P                             | ROCESS FLOW                       |             |                       |              |
|                                                   | >< WEIR                                                             | Kol                         | BALL CHEC          | K VALVE         |                            | $\langle \rangle$             |                                       |                     | SECONDAF                              | Y PROCESS FLOW                    |             |                       |              |
|                                                   |                                                                     |                             |                    |                 |                            |                               | VALVE                                 |                     | EXISTING F                            | IPING AND EQUIPMENT               |             |                       |              |
|                                                   | STOP LOG GATES (SLG)                                                | Ţ                           | MUD VALV           | E               |                            | $\mathbf{i}$                  |                                       |                     | EXISTING F                            | IPING AND EQUIPMENT               |             |                       |              |
|                                                   |                                                                     |                             |                    |                 |                            | SURGE RELIEF                  | VALVE                                 |                     | EXISTING F                            |                                   |             |                       |              |
|                                                   |                                                                     |                             | LOADED RI          |                 |                            |                               |                                       |                     | TO BE REM                             | OVED                              |             |                       |              |
|                                                   |                                                                     | FX                          | )                  |                 |                            |                               |                                       | 2                   | NN/XX     FLOW STREET                 | EAM NO. NN<br>NO. XX              |             |                       |              |
|                                                   | (TRIPLE DUTY)                                                       |                             | VANES              | AIGHTENING      |                            | & SOLENOID                    |                                       |                     |                                       | NN                                |             |                       |              |
|                                                   |                                                                     |                             |                    |                 |                            | SHUT-OFF VALV                 | E                                     | $\sum NN/2$         | FROM SHE                              | ET NO. XX                         |             |                       |              |
|                                                   | PIPING IDENTIFICA                                                   | TION                        |                    |                 |                            | INST                          | RUMENT IDENTIFIC                      | ATION TABLE         |                                       |                                   |             |                       |              |
|                                                   | 200 SS FTW                                                          |                             |                    |                 |                            |                               |                                       |                     |                                       |                                   |             |                       |              |
|                                                   |                                                                     |                             |                    |                 |                            |                               |                                       |                     |                                       |                                   |             |                       |              |
|                                                   |                                                                     | (                           |                    | MEAS            | FIRST LETTER               |                               | READC                                 | SUCCEEDIN<br>OUT OR | NG LETTERS                            |                                   |             |                       |              |
|                                                   |                                                                     | 3                           | LETTER             | INITIATING      | VARIABLE                   | MODIFIER                      | PASSIVE FU                            | NCTION              | OUTPUT FUNCTION                       | MODIFIER                          |             |                       |              |
|                                                   |                                                                     |                             | B                  | BURNER, (       | COMBUSTION                 |                               | AL                                    |                     | CLOSE, STOP, DECREASE (1)             | USER CHOICE (1)                   |             |                       |              |
|                                                   | INSTRUMENTATION                                                     |                             | C                  | USER CH         | IOICE (1)                  |                               |                                       |                     | CONTROL                               |                                   |             |                       |              |
|                                                   | TAG IDENTIFICATION                                                  |                             | E                  | VC              | DLTAGE                     |                               | SENSOR (PRIM                          | ARY ELEMENT)        |                                       |                                   |             |                       |              |
|                                                   |                                                                     | R(S)                        | F<br>G             | FLC<br>USER CH  | OW RATE                    | RATIO                         | GLASS GAUGE. \                        | /IEWING DEVICE      | GATE                                  | FAIL (1)                          |             |                       |              |
|                                                   |                                                                     |                             | Н                  | HAND            | (MANUAL)                   |                               | · · · · · · · · · · · · · · · · · · · |                     |                                       | HIGH (OPENED)                     |             |                       |              |
|                                                   |                                                                     | DN                          | J                  | CURRENT         | (ELECTRICAL) OWER          | SCAN                          | INDI                                  | CATE                |                                       |                                   |             |                       |              |
|                                                   |                                                                     |                             | K                  | TIME, TIM       | IE SCHEDULE                | IE RATE OF CHANG              | GE                                    | СПТ                 |                                       |                                   |             |                       |              |
|                                                   | TAG NUMBER TO BE BASED ON<br>EQUIPMENT CODING SYSTEM                | NUMBER.                     | M                  | MOTOR,          | MOTION (1)                 | MOMENTARY                     |                                       | Gi i i              | MOTOR (1)                             | MIDDLE OR INTERMEDIATE            |             |                       |              |
| ТWO                                               | SEE SPECIAL PROJECTS DESIG<br>MANUAL FOR DETAILS.                   | άN                          | N                  |                 | JE                         |                               | ORIFICE RE                            | STRICTION           |                                       | ON OR OPERATE (1)                 |             | ISSUED FOR 60% REVIEW | 2021/07/3    |
|                                                   |                                                                     |                             | P                  | PRESSU          | RE, VACUUM                 |                               | POINT (TEST) (                        | CONNECTION          | PUMP (1)                              |                                   | NO.         | DESCRIPTION           | DATE         |
|                                                   |                                                                     |                             | Q                  | QUA             | NTITY (2) INT              | EGRATE, TOTALIZ               | E BEC                                 | COBD                |                                       |                                   |             |                       |              |
|                                                   |                                                                     |                             | S                  | SPEED, F        | FREQUENCY                  | SAFETY                        |                                       |                     | SWITCH                                |                                   |             | TT                    |              |
|                                                   |                                                                     |                             | T<br>U             | TEMF<br>MULTIVA | PERATURE                   |                               | MULTIFUN                              | ICTION (2)          | TRANSMIT<br>MULTIFUNCTION (2)         | MULTIFUNCTION (2)                 | 1           |                       | Hal          |
| SIDUAL                                            |                                                                     |                             | V                  |                 | ECHANICAL ANALYSIS         |                               |                                       |                     | VALVE, DAMPER, LOUVER                 |                                   |             |                       | Wot          |
|                                                   |                                                                     |                             | X                  |                 | SSIFIED (2)                | X AXIS                        |                                       | SIFIED (2)          | UNCLASSIFIED (2)                      | UNCLASSIFIED (2)                  |             |                       | vval         |
| DSIVE LIMIT<br>TROL CENTRE<br>OR SUSPENDED SOLIDS | GENERAL NOTES                                                       |                             | Y                  | EVENT, STA      |                            | Y AXIS                        |                                       |                     | RELAY, COMPUTE, CONVERT               |                                   |             | ENGINE                | ERING        |
| TY)                                               |                                                                     |                             |                    | POS             |                            |                               |                                       |                     | UNCLASSIFIED FINAL<br>CONTROL ELEMENT |                                   |             | DEPART                | MENT         |
|                                                   |                                                                     |                             | (1) USER':         | S CHOICE        | I                          |                               | I                                     |                     |                                       |                                   | PROJECT:    |                       |              |
|                                                   | NOT ALL SYMBOLS AND ABBREVIATIC<br>SHOWN ARE LISED IN THIS CONTRACT | RE.<br>INS                  | (2) WHEN           | USED, SYMBOI    | L OR SIGNAL LINE IS ANNOTA | TED.                          |                                       |                     |                                       |                                   |             | BISSETTL              | AKE WWF      |
|                                                   |                                                                     |                             |                    |                 |                            |                               |                                       |                     |                                       |                                   | I&C         | - PROCESS & INST      | RUMENTATION  |
|                                                   |                                                                     |                             |                    |                 |                            |                               |                                       |                     |                                       |                                   |             |                       |              |
|                                                   |                                                                     |                             |                    |                 |                            |                               |                                       |                     |                                       |                                   | DRAWN       |                       | scale N.T.S. |
|                                                   |                                                                     |                             |                    |                 |                            |                               |                                       |                     |                                       |                                   | CHECKED MN  |                       |              |
|                                                   |                                                                     |                             |                    |                 |                            |                               |                                       |                     |                                       |                                   | PROJECT NO. |                       |              |
|                                                   |                                                                     |                             |                    |                 |                            |                               |                                       |                     |                                       |                                   |             | 201-08                | 639-00       |
|                                                   |                                                                     |                             |                    |                 |                            |                               |                                       |                     |                                       |                                   | DING NU.    |                       | ()1          |

| TION        | OUTPUT FUNCTION                                            | MODIFIER               |
|-------------|------------------------------------------------------------|------------------------|
| М           |                                                            |                        |
|             | CLOSE, STOP, DECREASE (1)                                  | USER CHOICE (1)        |
|             | CONTROL                                                    |                        |
|             | OPEN, START, INCREASE (1)                                  |                        |
| Y ELEMENT)  |                                                            |                        |
|             |                                                            | FAIL (1)               |
| WING DEVICE | GATE                                                       |                        |
|             |                                                            | HIGH (OPENED)          |
| TE          |                                                            |                        |
|             |                                                            |                        |
|             | CONTROL STATION                                            |                        |
| т           | LAMP (1)                                                   | LOW (CLOSED)           |
|             | MOTOR (1)                                                  | MIDDLE OR INTERMEDIATE |
|             |                                                            | ON OR OPERATE (1)      |
| RICTION     |                                                            |                        |
| NNECTION    | PUMP (1)                                                   |                        |
|             |                                                            |                        |
| RD          |                                                            |                        |
|             | SWITCH                                                     |                        |
|             | TRANSMIT                                                   |                        |
| ION (2)     | MULTIFUNCTION (2)                                          | MULTIFUNCTION (2)      |
|             | VALVE, DAMPER, LOUVER                                      |                        |
| L           |                                                            |                        |
| IED (2)     | UNCLASSIFIED (2)                                           | UNCLASSIFIED (2)       |
|             | RELAY, COMPUTE, CONVERT                                    |                        |
|             | DRIVER, ACTUATOR,<br>UNCLASSIFIED FINAL<br>CONTROL ELEMENT |                        |





# PS

# N LEGEND

1001













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HRWC - A1 <u>DWG FILENAME:</u> BIM 360://201-08639-00 - Bissett Lake and Autoport SPS - R20/201-08639-MEP-BSL\_APSPS\_v20.rvt

INTERNALLY SOURCED 120VAC - RED

TWISTED PAIR "+" - WHITE TWISTED PAIR "-" - BLACK

EXTERNALLY SOURCED 120VAC, INCLUDING NEUTRAL - YELLOW



<u>BACKPLATE</u> <u>VIEW</u>

# NOTES:

- 1. CONDUITS ARE NOT PERMITTED TO ENTER THE TOP OF THE PANEL WITHOUT APPROVAL FROM THE OWNER. BOTTOM ENTRY OR SIDE ENTRY IS REQUIRED.
- 2. INTRINSICALLY SAFE WIRING SHALL ENTER THE PANEL ON THE SIDE OF THE PANEL. INTRINSICALLY SAFE WIRING IS TO REMAIN ISOLATED FROM ALL OTHER PANEL AND FIELD WIRING.
- 3. PANEL SIZE IS MINIMUM REQUIRED. PROVIDE FINAL PANEL DESIGN TO SUIT APPLICATION.
- 4. THE CONTROL PANEL IS TO BE SUPPLIED WITH ALL COMMUNICATION PATCH CABLING INSTALLED (ETHERNET, USB, ETC.)
- 5. INSTALL INTRINSICALLY SAFE RELAYS IN DEDICATED AREA WITHIN THE CONTROL PANEL.PROVIDE DEDICATED PANEL DUCTS AND CONDUIT ENTRY POINTS FOR INTRINSICALLY SAFE FIELD WIRING.INTRINSICALLY SAFE WIRING SHALL BE KEPT PHYSICALLY SEPARATE FROM NON-INTRINSICALLY SAFE WIRING.

| NAME PLATE<br>LEGEND |                             |           |           |  |  |  |  |
|----------------------|-----------------------------|-----------|-----------|--|--|--|--|
|                      | LINE<br>1                   | LINE<br>2 | LINE<br>3 |  |  |  |  |
| NP1                  | INSTRUMENT<br>CONTROL PANEL | ОК        |           |  |  |  |  |
| NP2                  | SYSTEM                      | ОК        |           |  |  |  |  |
| NP3                  | SCADA                       | ALARM     |           |  |  |  |  |
| NP4                  | BACKUP                      | MODE      |           |  |  |  |  |
| NP5                  | RESET                       | BACKUP    | MODE      |  |  |  |  |

#

| ITEM                                       | 1 |                                   |                |                 |         |      |
|--------------------------------------------|---|-----------------------------------|----------------|-----------------|---------|------|
| DESCRIPTION<br>PACTLOGIX 1769-L36ERM       | - | kfy plan                          |                |                 |         |      |
| PACTLOGIX POWER SUPPLY                     | - |                                   |                |                 |         |      |
| PACTLOGIX I/O CARDS                        |   |                                   |                |                 |         |      |
| BUS RTU COMMUNICATION MODULE               |   |                                   |                |                 |         |      |
| BREAKER                                    |   |                                   |                |                 |         |      |
| D KNIFE SWITCH DISCONNECTS WITH BLOWN FUSE |   |                                   |                |                 |         |      |
| ATOR<br>OWER SUPPLY                        |   |                                   |                |                 |         |      |
| AL OUTPUT RELAYS                           |   |                                   |                |                 |         |      |
| RS                                         |   |                                   |                |                 |         |      |
| ER FAIL RELAY                              | - |                                   |                |                 |         |      |
| IMPLEX RECEPTACLE FOR UPS POWER            | - |                                   |                |                 |         |      |
| EX UTILITY RECEPTACLE                      | - |                                   |                |                 |         |      |
| RESCENT LIGHT                              |   |                                   |                |                 |         |      |
| LIGHT SWITCH                               |   |                                   |                |                 |         |      |
| DE BY 3" DEEP WIRE WAY                     |   |                                   |                |                 |         |      |
|                                            |   |                                   |                |                 |         |      |
| C REDUNDANCY MODULE                        |   |                                   |                |                 |         |      |
| E SUPPRESSOR                               |   |                                   |                |                 |         |      |
| BYPASS POWER DISTRIBUTION UNIT             |   |                                   |                |                 |         |      |
| BINATION 120VAC/RJ45 RECEPTACLE            |   |                                   |                |                 |         |      |
| AC CIRCUIT BREAKERS                        |   |                                   |                |                 |         |      |
| TED GROUND                                 |   |                                   |                |                 |         |      |
| TRICAL GROUND                              |   |                                   |                |                 |         |      |
| BYPASS RELAY (15A RATED CONTACTS)          |   |                                   |                |                 |         |      |
| AREA OUTLET/COPPER PATCH PANEL             |   |                                   |                |                 |         |      |
| ING LAPTOP TRAY                            |   |                                   |                |                 |         |      |
| L FAN                                      |   |                                   |                |                 |         |      |
| NT LOCKING DOOR HANDLE                     |   |                                   |                |                 |         |      |
| ATOR INTERFACE                             |   |                                   |                |                 |         |      |
| /ING POCKET                                |   |                                   |                |                 |         |      |
| NSICALLY SAFE RELAY                        |   |                                   |                | //              |         |      |
| ONTROL RELAYS                              |   | NO.                               | DESCRIPTION    | DATE            | DRAWN   | CHKD |
| EM OK PILOT LIGHT                          |   |                                   |                |                 |         |      |
| A ALARM PILOT LIGHT                        |   | 1                                 |                |                 | ifor    | 7    |
| ERATURE TRANSMITTER                        |   |                                   |                | Indi            |         | X    |
| C CIRCUIT BREAKERS                         |   |                                   |                | Wat             | ler     |      |
| UP MODE PILOT LIGHT                        |   |                                   | ENGIN<br>DEPAR | EERING<br>TMENT |         |      |
| UP MODE RESET PUSH BUTTON                  |   | PROJECT:                          |                | 1 1V1 12 1 N 1  |         |      |
|                                            | ] |                                   | BISSETT L      | AKE WWF         | PS      |      |
|                                            |   | I&C-                              | TYPICAL DOUBL  | E DOOR CONTR    | OL PANE | L    |
|                                            |   |                                   |                | 1               |         |      |
|                                            |   | DRAWN SL<br>Checked <sub>MN</sub> |                | SCALE N.T.S.    |         |      |
|                                            |   |                                   |                | DATE            |         |      |
|                                            |   | FRUJECT NO.                       | 201-08         | 8639-00         |         |      |

DWG NO.

1005



|                                      | PLC |  |                                                                                                                       |
|--------------------------------------|-----|--|-----------------------------------------------------------------------------------------------------------------------|
| TO<br>GND<br>BUS                     |     |  | KEY PLAN:                                                                                                             |
|                                      |     |  |                                                                                                                       |
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| LC CONTROL                           |     |  | Image: 1     ISSUED FOR 60% REVIEW     2021/07/30     MM     IT       NO.     DESCRIPTION     DATE     DRAWN     CHKD |
| FD OR CONTROL PAN                    | EL  |  | Halifax<br>Water                                                                                                      |
| ILY. PROVIDE THE<br>EQUIRED BY<br>ND |     |  | ENGINEERING<br>DEPARTMENT                                                                                             |
| OUTPUTS. FOLLOW<br>TRUCTIONS.        |     |  | BISSETT LAKE WWPS                                                                                                     |
| WIRED FAIL SAFE.                     |     |  | I & C - TYPICAL POWER DISTRIBUTION CONTROL PANEL                                                                      |
|                                      |     |  | DRAWN SL SCALE N.T.S.                                                                                                 |
|                                      |     |  | MIN<br>APPROVED DATE<br>PROJECT NO                                                                                    |
|                                      |     |  | 201-08639-00<br>DWG NO.                                                                                               |
|                                      |     |  | 1006                                                                                                                  |

#### COMMUNICATIONS RTU TO BE SUPPLIED AND INSTALLED BY HALIFAX WATER. CONTRACTOR TO CO-ORDINATE WITH HALIFAX WATER FOR INSTALLATION (24" X 30" X 10")



# NOTES:

- 1. PROVIDE CONDUIT AND CABLING BETWEEN ICP AND
- COMMUNICATIONS RTU.
- 2. PROVIDE CAPPED CONDUIT FROM RTU AND ROOF
- PENETRATION FOR ANTENNA INSTALLATION.
- 3. COORDINATE INSTALLATION OF HALIFAX WATER WAN
- EQUIPMENT AND ANTENNA WITH HALIFAX WATER



| NA TO BE SUPPLIED BY HALIFAX WATER.<br>ACTOR TO INSTALL AND PROVIDE<br>OPRIATE CONDUIT, CABLE AND ROOF<br>RATION AND CO-ORDINATED WITH HALIFAX<br>& FOR ANTENNA AND CABLE INSTALLATION |                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| ALIFAX REGIONAL<br>ER COMMISSION                                                                                                                                                       | KEY PLAN:                                                                                                      |
|                                                                                                                                                                                        |                                                                                                                |
| X                                                                                                                                                                                      |                                                                                                                |
|                                                                                                                                                                                        |                                                                                                                |
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| PANEL<br>A                                                                                                                                                                             |                                                                                                                |
|                                                                                                                                                                                        |                                                                                                                |
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|                                                                                                                                                                                        | Halifax<br>Water                                                                                               |
|                                                                                                                                                                                        | ENGINEERING<br>DEPARTMENT<br>PROJECT:<br>BISSETT LAKE WWPS                                                     |
|                                                                                                                                                                                        | I & C - RTU AND CONTROL ARCHITECTURE                                                                           |
|                                                                                                                                                                                        | SL     SCALL     N.T.S.       CHECKED     MN       APPROVED     DATE       PROJECT NO.     201-08639-00        |
|                                                                                                                                                                                        | DWG NO. 1007                                                                                                   |



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# D LIMITED REGULATED MATERIALS SURVEY

# LIMITED REGULATED MATERIALS SURVEY

# BISSETT LAKE PUMPING STATION, 54 ATTWOOD CRESCENT, DARTMOUTH, NOVA SCOTIA

HALIFAX WATER

FEBRUARY 2, 2021



# wsp

# LIMITED REGULATED MATERIALS SURVEY

BISSETT LAKE PUMPING STATION, 54 ATTWOOD CRESCENT, DARTMOUTH, NOVA SCOTIA

HALIFAX WATER

FINAL REPORT WSP PROJECT NO.: 201-08639 CLIENT PROJECT NO.: P21.2020 DATE: FEBRUARY 2, 2021

WSP 1 SPECTACLE LAKE DRIVE DARTMOUTH, NS, CANADA B3B 1X7

T +1 902-935-9955 F +1 902-835-1645 WSP.COM



February 2, 2021

Halifax Water 450 Cowie Hill Road P.O. Box 8388 RPO CSC Halifax, NS, B3K 5M1 Telephone: 902-476-3520

Attention: Greg Rice

#### Subject: Limited Regulated Materials Survey – Bissett Lake Pumping Station, 54 Attwood Crescent, Dartmouth, NS

WSP Canada Inc. (WSP) is pleased to present the results of the Limited Regulated Materials Survey (RMS) conducted at the Bissett Lake Pumping Station building Mechanical Shop located at 54 Attwood Crescent in Dartmouth, Nova Scotia. We trust that this information meets your current requirements. If you have any questions, please do not hesitate to contact us.

Yours sincerely,

Kallyn DeGrace Environmental Engineering Technologist - Atlantic Environment

Lee Hyne

Lee Hynes, P.Eng., M.A.Sc. Project Manager – Atlantic Environment

WSP ref.: 201-08639

This report was prepared by WSP Canada Inc. for the account of HALIFAX WATER, in accordance with the professional services agreement. The disclosure of any information contained in this report is the sole responsibility of the intended recipient. The material in it reflects WSP's best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This limitations statement is considered part of this report.

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1 Spectacle Lake Drive Dartmouth, NS, Canada B3B 1X7

T: +1 902-835-9955 F: +1 902-835-1645 wsp.com

# EXECUTIVE SUMMARY

WSP Canada Inc. (WSP) was retained by Halifax Water to complete a Limited Regulated Materials Survey of the Bissett Lake Pumping Station building, located at 54 Attwood Crescent, Dartmouth, Nova Scotia.

The purpose of this survey was to complete a sampling program in the Site Building to determine the types and quantities of regulated materials that may be encountered during planned renovations to the building associated with an upcoming pump system upgrade.

A total of fifteen (15) asbestos samples and six (6) lead samples were collected from the Site and sent to EMSL for laboratory analysis. A summary of the results of WSP's sampling program is presented below:

#### ASBESTOS

Asbestos was not identified in any of the five building materials tested during the survey.

#### LEAD

#### Low-Level Lead Paint:

Lead concentrations exceeding the *Surface Coating Materials Regulations* (90 ppm) criteria but below 1,000 ppm were reported in the samples listed below. These paints are considered 'low-level lead paints' and are considered a potential health risk if disturbed. They do not require specialized disposal.

- LP4: Beige paint applied to beams, pipes and ducts in the basement on the "dry" side.
- LP6: Grey paint with blue layer underneath applied to platforms in the equipment room on the main floor.

#### **Lead-Containing Paint:**

The Code of Practice defines a "Lead-Containing Material" as a material containing an inorganic lead concentration exceeding 0.1% (1,000 ppm). Sample LP1 of white paint with orange, yellow and red layers underneath applied to one interior wall on the "dry" side exceeded the 1,000 ppm criteria and is considered lead-containing paint (448 ft<sup>2</sup>).

Lead-containing materials can be disposed of at Nova Scotia Landfills if the total bulk concentrations and the leachate concentrations do not exceed 1,000 ppm and 5 mg/L. However, if total lead concentrations exceed 1,000 ppm but leachate concentrations are below 5 mg/L, these materials can be disposed of at and approved construction and demolition (C&D) waste facility. Should total lead concentrations exceed 1,000 ppm and leachate concentrations exceed 5 mg/L, these materials will require specialized (non-landfill) disposal at a licensed hazardous waste facility if disturbed/removed. Currently there are no licensed hazardous waste disposal facilities available within Nova Scotia.

#### **RECOMMENDATIONS**

#### GENERAL

- Provide a copy of this report to all contractors who will bid on future renovation work for the areas investigated as part of this assessment.
- Retain qualified contractors to remove and dispose of identified, presumed, and potentially hazardous materials as per provincial and federal acts, regulations and codes of practice.
- Require all employees and contractors who may disturb hazardous materials wear appropriate Personal Protective Equipment.
- Require that contractors follow procedures to minimize the generation of dust which may contain asbestos, lead or other hazardous substances.

#### LEAD

- Materials with lead paint concentrations exceeding 1,000 mg/kg (identified above) are in poor condition (damaged, flaking/peeling) and should be removed by a qualified contractor. Lead leachate sampling should be completed to determine appropriate handling and disposal protocols prior to removal of these materials.
- If lead-containing paints are planned to be disturbed during the renovation, it is recommended the following procedures be implemented:
  - o Non-powered hand-held tools should be utilized.
  - Washing facilities should be provided for workers disturbing lead-containing painted materials;
  - Respirators should not be necessary if all general health and safety procedures are followed. However, any worker who requests a respirator shall be provided with a respirator and be trained in its use, fit and storage;
  - o Drop sheet should be place below the work area to capture any lead-containing dust and debris.
  - Wetting of materials shall be conducted whenever possible to control dust;
  - o All lead-containing dust and debris should be cleaned up utilizing a HEPA vacuum and water.
- If 'low-level lead-containing materials' are disturbed in a non-aggressive manner (i.e. no abrasive blasting, grinding, welding, heating, etc.), it is still recommended that dust suppression and general construction health & safety measures be utilized; these include but are not limited to: not smoking, eating, drinking and chewing gum in the work area, dust suppression techniques being implemented, and facilities being made available for workers to wash hands and face.

The statements in this Executive Summary are subject to the limitations included in Appendix E of this report and are to be read in conjunction with the remainder of the report.

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# wsp

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# 1 INTRODUCTION

### 1.1 BACKGROUND

WSP Canada Inc. (WSP) was retained by Halifax Water to complete a Limited Regulated Materials Survey of the Bisset Lake Pumping Station building, located at 54 Attwood Crescent, Dartmouth, Nova Scotia.

The purpose of this survey was to complete a sampling program in the Site Building to determine the types and quantities of regulated materials that may be encountered during planned renovations to the building associated with an upcoming pump system upgrade.

### 1.2 SURVEY OBJECTIVES

The objectives of the Limited Regulated Materials Survey were to:

- Complete a sampling program in the Site Building to determine types and quantities of regulated materials that may be encountered during the planned renovation work.
- Following the completion of the survey, complete temporary repairs to sample locations (where required) to protect staff and general public from potential exposure to regulated materials.

### 1.3 SCOPE OF WORK

The scope of work for this Limited Regulated Materials Survey entailed:

- Preparation of a site-specific Health and Safety Plan.
- Collection of fifteen (15) samples of selected for asbestos analysis.
- Collection of six (6) paint samples for total lead analysis.

The survey involved limited destructive sampling (i.e. brick mortars, wall paint, pipe insulation) for identification of potential friable and non-friable asbestos-containing materials as well as lead in paint. Asbestos means any of the following fibrous silicates: actinolite, amosite, anthophyllite, chrysotile, crocidolite or tremolite. The term 'friable material' is applied to a material that when dry, can be crumbled, pulverized or powdered with moderate hand pressure. Asbestos materials that are friable have a greater potential to release airborne asbestos fibres when disturbed. Common friable asbestos-containing buildings materials used in the past include sprayed fireproofing, stucco texture coat, and thermal pipe and jacket insulation. Common non-friable asbestos containing materials include vinyl floor tiles, gasket materials, asbestos cement (Transite™) pipe, Transite™ board and asbestos textiles. These materials can however release fine dust due to deterioration or during removal that is considered friable.

# 2 METHODOLOGY

# 2.1 GENERAL SURVEY METHODOLOGY

WSP's survey sought to identify those substances defined as Dangerous Goods under the *Dangerous Good Management Regulations* under section 84 of the *Environment Act (1995)*, including: asbestos (friable and nonfriable) and lead. Building materials containing substances outlined in the *Dangerous Good Management*  *Regulations* are often referred to as Regulated Materials for the purposes of assessment and documentation of such materials; this terminology is used throughout this report.

WSP's surveyors performed a systematic survey of the site for the purposes of identifying Regulated Materials and documenting observations made about their locations, estimated quantities and respective conditions. These observations form the basis for developing the recommendations provided within this report.

In situations where asbestos-containing materials or other Regulated Materials (lead paint) are confirmed, and the material extends into a non-accessible area such as the exterior of the second level windows, it is assumed that the asbestos-containing materials are also present in these areas and will be reported as such.

# 2.2 ASBESTOS SURVEY METHODOLOGY

The surveyors inspected interior mortar as well as pipe wraps, pipe insulation, and adhesives on ductwork for the presence of friable and non-friable asbestos-containing materials (ACM). Bulk samples were collected from suspect materials (i.e. materials known as having the potential to be asbestos-containing) and analyzed to identify or confirm the presence/absence of asbestos. Asbestos samples are collected by taking a small volume of material (approximately two square centimeters in size) from either intact material or preferably from a damaged section. Three individual samples are collected to represent one homogenous material, with sample IDs referring to the number of the homogenous material being sampled followed by A, B or C to represent the individual samples from different locations (e.g. AS1-A is the first homogenous material being sampled for asbestos [AS1], and this sample is the first of 3 to be collected of this material [-A]). The collected samples were placed in zipper storage plastic bags and labelled accordingly.

The bulk samples were then submitted to an accredited, independent laboratory for analysis of asbestos content (accompanied by a chain of custody form) via United States Environmental Protection Agency (US EPA) Method EPA/600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials. For this assessment, the laboratory utilized was EMSL Analytical Inc., located at 2756 Slough Street in Mississauga, Ontario. EMSL is accredited to AIHA-LAP, LLC IHLAP 196142 by the Canadian Association for Laboratory Accreditation (CALA) and the Standards Council of Canada (SCC).

The number of bulk samples required, in order to establish whether a material is asbestos-containing according to the *Nova Scotia Occupational Health and Safety Act* code of practice, *Asbestos in the Workplace: A Guide to Assessment & Management of Asbestos in the Workplace* summarized in Table 2-1, below.

#### Table 2-1: Asbestos Bulk Material Sample Requirements

| TYPE OF MATERIAL                                                                                         | SIZE OF HOMOGENEOUS MATERIAL                              | MINIMUM # OF BULK<br>SAMPLES |
|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|------------------------------|
| Surfacing material, including without limitation<br>material that is applied to surfaces by spraying, by | Less than 90m <sup>2</sup>                                | 3                            |
| troweling or otherwise, such as acoustical plaster<br>on ceilings, fireproofing materials on structural  | 90m <sup>2</sup> or more, but less than 450m <sup>2</sup> | 5                            |
| members and plaster                                                                                      | 450m <sup>2</sup> or more                                 | 7                            |
| Thermal insulation, except as described below                                                            | Any size                                                  | 3                            |
| Thermal insulation patch                                                                                 | Less than 2m or 0.5m <sup>2</sup>                         | 1                            |
| Other material                                                                                           | Any size                                                  | 3                            |

In accordance with the analysis techniques required by the Nova Scotia Occupational Health and Safety Act, where layered materials are present, subsamples are taken from each individual or discrete layer and each subsample is then treated as a discrete sample.

A total of fifteen (15) samples were collected from five (5) homogenous materials and submitted for asbestos analysis as part of this survey.

### 2.3 LEAD SURVEY METHODOLOGY

Bulk paint samples (paint chips) were collected from interior walls, beams, floors, and platforms. Samples were collected with the aid of a thin-bladed knife and a paint scraper, each of which were cleaned prior to each sampling event. WSP's surveyors selected sample locations where it appeared that the paint application was most representative of all areas on which it was applied. Each paint chip sample was placed in a clear bag with a tight closure, uniquely labelled and then placed in a second, similar bag. A chain of custody form was completed and accompanied the bulk samples to EMSL Analytical Inc. for analysis of lead content. Lead analysis was performed following ASTM Method, ASTM D3335-85A "*Standard Method to Test for Low Concentrations of Lead in Paint by Atomic Absorption Spectrophotometry*".

A total of six (6) lead paint samples were collected for analysis.

# 3 SITE OVERVIEW

### 3.1 SITE DESCRIPTION

The subject Site is located at 54 Attwood Crescent in a subdivision in Colby Village, Dartmouth, Nova Scotia. The Site is occupied by a one-storey stone building with a basement extending two storeys below ground. One side of the building is considered to be the "dry" side of the building, and the basement currently houses 3 pumps and associated pipework. The other side of the building is considered to be the "wet" side of the building, and is an unfinished basement with submerged pumps that is not expected to be impacted by the upgrading activities at the Site. The main floor of the building contains a kitchenette, a bathroom, an equipment room, and a generator room.

The floors within the building consisted of bare or painted concrete. Walls were generally constructed of concrete, with some areas containing concrete block walls. Ceilings were open to the concrete structure. The exterior of the building was finished with concrete and brick.

# 3.2 SITE INSPECTION

The building was inspected by WSP representatives Lee Hynes and Kallyn DeGrace on October 1<sup>st</sup>, 2020. A total of fifteen (15) asbestos samples and six (6) lead paint samples were collected from the Site and sent to EMSL for laboratory analysis. A figure outlining sampling locations can be found in Appendix A, and photos of each sampling location can be found in Appendix B.

# 4 REGULATORY CONTEXT

The survey was conducted according to the requirements of the applicable provincial and federal acts, regulations and policies. Specific regulations related to asbestos and lead in paint are summarized below, in addition to other relevant provincial and federal regulations, guidelines and reference documents.

### 4.1 ASBESTOS

Asbestos is a component of a variety of building materials manufactured before 1984 including mechanical insulation, floor tiles, ceiling tiles, caulking, plaster, wiring, etc. Workers and building occupants may be exposed during demolition/renovation activities. Exposure to asbestos can cause cancer and lung disease. The route of exposure is primarily by inhalation.

In Nova Scotia, an asbestos-containing material (ACM) is defined as any material that contains at least 0.5% asbestos by volume according to the NS Department of Labour and Advanced Education document entitled *Asbestos in the Workplace: A Guide to Removal of Friable Asbestos Containing Material*. ACMs are placed into two general classes, "friable" and "non-friable" ACMs. Friable ACMs are those materials that when dry can be crumbled, pulverized and reduced to powder by hand pressure.

The disposal of asbestos waste must follow the guidelines set out in the Asbestos Waste Management Regulations and Asbestos in the Workplace: A Guide to Removal of Friable Asbestos Containing Material documents. According to the Asbestos Waste Management Regulations, asbestos waste is defined as friable waste material containing asbestos fibre or asbestos dust in a concentration greater than 1% by weight.

# 4.2 LEAD

Lead may be present in paint, solder used on copper pipes, caulking on cast iron water pipes, glazing on ceramic tiles, electrical wires and fixtures. Workers and building occupants may be exposed during demolition/renovation activities. Primary routes of exposure include inhalation, absorption through the skin and ingestion. Overexposure can affect the blood, kidneys, gastro-intestinal system, nervous system and reproductive system.

The following guidelines and codes of practice have been developed by the Nova Scotia Department of Labour and Advanced Education and the Nova Scotia Department of Environment to govern the management of lead in Nova Scotia:

- *Lead in the Workplace: A Guide to Working with Lead (2015), which is based on and supported by the following previously published guidelines/codes of practice:* 
  - Working with Inorganic Lead: Code of Practice (2010);
  - Working with Inorganic Lead An Information Package; and,
  - o Guidelines for Disposal of Contaminated Solids in Landfills (2012).

The Code of Practice defines a "Lead-Containing Material" as a material containing an inorganic lead concentration exceeding 0.1% (1,000 ppm).

The maximum acceptable concentrations for disposal of lead-containing substances is defined by the Nova Scotia Guidelines for Disposal of Contaminated Solids in Landfills and is summarized in the following table. Lead-containing materials can be disposed of at Nova Scotia Landfills if the total concentrations and the leachate concentrations do not exceed the listed values.

#### Table 4-1: Maximum Acceptable Concentrations of Lead-Containing Substances for Landfill Disposal

| MATERIAL | TOTAL CONCENTRATION MAXIMUM<br>LIMIT (PPM) | LEACHATE CONCENTRATION MAXIMUM<br>LIMIT (MG/L) |
|----------|--------------------------------------------|------------------------------------------------|
| Lead     | 1,000                                      | 5                                              |

The Surface Coating Materials Regulation (SOR/2016-193) made under the federal Hazardous Products Act (HPA) prescribes an acceptable level of 0.009% (90 mg/kg) lead by dry weight or less, as determined by bulk chemical analysis in accordance with good laboratory practises. Under the Surface Coating Materials Regulation (SOR/2005-109) Section 4.2, the following paints and surface coatings are excluded from the above noted acceptable lead level:

- as an anti-corrosive or an anti-weathering coating applied on the interior or exterior surface of any building or equipment that is used for an agricultural or industrial purpose;
- as an anti-corrosive or an anti-weathering coating applied on any structure other than a building, that is used for an agricultural, industrial or public purpose;
- as a touch-up coating for metal surfaces;
- on traffic signs;
- for graphic art on billboards or similar displays;
- for identification marks in industrial buildings; or
- as materials for the purposes of arts, crafts or hobbies, other than material for use by children.

For the purposes of this report, WSP has classified anything between 90 ppm and 1000 ppm as 'low-level lead-containing paint'.

### 4.3 OTHER APPLICABLE REGULATIONS AND GUIDELINES

Additional provincial and federal regulations, relevant guidelines and reference documents are as follows:

- Hazardous Products Act, R.S.C., c.H-3 (amended 2018)
- Occupational Health and Safety Act, S.N.S. 1996 (amended 2016)
- Environmental Emergency Regulations, N.S.Reg.16/2013
- Dangerous Goods Management Regulations, N.S. Reg. 57/2016
- Dangerous Goods Transportation Act, N.S. Reg. 105//2002
- PCB Regulations, SOR/2008-273 (amended 2015)
- Identification of Lamp Ballasts Containing PCBs, Environment Canada Report EPA 2/CC/2, revised 1991
- Guidelines for Management of Wastes Containing PCBs, Environment Canada, 1989
- Handbook on PCBs in Electrical Equipment, 3rd ed. Environment Canada, 1988
- Canada Wide Standard for Mercury Containing Lamps (Canadian Council of Ministers of the Environment [CCME], 2001)

- Canada Wide Standard for Mercury Emissions (CCME, 2000)
- Mould Guidelines for the Canadian Construction Industry (Canadian Centre for Architecture [CCA], 2004)
- Fungal Contamination in Public Buildings: A Guide to Recognition and Management, Federal- Provincial Committee on Environmental and Occupational Health, 2004
- Environmental Abatement Council of Ontario (EACO) Mould Abatement Guidelines, 3<sup>rd</sup> Edition (2015)
- Ozone Layer Protection Regulations, N.S. Reg. 54/95
- Surface Coating Materials Regulation, SOR/2016-193 (updated 2019)

# 5 OBSERVATIONS AND RESULTS

Information in this section of the report should be provided to all prospective contractors, tenants, and/or workers who are likely to handle, come into contact with, or disturb asbestos or other regulated materials. Detailed specifications that outline specific abatement procedures are recommended when tendering any potential renovation/demolition work.

This information may require updating upon the removal of regulated materials upon completion of the renovations or demolition. A close out report stating that the materials are no longer present is also required once the materials are removed. If ACM is to remain in place, *Asbestos in the Workplace: A Guide to Assessment & Management of Asbestos in the Workplace* requires the owner to prepare and establish an Asbestos Management Plan for the building.

Contractors and maintenance personnel should be warned of the possibility of undisclosed materials when breaking into enclosed areas. Friable and Non-Friable building materials discovered in enclosed areas should be treated as asbestos until proven otherwise and other substances, self-evident as designated substances, should be handled in a likewise fashion.

# 5.1 ASBESTOS

#### 5.1.1 ASBESTOS-CONTAINING MATERIALS

In accordance with the requirements of the NS document *Asbestos in the Workplace: A Guide to Removal of Friable Asbestos Containing Material*, homogenous materials (i.e. materials uniform in color and texture) are considered to be asbestos-containing if any sample which is collected from that homogeneous material, is identified to have an asbestos concentration of 0.5% or greater.

A total of fifteen (15) building material samples were collected from five (5) homogeneous building materials and submitted for laboratory analysis of asbestos content using the EPA600/R-93/116 method with "positive stop". Positive stop methodology refers to discontinuing further analyses of samples from a homogenous material after the first positive identification of asbestos from a sample of that material.

Asbestos was not identified in any of the five building materials tested during the survey. As such, all samples have been identified as "non-asbestos" and are summarized in Section 5.1.2, below.

#### 5.1.2 BULK SAMPLES IDENTIFIED AS "NON-ASBESTOS"

The table below summarizes the results of bulk material samples collected from suspect materials during this survey, which had either no detectable concentrations of asbestos, or had asbestos concentrations less than the regulated threshold limit of 1% (by weight), and therefore can be considered as "non-asbestos" in accordance with *Asbestos in the Workplace: A Guide to Assessment & Management of Asbestos in the Workplace.* 

#### Table 5-1: Summary of Bulk Samples Identified as "Non-Asbestos"

| MATERIAL DESCRIPTION & LOCATION                                             | SAMPLE ID  | PHOTO<br>REFERENCE |
|-----------------------------------------------------------------------------|------------|--------------------|
| Pipe wrap found on floor level pipe in generator room                       | AS1-A/B/C  | 9                  |
| Mortar from cinder block wall between generator room and "wet" side         | AS2-A/B/C  | 10                 |
| Adhesive compound on ductwork in generator room                             | AS3-A/B/C  | 11                 |
| Insulation wrapped around a pipe at the top of the stairs on the "wet" side | AS4-A//B/C | 12                 |
| Spay foam insulation from a pipe at the top of the stairs on the "wet" side | AS5-A/B/C  | 12                 |

1 For sample locations refer to Appendix A: Figures.

2 For relevant photographs taken during the survey refer to Appendix B: Site Photographs.

3 For sample ID and concentration levels refer to Appendix C: Laboratory Certificates.

### 5.2 LEAD

#### 5.2.1 LEAD PAINT

A total of six (6) paint samples from six unique painted surfaces were collected and analyzed at the time of the survey. Sample locations are shown in Appendix A. The table below summarizes the results of laboratory analyses for the bulk paint and surface coating samples collected during the survey. Samples with lead concentrations equal to or greater than 1,000 ppm (0.1%) by weight are shown in bold. These samples are considered "lead-containing" under the NS Code of Practice for Working with Inorganic Lead. Photos of lead-containing paints are provided in Appendix B. Laboratory results sheets are provided in Appendix C.

#### Table 5-2: Summary of Bulk Paint Sample Analytical Results

| MATERIAL DESCRIPTION & LOCATION                                                                                        | SAMPLE INFORMATION                                                   |
|------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|
| White paint applied to wall in basement on "dry" side with<br>orange/yellow/red layers below<br>Photo 3                | Sample ID: LP1<br>Concentration: <b>5,000 ppm</b><br>Condition: Poor |
| White paint applied to walls in basement on "dry" side with beige/grey layers below Photo 4                            | Sample ID: LP2<br>Concentration: 82 ppm<br>Condition: Fair           |
| Beige paint applied to metal beams, ducts and pipes on "dry" side<br>Photo 5                                           | Sample ID: LP4<br>Concentration: 620 ppm<br>Condition: Good          |
| Grey paint applied to floor in basement of "dry" side<br>Photo 6                                                       | Sample ID: LP5<br>Concentration: non-detect<br>Condition: Good       |
| Grey paint applied concrete platforms in the equipment room on<br>the main floor with blue layer underneath<br>Photo 7 | Sample ID: LP6<br>Concentration: 900 ppm<br>Condition: Good          |
| Beige paint applied to walls and ceiling in the generator room<br>Photo 8                                              | Sample ID: LP7<br>Concentration: non-detect<br>Condition: Good       |

1 For sample locations refer to Appendix A: Figures.

#### Low-Level Lead Paint:

The Surface Coating Materials Regulation (SOR/2016-193) made under the federal Hazardous Products Act (HPA) prescribes an acceptable level of 0.009% (90 mg/kg or 90 ppm) lead by dry weight or less. As shown in Table 5-2, two (2) lead in paint results (samples LP4 and LP6) exceeded the Surface Coating Materials Regulation guideline of 90 ppm (but were below 1,000 ppm) and are considered 'low-level lead-containing paint'.

If 'low-level lead-containing materials' are disturbed in a non-aggressive manner (i.e. no abrasive blasting, grinding, welding, heating, etc.), it is still recommended that dust suppression and general construction health & safety measures be utilized; these include but are not limited to: not smoking, eating, drinking and chewing gum in the work area, dust suppression techniques being implemented, and facilities being made available for workers to wash hands and face.

#### Lead-Containing Paint:

Samples with lead concentrations equal to or greater than 1,000 ppm (0.1%) by weight are considered "leadcontaining" under the NS Code of Practice for Working with Inorganic Lead. As shown in Table 5-2, sample LP1 exceeded this threshold and is considered 'lead-containing paint'. A layer of peeling orange paint similar in colour to the orange layer in LP1 was also observed on the "wet" side of the building, but was not sampled as it is unlikely to be disturbed in the planned upgrades. If lead-containing paints are planned to be disturbed during the renovation, it is recommended the following procedures be implemented:

- Non-powered hand-held tools should be utilized.
- Washing facilities should be provided for workers disturbing lead-containing painted materials;
- Respirators should not be necessary if all general health and safety procedures are followed. However, any worker who requests a respirator shall be provided with a respirator and be trained in its use, fit and storage;
- Drop sheet should be place below the work area to capture any lead-containing dust and debris.
- Wetting of materials shall be conducted whenever possible to control dust;
- All lead-containing dust and debris should be cleaned up utilizing a HEPA vacuum and water.

# 6 SUMMARY

Confirmed and potential hazardous materials identified during the survey are summarized below.

### 6.1 ASBESTOS

Asbestos was not identified in any of the five building materials tested during the survey.

### 6.2 LEAD IN PAINT

#### Low-Level Lead Paint:

Lead concentrations exceeding the *Surface Coating Materials Regulations* (90 ppm) criteria but below 1,000 ppm were reported in the samples listed below. These paints are considered 'low-level lead paints' and are considered a potential health risk if disturbed. They do not require specialized disposal.

- LP4: Beige paint applied to beams, pipes and ducts in the basement on the "dry" side.
- LP6: Grey paint with blue layer underneath applied to platforms in the equipment room on the main floor.

#### Lead-Containing Paint:

The Code of Practice defines a "Lead-Containing Material" as a material containing an inorganic lead concentration exceeding 0.1% (1,000 ppm). Sample LP1 of white paint with orange, yellow and red layers underneath applied to one interior wall on the "dry" side exceeded the 1,000 ppm criteria and is considered lead-containing paint (448 ft<sup>2</sup>).

Lead-containing materials can be disposed of at Nova Scotia Landfills if the total bulk concentrations and the leachate concentrations do not exceed 1,000 ppm and 5 mg/L. However, if total lead concentrations exceed 1,000 ppm but leachate concentrations are below 5 mg/L, these materials can be disposed of at and approved construction and demolition (C&D) waste facility. Should total lead concentrations exceed 1,000 ppm and leachate concentrations exceed 5 mg/L, these materials will require specialized (non-landfill) disposal at a licensed hazardous waste facility if disturbed/removed. Currently there are no licensed hazardous waste disposal facilities available within Nova Scotia.

# 7 RECOMMENDATIONS

Based on the results of the Limited Regulated Materials Survey, the following recommendations are provided:

#### GENERAL

- Provide a copy of this report to all contractors who will bid on future renovation work for the areas investigated as part of this assessment.
- Retain qualified contractors to remove and dispose of identified, presumed, and potentially hazardous materials as per provincial and federal acts, regulations and codes of practice.
- Require all employees and contractors who may disturb hazardous materials wear appropriate Personal Protective Equipment.
- Require that contractors follow procedures to minimize the generation of dust which may contain asbestos, lead or other hazardous substances.

#### LEAD

- Materials with lead paint concentrations exceeding 1,000 mg/kg (identified above) are in poor condition (damaged, flaking/peeling) and should be removed by a qualified contractor. Lead leachate sampling should be completed to determine appropriate handling and disposal protocols prior to removal of these materials.
- If lead-containing paints are planned to be disturbed during the renovation, it is recommended the following procedures be implemented:
  - Non-powered hand-held tools should be utilized.
  - Washing facilities should be provided for workers disturbing lead-containing painted materials;
  - Respirators should not be necessary if all general health and safety procedures are followed. However, any worker who requests a respirator shall be provided with a respirator and be trained in its use, fit and storage;
  - Drop sheet should be place below the work area to capture any lead-containing dust and debris.
  - Wetting of materials shall be conducted whenever possible to control dust;
  - o All lead-containing dust and debris should be cleaned up utilizing a HEPA vacuum and water.
- If 'low-level lead-containing materials' are disturbed in a non-aggressive manner (i.e. no abrasive blasting, grinding, welding, heating, etc.), it is still recommended that dust suppression and general construction health & safety measures be utilized; these include but are not limited to: not smoking, eating, drinking and chewing gum in the work area, dust suppression techniques being implemented, and facilities being made available for workers to wash hands and face.

# 8 CLOSURE

This report has been prepared by Kallyn DeGrace. Internal senior technical review has been provided by Lee Hynes, P. Eng. Technical limitations associated with the report can be found in Appendix D.

Yours truly,

WSP Canada Inc.

Darado

Kallyn DeGrace Environmental Engineering Technologist - Atlantic Environment

Lee Hyne

Lee Hynes, P.Eng., M.A.Sc. Project Manager – Atlantic Environment







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| DISCLAIMER:<br>THIS DRAWING AND<br>NOT BE USED, REPRO<br>BY WSP C ANADA INC<br>DIMENSIONS AND U<br>OMISSIONS PRIOR T<br>PROJECT:<br>LIMITED R<br>BISSET<br>ATTWOOD<br>PROJECT NO.:<br>CLIENT:<br>FIGURE:<br>SAMPL<br>FIGURE NO.:<br>COMPLETED BY:                | DESIGN IS CO<br>DDUCED OR REV<br>THE CONTRA<br>TILITY LOCATION<br>O COMMENCINC<br>EGULATED<br>T LAKE PU<br>DD CRESCE<br>201-08<br>HALIFA)<br>LE LOCATIK                    | PYRIGHT PROT<br>ISED WITHOUT<br>TOR SHALL CR<br>SAND REPOP<br>WORK.<br>DMATERIA<br>MPING ST/<br>INT, DARTI<br>2639<br>(WATER<br>DNS: MAIN<br>REVISION NO<br>CHECKED B                               | ECTED WHICH<br>WRITTEN PERM<br>IECK AND VERM<br>IT ALL ERROR<br>ATION, 54<br>MOUTH NS<br>FLOOR                                                                          | SHAL<br>NISSIG<br>IFY AL<br>EY<br>S        |
| DISCLAIMER:<br>THIS DRAWING AND<br>NOT BE USED, REPRE<br>BY WSP CANADA INC<br>DIMENSIONS AND U<br>OMISSIONS PRIOR T<br>PROJECT:<br>LIMITED R<br>BISSET<br>ATTWOC<br>PROJECT NO.:<br>CLIENT:<br>FIGURE:<br>FIGURE NO.:<br>COMPLETED BY:<br>KALL                   | ESIGN IS CO<br>DDUCED OR REV<br>ILLTY LOCATION<br>O COMMENCINC<br>EGULATED<br>T LAKE PU<br>DD CRESCE<br>201-08<br>HALIFAX<br>LE LOCATION<br>1<br>LYN DEGRACE               | PYRIGHT PROT<br>ISED WITHOUT<br>TOR SHALL CR<br>SAND REPOP<br>WORK.<br>DMATERIA<br>MPING ST/<br>INT, DARTI<br>2639<br>(WATER<br>DNS: MAIN<br>REVISION NO<br>CHECKED B                               | ECTED WHICH<br>WRITTEN PERM<br>IECK AND VERM<br>IT ALL ERROR<br>ATION, 54<br>MOUTH NS<br>FLOOR<br>D::<br>LEE HYNES                                                      | SHAINSEIC                                  |
| DISCLAIMER:<br>THIS DRAWING AND<br>NOT BE USED, REPRO<br>BY WSP CANADA INC<br>DIMENSIONS AND U<br>OMISSIONS PRIOR T<br>PROJECT:<br>LIMITED R<br>BISSET<br>ATTWOOD<br>PROJECT NO.:<br>CLIENT:<br>FIGURE:<br>FIGURE NO.:<br>COMPLETED BY:<br>KALL                  | ESIGN IS CO<br>DDUCED OR REV<br>THE CONTRA<br>TULTY LOCATION<br>O COMMENCINC<br>EGULATED<br>T LAKE PU<br>DD CRESCE<br>201-08<br>HALIFAX<br>LE LOCATION<br>1<br>LYN DEGRACE | PYRIGHT PROT<br>ISED WITHOUT<br>TOR SHALL CR<br>SAND REPOP<br>WORK.<br>DMATERIA<br>MPING ST/<br>INT, DARTI<br>1639<br>(WATER<br>DNS: MAIN<br>REVISION NO<br>CHECKED B                               | ECTED WHICH<br>WRITTEN PERM<br>IECK AND VERM<br>IT ALL ERROR<br>ATION, 54<br>MOUTH NS<br>FLOOR<br>D::<br>LEE HYNES                                                      | SHAL<br>MISSICS<br>S ANT<br>EY<br>S        |
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# wsp

Halifax Water Bissett Lake Pumping Station, 54 Attwood Crescent, Dartmouth, NS– Photographic Log Project Number 201-08639



Photo 1: Main level entrance on dry side, October 1, 2020.



Photo 3: Sample LP1 of white paint, dry side basement, October 1, 2020.



Photo 2: View of dry side from top of stairs, October 1, 2020.



Photo 4: Sample LP2 of white paint, dry side basement, October 1, 2020.

# wsp

Halifax Water Bissett Lake Pumping Station, 54 Attwood Crescent, Dartmouth, NS– Photographic Log Project Number 201-08639



Photo 5: Sample LP4 of paint applied to beams, pipes, and ducts in the basement on the dry side, October 1, 2020.



Photo 6: Sample LP5 of grey paint applied to the floor in the basement, October 1, 2020.



Photo 7: Sample LP6 of grey paint on platforms in equipment room, October 1, 2020.



Photo 8: Samples LP7 of beige paint applied to walls and ceiling in the generator room, October 1, 2020.

# wsp

Halifax Water Bissett Lake Pumping Station, 54 Attwood Crescent, Dartmouth, NS– Photographic Log Project Number 201-08639



Photo 9: Sample AS1 or pipe wrap in the generator room, October 1, 2020.



Photo 11: Sample AS3 of adhesive applied to ducts in the generator room, October 1, 2020.



Photo 10: Sample AS2 of mortar in the generator room, October 1, 2020.



Photo 12: Samples set AS4 of insulation and AS5 of spray foam, October 1, 2020.



# C LABORATORY CERTIFICATES



Attn: Lee Hynes WSP Canada, Inc. 1 Spectacle Lake Drive Dartmouth, NS B3B 1X7 Phone: Fax: Received: Collected: (902) 835-9955 10/6/2020 09:00 AM 10/1/2020

Project: 201-08639-00

# Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)\*

| Client SampleDescription | Collected Analyzed                                                            | Weight   | RDL     | Lead Concentration |
|--------------------------|-------------------------------------------------------------------------------|----------|---------|--------------------|
| LP1<br>552012621-0001    | 10/1/2020 10/6/2020<br>Site: White Paint on Wall, Orange Underneath           | 0.2501 g | 160 ppm | 5000 ppm           |
| LP2<br>552012621-0002    | 10/1/2020 10/6/2020<br>Site: White Paint on Wall, Beige/Grey Underneath       | 0.2432 g | 82 ppm  | <82 ppm            |
| LP4<br>552012621-0003    | 10/1/2020 10/6/2020<br>Site: Beige Paint on Pipes/Beams                       | 0.2501 g | 80 ppm  | 620 ppm            |
| LP5<br>552012621-0004    | 10/1/2020 10/6/2020<br>Site: Grey Paint on Floor in Basement                  | 0.2498 g | 80 ppm  | <80 ppm            |
| LP6<br>552012621-0005    | 10/1/2020 10/6/2020<br>Site: Grey Paint on Floor Upper Level                  | 0.2444 g | 82 ppm  | 900 ppm            |
| LP7<br>552012621-0006    | 10/1/2020 10/6/2020<br>Site: Beige Paint on Walls and Ceiling, Generator Room | 0.2416 g | 83 ppm  | <83 ppm            |

thanto

Rowena Fanto, Lead Supervisor or other approved signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted.

Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.008% wt based on the minimum sample weight per our SOP. "<" (less than) result signifies the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. Definitions of modifications are available upon request. Samples analyzed by EMSL Canada Inc. Mississauga, ON AIHA-LAP, LLC - ELLAP #196142

| EMSL Canada Inc. EMSL Canada O Customer ID:                                                                                                                                                                                                                            |                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| ENSI 2750 Claugh Street Mississaure ON LAT 402                                                                                                                                                                                                                         | rder 552012818<br>55GNVR34 |
| Customer PO:                                                                                                                                                                                                                                                           | 201-08639-00               |
| Phone/Fax: (289) 997-4602 / (289) 997-4607 Project ID:                                                                                                                                                                                                                 |                            |
| http://www.EMSL.com / torontolab@emsl.com                                                                                                                                                                                                                              |                            |
| Attn: Lee Hynes Phone: (902) 835-9955                                                                                                                                                                                                                                  |                            |
| WSP Canada, Inc. Fax:                                                                                                                                                                                                                                                  |                            |
| 1 Spectacle Lake Drive Collected: 10/ 1/2020                                                                                                                                                                                                                           |                            |
| Dartmouth, NS B3B 1X7 Received: 10/06/2020                                                                                                                                                                                                                             |                            |
| Analyzed: 10/12/2020                                                                                                                                                                                                                                                   |                            |
| Proj: 201-08639-00                                                                                                                                                                                                                                                     |                            |
| mple Description: Pipe wrap Analyzed Non-Asbestos                                                                                                                                                                                                                      |                            |
| TEST Date Color Fibrous Non-Fibrous Asbestos Comment                                                                                                                                                                                                                   |                            |
| M 10/12/2020 White/Yellow 95.0% 5.0% None Detected                                                                                                                                                                                                                     |                            |
| ient Sample ID: AS1-B Lab Sample II                                                                                                                                                                                                                                    | D: 552012818-0002          |
| ample Description: Pipe wrap                                                                                                                                                                                                                                           |                            |
|                                                                                                                                                                                                                                                                        |                            |
| Analyzed Non-Asbestos                                                                                                                                                                                                                                                  |                            |
| Analyzed Non-Asbestos<br>TEST Date Color Fibrous Non-Fibrous Asbestos Comment                                                                                                                                                                                          |                            |
| Analyzed     Non-Asbestos       TEST     Date     Color     Fibrous     Non-Fibrous     Asbestos     Comment       .M     10/12/2020     White/Yellow     95.0%     5.0%     None Detected                                                                             |                            |
| Analyzed     Non-Asbestos       TEST     Date     Color     Fibrous     Non-Fibrous     Asbestos       .M     10/12/2020     White/Yellow     95.0%     5.0%     None Detected       .ient Sample ID:     AS1-C     Lab Sample ID                                      |                            |
| Analyzed     Non-Asbestos       TEST     Date     Color     Fibrous     Non-Fibrous     Asbestos       M     10/12/2020     White/Yellow     95.0%     5.0%     None Detected       ient Sample ID:     AS1-C     Lab Sample ID       imple Description:     Pipe wrap | <br>D: 552012818-0003      |

|                     |          | Analyzed   |                     | Non     | -Asbestos   |               |                |                |
|---------------------|----------|------------|---------------------|---------|-------------|---------------|----------------|----------------|
| TEST                |          | Date       | Color               | Fibrous | Non-Fibrous | Asbestos      | Comment        |                |
| PLM                 |          | 10/12/2020 | Nhite/Silver/Yellow | 95.0%   | 5.0%        | None Detected |                |                |
| Client Sample ID:   | AS2-A    |            |                     |         |             |               | Lab Sample ID: | 552012818-0004 |
| Sample Description: | Mortar   |            |                     |         |             |               |                |                |
|                     |          | Analyzed   |                     | Non     | -Asbestos   |               |                |                |
| TEST                |          | Date       | Color               | Fibrous | Non-Fibrous | Asbestos      | Comment        |                |
| PLM                 |          | 10/12/2020 | Gray/Tan            | 0.0%    | 100.0%      | None Detected |                |                |
| Client Sample ID:   | AS2-B    |            |                     |         |             |               | Lab Sample ID: | 552012818-0005 |
| Sample Description: | Mortar   |            |                     |         |             |               |                |                |
|                     |          | Analyzed   |                     | Non     | -Asbestos   |               |                |                |
| TEST                |          | Date       | Color               | Fibrous | Non-Fibrous | Asbestos      | Comment        |                |
| PLM                 |          | 10/12/2020 | Gray/Tan            | 0.0%    | 100.0%      | None Detected |                |                |
| Client Sample ID:   | AS2-C    |            |                     |         |             |               | Lab Sample ID: | 552012818-0006 |
| Sample Description: | Mortar   |            |                     |         |             |               |                |                |
|                     |          | Analyzed   |                     | Non     | -Asbestos   |               |                |                |
| TEST                |          | Date       | Color               | Fibrous | Non-Fibrous | Asbestos      | Comment        |                |
| PLM                 |          | 10/12/2020 | Gray                | 4.0%    | 96.0%       | None Detected |                |                |
| Client Sample ID:   | AS3-A    |            |                     |         |             |               | Lab Sample ID: | 552012818-0007 |
| Sample Description: | Adhesive | e on Duct  |                     |         |             |               |                |                |
|                     |          |            |                     |         |             |               |                |                |

 Analyzed
 Non-Asbestos

 TEST
 Date
 Color
 Fibrous
 Non-Fibrous
 Asbestos
 Comment

 PLM
 10/12/2020
 Gray
 0.0%
 100.0%
 None Detected



# EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3 Phone/Fax: (289) 997-4602 / (289) 997-4607 <u>http://www.EMSL.com</u> / <u>torontolab@emsl.com</u>

# Test Report: Asbestos Analysis of Bulk Materials for Nova Scotia Code of Practice Section 66 OHS Act - Asbestos in the Workplace via EPA600/R-93/116 Method

|                     |                    |              |                     | A000/IX-33/110 M | ethou          |                |
|---------------------|--------------------|--------------|---------------------|------------------|----------------|----------------|
| Client Sample ID:   | AS3-B              |              |                     |                  | Lab Sample ID: | 552012818-0008 |
| Sample Description: | Adhesive on Duct   |              |                     |                  |                |                |
|                     |                    |              |                     |                  |                |                |
|                     | Analyzed           |              | Non-Asbestos        | • • • • • • •    | <b>0</b>       |                |
| IESI                | Date               | Color        | Fibrous Non-Fibrous | Asbestos         | Comment        |                |
| PLM                 | 10/12/2020         | Gray         | 0.0% 100.0%         | None Detected    |                |                |
| Client Sample ID:   | AS3-C              |              |                     |                  | Lab Sample ID: | 552012818-0009 |
| Sample Description: | Adhesive on Duct   |              |                     |                  |                |                |
|                     | Applyzed           |              | Non Ashastas        |                  |                |                |
| TEST                | Date               | Color        | Fibrous Non-Fibrous | Ashestas         | Comment        |                |
| PLM                 | 10/12/2020         | Grav         | 0.0% 100.0%         | None Detected    | Common         |                |
| Client Comple ID:   |                    |              |                     |                  | Lab Sample ID: | 552012818-0010 |
| Sample Description  | A54-A              |              |                     |                  | Lab Sample ID. | 332012010-0010 |
| Sample Description: | Insulation on pipe |              |                     |                  |                |                |
|                     | Analyzed           |              | Non-Asbestos        |                  |                |                |
| TEST                | Date               | Color        | Fibrous Non-Fibrous | Asbestos         | Comment        |                |
| PLM                 | 10/12/2020         | Brown/Tan    | 95.0% 5.0%          | None Detected    |                |                |
| Client Sample ID:   | AS4-B              |              |                     |                  | Lab Sample ID: | 552012818-0011 |
| Sample Description: | Insulation on pipe |              |                     |                  |                |                |
|                     |                    |              |                     |                  |                |                |
|                     | Analyzed           |              | Non-Asbestos        |                  |                |                |
| TEST                | Date               | Color        | Fibrous Non-Fibrous | Asbestos         | Comment        |                |
| PLM                 | 10/12/2020         | Brown/Tan    | 90.0% 10.0%         | None Detected    |                |                |
| Client Sample ID:   | AS4-C              |              |                     |                  | Lab Sample ID: | 552012818-0012 |
| Sample Description: | Insulation on pipe |              |                     |                  |                |                |
|                     |                    |              |                     |                  |                |                |
|                     | Analyzed           |              | Non-Asbestos        |                  |                |                |
| TEST                | Date               | Color        | Fibrous Non-Fibrous | Asbestos         | Comment        |                |
| PLM                 | 10/12/2020         | Brown        | 85.0% 15.0%         | None Detected    |                |                |
| Client Sample ID:   | AS5-A              |              |                     |                  | Lab Sample ID: | 552012818-0013 |
| Sample Description: | Foam on pipe       |              |                     |                  |                |                |
|                     |                    |              |                     |                  |                |                |
|                     | Analyzed           |              | Non-Asbestos        |                  |                |                |
| TEST                | Date               | Color        | Fibrous Non-Fibrous | Asbestos         | Comment        |                |
| PLM                 | 10/12/2020         | Yellow       | 0.0% 100.0%         | None Detected    |                |                |
| Client Sample ID:   | AS5-B              |              |                     |                  | Lab Sample ID: | 552012818-0014 |
| Sample Description: | Foam on pipe       |              |                     |                  |                |                |
|                     |                    |              |                     |                  |                |                |
| TEST                | Analyzed<br>Date   | Color        | NON-ASDESTOS        | <b>A</b> shaetae | Comment        |                |
| PLM                 | 10/12/2020         | Brown/Yellow | 0.0% 100.0%         | None Detected    | comment        |                |
|                     |                    | 2.0          |                     |                  | Lob Comple 10: | EE2042040 004E |
| Client Sample ID:   | A55-U              |              |                     |                  | Lap Sample ID: | 552012016-0015 |
| Sample Description: | Foam on pipe       |              |                     |                  |                |                |
|                     | Analyzed           |              | Non-Ashastas        |                  |                |                |
| TEST                | Date               | Color        | Fibrous Non-Fibrous | Asbestos         | Comment        |                |
| PLM                 | 10/12/2020         | Yellow       | 0.0% 100.0%         | None Detected    |                |                |
| ••                  |                    |              |                     |                  |                |                |



EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3 Phone/Fax: (289) 997-4602 / (289) 997-4607 http://www.EMSL.com / torontolab@emsl.com EMSL Canada Order 552012818Customer ID:55GNVR34Customer PO:201-08639-00Project ID:201-08639-00

Test Report: Asbestos Analysis of Bulk Materials for Nova Scotia Code of Practice Section 66 OHS Act - Asbestos in the Workplace via EPA600/R-93/116 Method

Analyst(s):

Johannes Breckheimer PLM (10) Maye Yassin PLM (5)

Reviewed and approved by:

and

Matthew Davis or other approved signatory or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency or the U.S. Government

Samples analyzed by EMSL Analytical, Inc. New York, NY AIHA-LAP, LLC--IHLAP Lab 102581, NVLAP Lab Code 101048-9, NYS ELAP 11506, NJ NY022, CT PH-0170, MA AA000170

Initial report from: 10/12/202023:42:28

Test Report:EPAMultiTests-7.32.2.D Printed: 10/13/2020 08:17AM

# **APPENDIX**

# **DTECHNICAL LIMITATIONS**



# LIMITATIONS

# Limited use

This Report was prepared for Halifax Water, solely for their exclusive use to provide an Assessment of current environmental conditions in association with the Site. WSP will not be responsible for any use of this report by any other party, for any decisions to be made based on it, or for the consequences thereof, unless written reliance is granted by WSP. Unless otherwise agreed in writing by WSP, it shall not be used to express or imply warranty as to the suitability of the property for a particular purpose. WSP disclaims responsibility of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs.

# Excerpts

The Report is intended to be used in its entirety. No excerpts may be taken to be representative of the findings in the assessment.

# Information from others

In evaluating the Site, WSP has relied in good faith on information provided by others, as noted in the Report. WSP has assumed that the information provided is correct and WSP assumes no responsibility for the accuracy, completeness or workmanship of any such information.

# Standard of care

This project has been carried out using investigation techniques and engineering analysis methods consistent with those ordinarily exercised by WSP and other engineering/scientific practitioners, working under similar conditions and subject to the time, financial and physical constraints applicable to this project. The conclusions presented in this Report are based on Work undertaken by trained professional and technical staff and the reasonable and professional interpretation using accepted engineering and scientific practices current at the time the work was performed. Conclusions presented in this report should not be construed as legal advice. WSP makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in the Report, including, but not limited to, ownership of any property, or the application of any law to the findings of the Assessment.

# Limited scope

The Report summarizes WSP's review of available data in accordance with the principal components of the stated regulations, standards and guidelines and the scope, terms and conditions of the contract or proposal to which the Assignment was conducted. No other warranties are either expressed or implied with respect to the professional services provided under the terms of the contract or proposal and represented in this Report. Conditions may exist which were not detected given the nature of the inquiry WSP was retained to undertake with respect to the Site. Additional environmental studies and actions may be recommended.

1 Spectacle Lake Drive Dartmouth, NS Canada B3B 1X7

T: +1 902-835-9955 F: +1 902-835-1645 wsp.com

# Changes over time

The Report is based on data and information collected at the time of this Assessment, as stated in the Report. Site use or conditions change and the information and conclusions in the Report may no longer apply following the date of this Report. If any conditions become apparent that differ significantly from that presented in this Report, we request that we be notified to reassess the conclusions and recommendations provided herein. WSP disclaims any obligation to update this Report for conditions that may be identified after the date of this Report; however, WSP reserves the right to amend or supplement this report based on additional information, documentation or evidence.

# Variability between test locations

Conclusions are based on the Site conditions observed by WSP at the time the work was performed and may include information obtained at specific testing and/or sampling locations. It is recognized that overall conditions can only be extrapolated to an undefined limited area around these testing and sampling locations. The conditions that WSP interprets to exist between testing and sampling points may differ from those that actually exist. The accuracy of any extrapolation and interpretation beyond the sampling locations will depend on natural conditions, the history of Site development and changes through construction and other activities. In addition, analysis has been carried out for the identified chemical and physical parameters only, and it should not be inferred that other chemical species or physical conditions are not present. WSP cannot warrant against undiscovered environmental liabilities or adverse impacts off-Site.

# Use for design and construction

Design recommendations given in this report are applicable only to the project and areas as described in the text and then only if constructed in accordance with the details stated in this report. The comments made in this report on potential construction issues and possible methods are intended only for the guidance of the designer. The number of testing and/or sampling locations may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. Contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.



# E 60% DESIGN COST ESTIMATE

| PROJECT: | Bissett Wastewater Pump Station  |
|----------|----------------------------------|
| DONE BY: | WSP Project Team                 |
| SUBJECT: | 60% Design Capital Cost Estimate |

 PROJ. NO.:
 201-08639-00

 DATE:
 July 27, 2021

# 60% DESIGN CAPITAL COST ESTIMATE

| <b></b>  |                                                   |     |         | MATER   | RIAL    | п     | NSTALLATIO | N       | TOTAL     | SUB         |
|----------|---------------------------------------------------|-----|---------|---------|---------|-------|------------|---------|-----------|-------------|
| SPEC     |                                                   |     |         | UNIT    | TOTAL   | % OF  | or UNIT    | TOTAL   | MAT'L &   | TOTAL       |
| DIV      |                                                   |     |         | COST    | COST    | MAT'L | COST       | COST    | INSTALL.  | COST        |
| No       | DESCRIPTION OF ITEM                               | QTY | UNIT    | (\$)    | (\$)    | (%)   | (\$)       | (\$)    | (\$)      | (\$)        |
| Division | 00 - Procurement and Contract Requirements        |     |         |         |         |       |            |         |           |             |
|          | Bonds & Insurance (\$20 / \$1,000)                | 1   | LS      | 79,359  | 79,359  |       |            | 0       | 79,359    |             |
|          |                                                   |     |         |         |         |       |            |         |           |             |
| TASK TO  | DTAL COST                                         |     |         |         |         |       |            | Total:  | 79,359    | \$79,360    |
| Division | 01 - General Requirements                         |     | T.C.    | 15.000  | 15 000  |       |            |         | 15 000    |             |
| -        | Mobilization/Demobilization                       | 6   | LS      | 15,000  | 15,000  |       |            | 0       | 15,000    |             |
| -        | Project Admin and Management (\$4,000 / Month)    | 6   | ea      | 4 000   | 24,000  |       |            | 0       | 24,000    |             |
| -        | Submittals and Closeout Documents                 | 1   | LS      | 10,000  | 10 000  |       |            | 0       | 10,000    |             |
|          | Commissioning & Training                          | 1   | LS      | 10,000  | 10,000  |       |            | 0       | 10,000    |             |
| -        | Overhead and Profit (20%)                         | 20  | %       | 793,586 | 793,586 |       |            | 0       | 793,586   |             |
|          | Sub Markup (15%)                                  | 15  | %       | 595,189 | 595,189 |       |            | 0       | 595,189   |             |
|          |                                                   |     |         |         |         |       |            |         |           |             |
| TASK T   | OTAL COST                                         |     |         |         |         |       |            | Total:  | 1,453,775 | \$1,453,780 |
| Division | 02 - Existing Conditions                          |     |         |         |         |       |            |         | -         |             |
|          |                                                   |     |         |         |         |       |            |         |           |             |
|          |                                                   |     |         |         |         |       |            |         |           |             |
| TASK TO  | DTAL COST                                         |     |         |         |         |       |            | Total:  | 0         | \$0         |
| Division | 03 - Concrete                                     | 1   | TC      | 5 000   | 5 000   | 0     |            | 0       | 5 000     |             |
|          | General Concrete Repairs                          | 1   | LS      | 5,000   | 5,000   | 0     |            | 0       | 5,000     |             |
| -        | Existing Concrete Removal for Pump Access Hatches | 1   | LS      | 7 500   | 7 500   | 0     |            | 0       | 7 500     |             |
| -        | Electrical Panel and Generator Concrete Bases     | 1   | LS      | 5 000   | 5 000   | 0     |            | 0       | 5 000     |             |
| -        | Pump Bases and Pipe Supports in Pump Room         | 1   | LS      | 3,500   | 3,500   | 0     |            | 0       | 3,500     |             |
|          | New Bypass Pipe Penetration                       | 1   | LS      | 2,500   | 2,500   | 0     |            | 0       | 2,500     |             |
|          |                                                   |     |         |         |         |       |            |         | ,         |             |
| TASK T   | OTAL COST                                         | -   | ••      |         |         |       |            | Total:  | 28,500    | \$28,500    |
| Division | 04 - Masonry                                      |     |         |         |         |       |            |         |           |             |
|          |                                                   |     |         |         |         |       |            |         |           |             |
| TASK T   | OTAL COST                                         |     |         |         |         |       |            | Total:  | 0         | \$0         |
| Division | 05 - Metals                                       |     |         |         |         |       |            |         |           |             |
|          | Miscellaneous Metals                              | 1   | LS      | 5,000   | 5,000   | 30    |            | 1,500   | 6,500     |             |
|          | Pipe Supports, etc.                               | 1   | LS      | 10,000  | 10,000  | 30    |            | 3,000   | 13,000    |             |
| TACKT    | OT IL COST                                        |     |         |         |         |       |            | Tatala  | 10 500    | \$10.500    |
| Division | 01AL COST<br>06 - Wood Platics and Composites     |     |         |         |         |       |            | Totat.  | 19,300    | \$19,500    |
| Division | ou - wood, mattes and composites                  | 1   |         |         |         |       |            |         |           |             |
| TASK T   | OTAL COST                                         |     |         |         |         |       |            | Total:  | 0         | \$0         |
| Division | 07 - Thermal and Moisture Protection              |     |         |         |         |       |            |         |           |             |
|          |                                                   |     |         |         |         |       |            |         |           |             |
| TASK T   | OTAL COST                                         |     |         |         |         |       |            | Total:  | 0         | \$0         |
| Division | 8 - Openings                                      |     |         |         |         |       |            |         | -         |             |
|          | New Access Doors                                  | 3   | ea      | 3,000   | 9,000   | 0     |            | 0       | 9,000     |             |
|          | New Pump Access Hatches                           | 2   | ea      | 5,000   | 10,000  | 0     |            | 0       | 10,000    |             |
|          |                                                   |     |         |         |         |       |            |         |           |             |
| TASK T   | 00 Etitle                                         |     |         |         |         |       |            | Total:  | 19,000    | \$19,000    |
| Division | 09 - Finisnes                                     |     |         |         |         |       |            |         |           |             |
| TASKT    | OT AL COST                                        |     |         |         |         |       |            | Total   | 0         | \$0         |
| Division | 10 - Specialties                                  |     |         |         |         |       |            | Total.  | 0         | 30          |
| DIVISION |                                                   |     |         |         |         |       |            |         |           |             |
| TASK T   | OTAL COST                                         |     |         |         |         |       |            | Total:  | 0         | \$0         |
| Division | 11 - Equipment                                    |     |         |         |         |       |            |         |           |             |
|          |                                                   |     |         |         |         |       |            |         |           |             |
| TASK T   | OTAL COST                                         |     |         |         |         |       |            | Total:  | 0         | \$0         |
| Division | 12 - Furnishings                                  |     |         |         |         |       |            |         |           |             |
| ļ        |                                                   |     |         |         |         |       |            |         |           |             |
| TASK T   | OTAL COST                                         |     |         |         |         |       |            | Total:  | 0         | \$0         |
| Division | 13 - Special Construction                         | 1   | 1       | r       |         |       |            |         |           |             |
| TACKT    | OT U. COST                                        |     |         |         |         |       |            | Terel   |           | 60          |
| Division | 14 - Conveying Equipment                          |     |         |         |         |       |            | 1 otal: | 0         | 50          |
| DIVISION | 14 - Conveying Equipment                          |     |         |         |         |       |            |         |           |             |
| TASK T   | OTAL COST                                         |     |         |         |         |       |            | Total   | 0         | \$0         |
| Division | 21 - Fire Supression                              |     |         |         |         |       |            | . out.  | 0         | 30          |
| 1        | E and a                                           |     |         |         |         |       |            |         |           |             |
| TASK T   | OTAL COST                                         |     | • • • • |         |         |       |            | Total:  | 0         | \$0         |
| Division | 22 - Plumbing                                     |     |         |         |         |       |            |         |           |             |
|          | Mechanical Removals and Demolitions               | 1   | LS      | 15,000  | 15,000  | 0     |            | 0       | 15,000    |             |
|          | Station Piping                                    | 1   | LS      | 35,000  | 35,000  | 50    |            | 17,500  | 52,500    |             |
| L        | Sump Pump (Explosion-proof type)                  | 1   | ea      | 8,000   | 8,000   | 30    |            | 2,400   | 10,400    |             |
| <b> </b> | Washroom                                          | 1   | LS      | 5,000   | 5,000   | 30    |            | 1,500   | 6,500     |             |
| L        | I hermal Insulation                               | 1   | LS      | 5,000   | 5,000   | 35    |            | 1,750   | 6,750     |             |
| L        | Miscellaneous Supports and Hangers                | 1   | LS      | 20,000  | 20,000  | 35    |            | 7,000   | 27,000    | 1           |

| Bissett Wastewater Pump Station  |
|----------------------------------|
| WSP Project Team                 |
| 60% Design Capital Cost Estimate |
|                                  |

 PROJ. NO.:
 201-08639-00

 DATE:
 July 27, 2021

# 60% DESIGN CAPITAL COST ESTIMATE

| -         |                                                                 |          |     |         |         |    |          |        |           |             |
|-----------|-----------------------------------------------------------------|----------|-----|---------|---------|----|----------|--------|-----------|-------------|
|           | Core Drilling (Floor & Walls)                                   | 8        | ea  | 500     | 4,000   | 0  |          | 0      | 4,000     | l           |
|           |                                                                 |          |     |         |         |    |          |        |           | ł           |
| TASK T    | OTAL COST                                                       |          |     | •       |         |    |          | Total: | 122,150   | \$122,150   |
| Division  | 23 - HVAC                                                       |          |     |         |         |    |          |        | ,         | 0111,100    |
| DIVISION  | Station Ford (Flortnicel Brown)                                 | 2        |     | 10.000  | 20.000  | 25 |          | 7.000  | 27.000    |             |
| -         | Station Fans (Electrical Room)                                  | 2        | ea  | 10,000  | 20,000  | 33 |          | 7,000  | 27,000    |             |
|           | Station Fans (Wet Well)                                         | 2        | ea  | 10,000  | 20,000  | 35 |          | 7,000  | 27,000    |             |
|           | Station Fans (Dry Well)                                         | 2        | ea  | 8,000   | 16,000  | 35 |          | 5,600  | 21,600    |             |
|           | Duct Inline Filter c/w Pressure Gauge-Switch                    | 1        | ea  | 5,000   | 5,000   | 35 |          | 1,750  | 6,750     |             |
|           | Ductwork, Dampers, Louvers & Grilles (Dry Well)                 | 1        | LS  | 35,000  | 35,000  | 35 |          | 12,250 | 47,250    |             |
|           | Ductwork Dampers Louvers (Wet Well)                             | 1        | LS  | 50,000  | 50,000  | 35 |          | 17 500 | 67 500    |             |
|           | Daetwork, Dampers, Ebuvers (Wet Wen)                            | 2        | 10  | 1,500   | 2,000   | 25 |          | 1,500  | 4.050     | ł           |
|           | Damper Actuators (Dry wen)                                      | 2        | ea  | 1,300   | 3,000   | 33 |          | 1,030  | 4,030     |             |
|           | Damper Actuators (Wet Well)                                     | 2        | ea  | 4,500   | 9,000   | 35 |          | 3,150  | 12,150    | 4           |
|           | Unit Heaters (Electrical Room)                                  | 1        | ea  | 5,000   | 5,000   | 35 |          | 1,750  | 6,750     | 1           |
|           | Unit Heaters (Dry Well)                                         | 3        | ea  | 5,000   | 15,000  | 35 |          | 5,250  | 20,250    | ł           |
|           | Unit Heaters (Wet Well)                                         | 4        | ea  | 12,000  | 48,000  | 35 |          | 16.800 | 64,800    |             |
|           | Unit Heaters (Washroom)                                         | 1        | 69  | 5,000   | 5,000   | 35 |          | 1 750  | 6 750     |             |
|           |                                                                 | 1        | LC  | 20,000  | 20,000  | 50 |          | 1,750  | 20,000    | ł           |
| -         | HVAC Controls                                                   | 1        | LS  | 20,000  | 20,000  | 50 |          | 10,000 | 30,000    | ł           |
|           | Programming and System Integration including FAT and SAT        | 1        | LS  | 25,000  | 25,000  | 0  |          | 0      | 25,000    | ł           |
|           | HVAC TAB                                                        | 1        | LS  | 6,000   | 6,000   | 0  |          | 0      | 6,000     | ł           |
|           | 150 DIA Wet Well Vent, S.S.                                     | 1        | ea  | 4,000   | 4,000   | 75 |          | 3,000  | 7,000     | ł           |
|           |                                                                 |          |     |         |         |    |          |        |           | ł           |
| TASKT     | OT AL COST                                                      |          |     |         |         |    |          | Total  | 270 950   | \$270 850   |
| D: · ·    |                                                                 |          |     |         |         |    |          | Total: | 379,030   | 33/9,050    |
| Division  | 25 - Integrated Automation                                      | 1        | 1   |         |         | 1  | -        |        |           | 1           |
| I         |                                                                 |          |     |         |         | l  |          |        |           | 1           |
| TASK T    | OTAL COST                                                       |          |     |         |         |    |          | Total: | 0         | \$0         |
| Division  | 26 - Electrical                                                 |          |     |         |         |    |          |        |           |             |
|           | Electrical General Requirements (Miscellaneous)                 | 1        | 15  | 10.000  | 10.000  | 0  |          | 0      | 10.000    |             |
| I         | T-ma-man                                                        | 1        | 10  | 10,000  | 10,000  | 0  |          | 25.000 | 10,000    | 1           |
| I         | remporary service                                               | 1        | LS  | 100,000 | 100,000 | 25 |          | 25,000 | 125,000   |             |
| l         | Electrical Systems Analysis                                     | 1        | LS  | 10,000  | 10,000  | 0  |          | 0      | 10,000    |             |
|           | Demolition of Electrical Systems                                | 1        | LS  | 30,000  | 30,000  | 0  |          | 0      | 30,000    |             |
|           | Basic Electrical Equipment & Materials                          | 1        | LS  | 125,000 | 125,000 | 25 |          | 31,250 | 156,250   | ł           |
|           | Underground Duct Systems and Access Holes                       | 1        | LS  | 200.000 | 200.000 | 25 |          | 50.000 | 250,000   |             |
|           | Conduit and Coldistant Systems                                  | 1        | LC  | 12,000  | 12,000  | 25 |          | 2,000  | 15,000    | ł           |
|           | Conduit and Cablefray Systems                                   | 1        | LS  | 12,000  | 12,000  | 23 |          | 3,000  | 13,000    | ł           |
|           | Wire and Cables                                                 | 1        | LS  | 5,000   | 5,000   | 25 |          | 1,250  | 6,250     | 1           |
|           | Electrical Boxes                                                | 1        | LS  | 2,000   | 2,000   | 25 |          | 500    | 2,500     | 1           |
|           | Wiring Device                                                   | 1        | LS  | 8,000   | 8,000   | 25 |          | 2,000  | 10,000    |             |
|           | Standby Diesel Generator Set                                    | 1        | ea  | 240.000 | 240.000 | 25 |          | 60.000 | 300.000   | ł           |
|           | Auto Transfer Switch                                            | 1        | IS  | 20,000  | 20,000  | 25 |          | 5 000  | 25,000    | ł           |
| -         |                                                                 | 1        | LO  | 20,000  | 20,000  | 25 |          | 3,000  | 25,000    | ł           |
|           | Control Devices                                                 | 1        | LS  | 10,000  | 10,000  | 25 |          | 2,500  | 12,500    |             |
|           | Grounding                                                       | 2        | LS  | 12,000  | 24,000  | 25 |          | 6,000  | 30,000    |             |
|           | Low Voltage Motor Control Centres                               | 1        | LS  | 250,000 | 250,000 | 25 |          | 62,500 | 312,500   | ł           |
|           | Variable Frequency Drives                                       | 3        | ea  | 40,000  | 120.000 | 25 |          | 30,000 | 150,000   | ł           |
|           | Active Harmonic Filter                                          | 0        | 00  | 50,000  | 0       | 25 |          | 0      | 0         | ł           |
| -         |                                                                 | 0        | LC  | 30,000  | 0       | 25 |          | 0      | 0         | ł           |
| -         |                                                                 | 0        | LS  | 30,000  | 0       | 25 |          | 0      | 0         | ł           |
|           | Surge Protection Device (SPD) (1-200kA, 2-80kA)                 | 0        | LS  | 5,000   | 0       | 25 |          | 0      | 0         | 1           |
| TASK T    | OTAL COST                                                       |          |     |         |         |    |          | Total: | 1,445,000 | \$1,445,000 |
| Division  | 27 - Communications                                             |          |     |         |         |    |          |        |           |             |
|           |                                                                 |          |     |         |         |    |          |        |           |             |
| TASK T    | OTAL COST                                                       |          |     | 1       |         |    |          | Total  | 0         | \$0         |
| Distation | 28 Electronic Selet: and Security                               |          |     |         |         |    |          | Total. | 0         | 30          |
| DIVISION  | 28 - Electronic Salety and Security                             | r        | r   |         |         |    |          |        |           | ł           |
|           |                                                                 |          |     |         |         |    |          |        |           | 1           |
| TASK T    | OTAL COST                                                       |          |     |         |         |    |          | Total: | 0         | \$0         |
| Division  | 31 - Earthworks                                                 |          |     |         |         |    |          |        |           |             |
| i i       | Temporary Bypass Pumping (\$45k / Week)                         | 20       | ea  | 45,000  | 900.000 | 0  |          | 0      | 900.000   |             |
| 1         | Landscaping (including Grading Asphalt and Curbs)               | 1        | 15  | 25,000  | 25 000  | 0  |          | 0      | 25 000    |             |
|           | Sediment and Erosion control                                    | 1        | IC  | 5 000   | 20,000  | 0  |          | 0      | 5.000     |             |
|           | Scannent and Elosion control                                    | 1        |     | 5,000   | 5,000   |    |          |        | 5,000     |             |
|           | Excavation (Generator Duct Bank/Fuel Line, Bypass Connection)   | 1        | LS  | 5,000   | 5,000   |    |          |        | 5,000     | 1           |
|           | Tree Protection                                                 | 1        | LS  | 5,000   | 5,000   |    |          |        | 5,000     | 1           |
|           |                                                                 |          |     |         |         |    |          |        |           |             |
| TASK T    | OTAL COST                                                       |          |     |         |         |    |          | Total: | 940.000   | \$940,000   |
| Division  | 22 Exterior Improvements                                        |          |     |         |         |    |          |        | ,,        |             |
| DIVISION  | 52 - Exterior Improvements                                      |          | r   |         |         |    |          |        |           | ł           |
|           |                                                                 |          |     |         |         |    |          |        |           | ł           |
| TASK T    | OTAL COST                                                       |          |     |         |         |    |          | Total: | 0         | \$0         |
| Division  | 33 - Utilities                                                  |          |     |         |         |    |          |        |           |             |
|           |                                                                 |          |     |         |         |    |          |        |           |             |
| TASKT     | OTAL COST                                                       |          |     |         |         |    |          | Total  | 0         | \$0.        |
| Distant   | 24 Transportation                                               |          |     |         |         |    |          | Total: | U         | 50          |
| Division  | 54 - Transportation                                             |          |     |         |         | 1  |          |        |           | ł           |
| I         | <u> </u>                                                        |          |     |         |         |    |          |        |           | 1           |
| TASK T    | OTAL COST                                                       |          |     |         |         |    |          | Total: | 0         | \$0         |
| Division  | 35 - Waterway and Marine Construction                           |          |     |         |         |    |          |        |           |             |
|           | · · · · ·                                                       |          |     |         |         |    |          |        |           | l           |
| TACET     | OTAL COST                                                       | <u>ا</u> | I   | !       |         | !  | <u> </u> | Tatal  |           | e0.         |
| D: · ·    | 10 D                                                            |          |     |         |         |    |          | Total: | 0         | 50          |
| Division  | 40 - Process Interconnections                                   | 1        | 1 - |         |         | 1  | -        |        |           | 1           |
|           | Process Valves                                                  | 1        | LS  | 65,000  | 65,000  | 30 |          | 19,500 | 84,500    | 1           |
| 1         | RPU Panel Construction                                          | 1        | LS  | 60,000  | 60,000  | 0  | 1,000    | 1,000  | 61,000    |             |
| I         | Gas Detection System including instruments.panel .lights .horns | 1        | LS  | 30,000  | 30.000  | 30 |          | 9.000  | 39.000    |             |
| I         | Door/Hatch Contacts                                             | 1        | IS  | 2 000   | 2 000   | 30 |          | 600    | 2 600     | 1           |
| I         | Flowmator                                                       | 1        | TC  | 12,000  | 12,000  | 30 |          | 2.000  | 15 (00    | l           |
|           | riowineter                                                      | 1        | LS  | 12,000  | 12,000  | 30 | 1        | 3,600  | 15,600    | 1           |

| PROJECT: | Bissett Wastewater Pump Station  |
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| DONE BY: | WSP Project Team                 |
| SUBJECT: | 60% Design Capital Cost Estimate |

| DOILD1.  |       |
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| SUBJECT: | 60% D |

201-08639-00 PROJ. NO.: July 27, 2021 DATE:

# 60% DESIGN CAPITAL COST ESTIMATE

| Pr                                                           | ressure Transmitter                                                 | 1       | LS    | 3,000   | 3,000   | 30 | 900     | 3,900   |             |
|--------------------------------------------------------------|---------------------------------------------------------------------|---------|-------|---------|---------|----|---------|---------|-------------|
| Pr                                                           | ressure Gauges                                                      | 6       | each  | 500     | 3,000   | 30 | 900     | 3,900   |             |
| Fl                                                           | loat Switchs                                                        | 9       | each  | 600     | 5,400   | 30 | 1,620   | 7,020   |             |
| M                                                            | lain - Programming and System Integration including FAT;s and SAT;s | 1       | LS    | 30,000  | 30,000  | 0  | 0       | 30,000  |             |
| Pc                                                           | ower Monitoring and Pump Protection Relays                          | 1       | LS    | 8,500   | 8,500   | 30 | 2,550   | 11,050  |             |
| Le                                                           | evel Sensor and Transmitter                                         | 1       | ea    | 3,500   | 3,500   | 50 | 1,750   | 5,250   |             |
| De                                                           | emolition and Removals                                              | 1       | LS    | 6,000   | 6,000   | 50 | 3,000   | 9,000   |             |
|                                                              |                                                                     |         |       |         |         |    |         |         |             |
| TASK TOT                                                     | TAL COST                                                            |         |       |         |         |    | Total:  | 272,820 | \$272,820   |
| Division 41                                                  | - Material Processing and Handling Equipment                        |         |       |         |         |    |         |         |             |
| М                                                            | Ionorail Beam                                                       | 1       | LS    | 7,500   | 7,500   | 30 | 2,250   | 9,750   |             |
| El                                                           | lectric Chain Hoist                                                 | 1       | LS    | 6,900   | 6,900   | 30 | 2,070   | 8,970   |             |
|                                                              |                                                                     |         |       |         |         |    |         |         |             |
| TASK TOT                                                     | TAL COST                                                            |         |       |         |         |    | Total:  | 18,720  | \$18,720    |
| Division 42 - Process Heating, Cooling, and Drving Equipment |                                                                     |         |       |         |         |    |         |         |             |
|                                                              |                                                                     |         |       |         |         |    |         |         |             |
| TASK TOT                                                     | TAL COST                                                            |         |       |         |         |    | Total:  | 0       | \$0         |
| Division 43                                                  | - Process Gas and Liquid Handling, Purification, and Storage Equip  | oment   |       |         |         |    |         |         |             |
| Re                                                           | emove Existing Pumps, Pipes and Valves                              | 1       | LS    | 15,000  | 15,000  | 0  | 0       | 15,000  |             |
| In                                                           | istall New Pumps                                                    | 3       | ea    | 181,382 | 544,146 | 30 | 163,244 | 707,390 |             |
|                                                              |                                                                     |         |       |         |         |    |         |         |             |
| TASK TOT                                                     | TAL COST                                                            |         |       |         |         |    | Total:  | 722,390 | \$722,390   |
| Division 44                                                  | - Process Heating, Cooling and Drying Equipment, Pollution Control  | ol Equi | pment |         |         |    |         |         |             |
|                                                              |                                                                     |         |       |         |         |    |         |         |             |
| TASK TOT                                                     | TAL COST                                                            |         |       |         |         |    | Total:  | 0       | \$0         |
| Division 45                                                  | - Industry-Specific Manufacturing Equipment                         |         |       |         | `       |    |         |         |             |
|                                                              |                                                                     |         |       |         |         |    |         |         |             |
| TASK TOT                                                     | TAL COST                                                            |         |       |         |         |    | Total:  | 0       | \$0         |
| <b>Division 46</b>                                           | - Water and Wastewater Equipment                                    |         |       |         |         |    |         |         |             |
|                                                              |                                                                     |         |       |         |         |    |         |         |             |
| TASK TOT                                                     | TAL COST                                                            |         |       |         |         |    | Total:  | 0       | \$0         |
| Division 48                                                  | - Electrical Power Generation Equipment                             |         |       |         |         |    |         |         |             |
|                                                              |                                                                     |         |       |         |         |    |         |         |             |
| TASK TOT                                                     | TAL COST                                                            |         |       |         |         |    | Total:  | 0       | \$0         |
|                                                              |                                                                     |         |       |         |         |    |         | TOTAL   | \$5,501,070 |



# **F**SPECIFICATIONS

# Bissett Lake Wastewater Pump Station Specification List

Specifications will utilize Halifax Water's front end specifications

# 03 10 00 03 11 00 03 11 13 03 15 00

03 00 00 Concrete **Concrete Forming and Accessories** Concrete Forming Structural Cast-in-Place Concrete Forming **Concrete Accessories** 

03 15 13 Waterstops 03 15 16 **Concrete Construction Joints** 03 15 19 **Cast-In Concrete Anchors** 03 20 00 Concrete Reinforcing 03 21 00 **Reinforcement Bars** 03 21 11 Plain Steel Reinforcement Bars 03 21 13 Galvanized Reinforcement Steel Bars 03 21 16 **Epoxy-Coated Reinforcement Steel Bars** 03 30 00 Cast-in-Place Concrete 03 30 53 Miscellaneous Cast-in-Place Concrete 03 60 00 Groutina 03 61 00 **Cementitious Grouting** 03 61 13 **Dry-Pack Grouting** 03 62 00 Non-Shrink Grouting 03 62 13 Non-Metallic Non-Shrink Grouting Metallic Non-Shrink Grouting 03 62 16 03 63 00 **Epoxy Grouting** 03 64 00 **Injection Grouting** 03 64 23 **Epoxy Injection Grouting** 04 05 00 Common Work Results for Masonry 04 05 05 Selective Demolition for Masonry 04 05 13 Masonry Mortaring 04 05 16 Masonry Grouting 04 05 19 Masonry Anchorage and Reinforcing 04 05 21 Masonry Strengthening Masonry Accessories 04 05 23 04 20 00 Unit Masonry 04 22 00 **Concrete Unit Masonry** 04 22 00.13 Concrete Unit Veneer Masonry 04 22 23 Architectural Concrete Unit Masonry 04 22 33 Interlocking Concrete Unit Masonry 05 00 00 Metals 05 50 00 Metal Fabrications 05 51 00 Metal Stairs 05 52 00 Metal Railings 05 53 00 Metal Gratings 05 54 00 Metal Floor Plates 05 55 00 **Metal Stair Treads and Nosings** 05 56 00 Metal Castings Wood, Plastics, and Composites 06 00 00 **Rough Carpentry** 06 10 00 06 10 53 Miscellaneous Rough Carpentry

| 06 60 00             | Plastic Fabrications                    |
|----------------------|-----------------------------------------|
| 06 74 13             | Fiberglass Reinforced Gratings          |
| 06 80 00             | Composite Fabrications                  |
| 06 81 00             | Composite Railings                      |
| 06 81 13             | Glass-Fiber-Reinforced Plastic Railings |
| 07 00 00             | <b>Thermal and Moisture Protection</b>  |
| 07 12 00             | Built-Up Bituminous Waterproofing       |
| 07 16 00             | Cementitious and Reactive Waterproofing |
| 07 20 00             | Thermal Protection                      |
| 07 21 00             | Thermal Insulation                      |
| 07 24 00             | Exterior Insulation and Finish Systems  |
| 07 80 00             | Fire and Smoke Protection               |
| 07 81 00             | Applied Fireproofing                    |
| 07 81 13             | Cement Aggregate Fireproofing           |
| 07 81 16<br>07 81 19 | Cementitious Fireproofing               |
| 07 81 23             | Intumescent Fireproofing                |
| 07 81 26             | Magnesium Cement Fireproofing           |
| 07 81 29             | Mineral-Fiber Cementitious Fireproofing |
| 07 81 33<br>07 82 00 | Board Fireproofing                      |
| 07 82 13             | Calcium-Silicate Board Fireproofing     |
| 07 82 16             | Slag-Fiber Board Fireproofing           |
| 07 84 00             | Firestopping                            |
| 07 84 13             | Penetration Firestopping                |
| 07 84 43<br>07 96 00 | Joint Firestopping                      |
|                      | Joint Protoction                        |
| 07 90 00             | Joint Sealants                          |
|                      | Openinge                                |
|                      | Openings                                |
| 08 10 00             | Doors and Frames                        |
| 08 11 00             | Metal Doors and Frames                  |
| 08 11 13             | Hollow Metal Doors and Frames           |
|                      |                                         |
|                      |                                         |
| 08 71 00             | Door Hardware                           |
| 08 90 00             | Louvers and vents                       |
| 08 91 00             | Louvers                                 |
| 08 95 00             | Vents                                   |
| 09 00 00             | Finishes                                |

| 09 60 00                       | Flooring                                            |
|--------------------------------|-----------------------------------------------------|
| 09 61 00                       | Flooring Treatment                                  |
| 09 90 00                       | Painting and Coating                                |
| 09 91 00                       | Painting                                            |
| 10 00 00                       | Specialties                                         |
| 10 28 00                       | Toilet, Bath, and Laundry Accessories               |
| 10 28 13                       | Toilet Accessories                                  |
| 11 00 00                       | Equipment                                           |
| 22 00 00                       | Plumbing                                            |
| 22 05 00                       | Common Work Results for Plumbing                    |
| 22 05 15                       | Plumbing Specialties and Accessories                |
| 22 10 00                       | Plumbing Piping                                     |
| 22 11 00                       | Facility Water Distribution                         |
| 22 11 16                       | Domestic Water Piping                               |
| <b>22 13 00</b><br>22 13 16 13 | Facility Sanitary Sewerage                          |
| 22 13 16.19                    | Sanitary Waste and Vent Piping – Plastic            |
| 22 30 00                       | Plumbing Equipment                                  |
| 22 33 00                       | Electric Domestic Water Heaters                     |
| 22 40 00                       | Plumbing Fixtures                                   |
| 22 42 00                       | Commercial Plumbing Fixtures                        |
| 22 42 13                       | Commercial Water Closets, Urinals, and Bidets       |
| 22 42 16                       | Commercial Lavatories and Sinks                     |
| 23 00 00                       | Heating, Ventilating, and Air                       |
|                                | Conditioning (HVAC)                                 |
| 23 05 00                       | Common Work Results for HVAC                        |
| 23 05 13                       | Common Motor Requirements for HVAC Equipment        |
| 23 05 15                       | Common Installation Requirements for HVAC Equipment |
| 23 05 23.01                    | Hangers and Supports for HVAC Piping and Equipment  |
| 23 05 33                       | Heat Tracing for HVAC Piping                        |
| 23 05 48                       | Vibration and Seismic Controls for HVAC             |
| 23 05 53                       | Identification for HVAC Piping and Equipment        |
| <b>23 03 93</b>                | HVAC Insulation                                     |
| 23 07 13                       | Duct Insulation                                     |
| 23 08 00                       | Commissioning of HVAC                               |
| 23 08 13                       | Performance Verification of HVAC Systems            |
| 23 08 16                       | Cleaning and Start-up of HVAC Piping Systems        |
| 23 09 00                       | Instrumentation and Control for HVAC                |
| 23 09 33                       | Electric and Electronic Control System for HVAC     |
| 5                              |                                                     |

| 23 30 00    | HVAC Air Distribution                               |
|-------------|-----------------------------------------------------|
| 23 31 00    | HVAC Ducts and Casings                              |
| 23 31 13.01 | Metal Ducts – Low Pressure to 500 PA                |
| 23 33 00    | Air Duct Accessories                                |
| 23 33 14    | Dampers - Balancing                                 |
| 23 33 15    | Dampers - Operating                                 |
| 23 33.16    | Dampers – Fire and Smoke                            |
| 23 34 00    | HVAC Fans                                           |
| 23 34 23.13 | Packaged Roof and Wall Exhausters                   |
| 23 37 00    | Air Outlets and Inlets                              |
| 23 37 13    | Diffusers, Registers, and Grilles                   |
| 23 37 20    | Louvres, Intakes and Vents                          |
| 23 82 00    | Convection Heating and Cooling Units                |
| 23 82 39    | Unit Heaters                                        |
| 23 82 39.23 | Unit Heaters - Electrics                            |
| 26 00 00    | Electrical                                          |
| 26 05 00    | Common Work Results for Electrical                  |
| 26 05 05    | Selective Demolition for Electrical                 |
| 26 05 19    | Building Wire and Cable                             |
| 26 05 22    | Connectors and Terminations                         |
| 26 05 28    | Grounding - Secondary                               |
| 26 05 29    | Electrical Supporting Devices                       |
| 26 05 31    | Outlet Boyes – Conduit Boyes and Eittings           |
| 26 05 32    | Conduits                                            |
| 26 05 34    | Boxes                                               |
| 26 05 36    | Cable Trays for Electrical Systems                  |
| 26 05 43.01 | Installation of Cables in Trenches and in Ducts     |
| 26 05 53    | Electrical Identification                           |
| 26 05 80    | Equipment Wiring                                    |
| 26 06 00    | Schedules for Electrical                            |
| 26 06 01    | Electrical General                                  |
| 26 08 00    | Commissioning of Electrical Systems                 |
| 26 12 00    | Medium-Voltage Transformers                         |
| 26 12 16.01 | Dry-Type Transformers up to 600V Primary            |
| 26 13 00    | Medium-Voltage Switchgear                           |
| 26 13 13    | Moulded Case Circuit Breaker                        |
| 26 20 00    | Low-Voltage Electrical Distribution                 |
| 26 24 00    | Switchboards and Panelboards                        |
| 26 24 02    | Service Entrance Board                              |
| 26 24 16    | Panelboards                                         |
| 26 24 19    | Motor-Control Centers                               |
| 26 27 00    | Low-Voltage Distribution Equipment                  |
| 26 27 16    | Outdoor Equipment Enclosures                        |
| 26 27 26    | Wiring Devices                                      |
| 26 28 00    | Low-Voltage Circuit Protective Devices              |
| 26 28 23    | Disconnect Switches Fused and Non-Fused uo to 1000V |

| 26 29 00                              | Low-Voltage Controllers                       |
|---------------------------------------|-----------------------------------------------|
| 26 29 03                              | Control Devices                               |
| 20 29 10                              | Eacility Electrical Bower Concreting and      |
| 20 30 00                              | Facility Electrical Power Generating and      |
|                                       | Storing Equipment                             |
| 26 32 00                              | Packaged Generator Assemblies                 |
| 26 32 13                              | Engine Generators                             |
| <b>26 32 13.13</b><br><b>26 36 00</b> | Transfer Switches                             |
| 26 36 23                              | Automatic Transfer Switches                   |
| 26 40 00                              | Electrical Protection                         |
| 26 43 00                              | Surge Protective Devices                      |
| 26 43 13                              | Transient Voltage Surge Suppressor            |
| 26 50 00                              | Lighting                                      |
| 26 51 00                              | Interior Lighting                             |
| 26 51 19                              | LED Interior Lighting                         |
| 26 52 00                              | Safety Lighting                               |
| 26 52 13<br>26 52 13 13               | Emergency and Exit Lighting                   |
| 26 52 13.16                           | Exit Signs                                    |
| 26 54 00                              | Classified Location Lighting                  |
| 26 54 19<br>26 56 00                  | LED Classified Location Lighting              |
| 20 30 UU<br>26 56 13                  | Lighting Poles and Standards                  |
| 26 56 19                              | LED Exterior Lighting                         |
| 26 56 21                              | HID Exterior Lighting                         |
| 31 00 00                              | Earthwork                                     |
| 31 05 00                              | Common Work Results for Earthwork             |
| 31 05 05                              | Selective Demolition for Earthwork            |
| 31 10 00                              | Site Clearing                                 |
| 31 11 00                              | Clearing and Grubbing                         |
| 31 13 00                              | Selective Tree and Shrub Removal and Trimming |
| 31 20 00                              | Earth Moving                                  |
| 31 22 00                              | Grading                                       |
| 31 23 00                              | Excavation and Fill                           |
| 31 23 33                              | Trenching and Backfilling                     |
| 31 25 00                              | Erosion and Sedimentation Controls            |
| 31 20 04.15                           | Farthwork Methods                             |
|                                       | Charing and Undersigning                      |
| 31 40 00                              | Shoring and Underpinning                      |
| 31 41 00                              | Snoring                                       |
| 32 30 00                              | Site Improvements                             |
|                                       |                                               |

32 31 00 Fences and Gates 32 90 00 Planting 32 91 00 **Planting Preparation** Soil Preparation 32 91 13 Landscape Grading 32 91 19 Topsoil Placement and Grading 32 91 19.13 **Turf and Grasses** 32 92 00 40 00 00 Process Interconnections 40 05 00 **Common Work Results for Process Interconnections** Couplings, Adapters, and Specials for Process Piping 40 05 06 40 05 07 Hangers and Supports for Process Piping Wall Pipes, Floor Pipes, and Pipe Sleeves 40 05 09 Stainless Steel Process Pipe and Tubing 40 05 23 40 05 51 **Common Requirements for Process Valves Process Control and Enterprise** 40 60 00 Management Systems **Control System Equipment** 40 63 00 Distributed Process Control Systems 40 63 13 **Programmable Logic Controllers** 40 63 43 40 63 83 **Remote Terminal Units Network and Communication Equipment** 40 66 00 40 67 00 **Control System Equipment Panels and Racks Process Control Software** 40 68 00 **Instrumentation for Process Systems** 40 70 00 40 71 00 Flow Measurement 40 71 13 Magnetic Flow Meters 40 72 00 Level Measurement 40 72 26 Laser Level Meters 40 72 76 Level Switches 40 73 00 Pressure, Strain, and Force Measurement Pressure and Differential Pressure Gauges 40 73 13 40 73 63 **Diaphragm Seals** 40 74 00 **Temperature Measurement Temperature Transmitters** 40 74 63 40 74 66 **Temperature Switches Process Gas Analytical Measurement** 40 76 00 40 76 13 **Oxygen Gas Analyzers** 40 76 23 **Combustible Gas Monitors** 40 76 33 Hydrogen Sulfide Monitors 40 78 00 Panel Mounted Instruments 40 78 13 Indicators and Meters 40 78 16 Indicating Lights Switches and Push Buttons 40 78 19 40 78 33 Annunciators

| 40 78 53 | Relays                                                        |  |
|----------|---------------------------------------------------------------|--|
| 40 78 56 | Isolators, Intrinsically-Safe Barriers, and Surge Suppressors |  |
| 40 78 59 | Power Supplies                                                |  |
| 40 78 63 | Alarm Dialers                                                 |  |
| 40 97 00 | Variable Frequency Drives                                     |  |
| 41 00 00 | 1 00 00 Material Processing and Handlin                       |  |
|          | Equipment                                                     |  |
| 41 20 00 | Piece Material Handling Equipment                             |  |
| 41 22 00 | Cranes and Hoists                                             |  |
| 43 00 00 | Process Gas and Liquid Handling,                              |  |
| 43 25 00 | Submersible/Immersible Liquid Pumps                           |  |
|          |                                                               |  |

# PART 1 - GENERAL

# 1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Nova-Scotia, Canada.

- .2 Indicate on drawings:
  - .1 Mounting arrangements.
  - .2 Operating and maintenance clearances.
- .3 Shop drawings and product data accompanied by: .1 Detailed drawings of bases, supports, and anchor bolts.
  - .2 Acoustical sound power data, where applicable.
  - .3 Points of operation on performance curves.
  - .4 Manufacturer to certify current model production.
  - .5 Certification of compliance to applicable codes.

.4 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

# 1.2 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 Closeout Submittals.
- Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
  .1 Operation and maintenance manual approved by, and final copies deposited with, Consultant before final inspection.
  .2 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

- .4 Operation instruction for systems and component.
- .5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

| Bissett Lake Wastewater       | COMMON WORK RESULTS | Section 22 05 00 |
|-------------------------------|---------------------|------------------|
| Pump Station -Cole Harbour,NS | FOR PLUMBING        | Page 2           |
| Project No. 201-08639-00      |                     | 2021-07-30       |

|     | .7 Colour coding chart.                                    |
|-----|------------------------------------------------------------|
| .3  | Maintenance data to include:                               |
|     | .1 Servicing, maintenance, operation and                   |
|     | trouble-shooting instructions for each item of equipment.  |
|     | .2 Data to include schedules of tasks, frequency, tools    |
|     | required and task time.                                    |
| . 4 | Performance data to include:                               |
| • - | 1 Equipment manufacturer's performance datasheets with     |
|     | noint of operation as left after commissioning is          |
|     | complete                                                   |
|     | 2 Equipment performance verification test regults          |
|     | 2 Special performance data as specified                    |
|     | .5 Special periormance data as specified.                  |
|     | .4 Testing, adjusting and balancing reports as specified   |
|     | in Section 23 05 93 - Testing, Adjusting and Balancing for |
| F   | HVAC.                                                      |
| • 5 | Approvals:                                                 |
|     | .1 Submit 2 copies of draft Operation and Maintenance      |
|     | Manual to Consultant for approval. Submission of           |
|     | individual data will not be accepted unless directed by    |
|     | Consultant.                                                |
|     | .2 Make changes as required and re-submit as directed by   |
|     | Consultant.                                                |
| .6  | Additional data:                                           |
|     | .1 Prepare and insert into operation and maintenance       |
|     | manual additional data when need for it becomes apparent   |
|     | during specified demonstrations and instructions.          |
| .7  | Site records:                                              |
|     | .1 Consultant will provide 1 set of reproducible           |
|     | mechanical drawings. Provide sets of white prints as       |
|     | required for each phase of work. Mark changes as work      |
|     | progresses and as changes occur. Include changes to        |
|     | existing mechanical systems, control systems and low       |
|     | voltage control wiring.                                    |
|     | .2 Transfer information weekly to reproducibles,           |
|     | revising reproducibles to show work as actually installed. |
|     | .3 Use different colour waterproof ink for each service.   |
|     | .4 Make available for reference purposes and inspection.   |
| .8  | As-built drawings:                                         |
|     | .1 Prior to start of Testing, Adjusting and Balancing      |
|     | for HVAC, finalize production of as-built drawings.        |
|     | .2 Identify each drawing in lower right hand corner in     |
|     | letters at least 12 mm high as follows: - "AS BUILT        |
|     | DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL |
|     | SYSTEMS AS INSTALLED" (Signature of Contractor) (Date)     |
|     | 3 Submit to Consultant for approval and make               |
|     | corrections as directed                                    |
|     | .4 Perform testing, adjusting and balancing for HVAC       |
|     | using as-built drawings.                                   |
|     | .5 Submit completed reproducible as-built drawings with    |
|     | Operating and Maintenance Manuals                          |
|     | -r                                                         |

.9 Submit copies of as-built drawings for inclusion in final TAB report.

## 1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 Closeout Submittals.
- .2 Furnish spare parts as follows:
  - .1 One set of packing for each pump.
  - .2 One casing joint gasket for each size pump.
  - .3 One glass for each gauge glass.
- .3 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

# 1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirementsandwith manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements: .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

# PART 2 - PRODUCTS

# 2.1 NOT USED

.1 Not used.

# PART 3 - EXECUTION

### 3.1 EXAMINATION

 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
 Inform Consultant of unacceptable conditions immediately

upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

# 3.2 PAINTING REPAIRS AND RESTORATION

- .1 Do painting in accordance with Section 09 91 23 Interior Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

# 3.3 SYSTEM CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

### 3.4 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 -ACTION AND INFORMATIONAL SUBMITTALS. .1 .
- .2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

# 3.5 CLEANING

- Progress Cleaning: clean in accordance with Section 01 74 00 -Cleaning.
   .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 Cleaning.

# 3.6 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

# PART 1 - GENERAL

## 1.1 REFERENCE STANDARDS

- ASTM International (ASTM)

   ASTM A 126-04(2009), Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
   ASTM B 62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.
- American Water Works Association (AWWA)

   ANSI/AWWA C700-09, Standard for Cold Water
   Meters-Displacement Type, Bronze Main Case.
   ANSI/AWWA C701-12, Standard for Cold Water Meters-Turbine
   Type for Customer Service.
   ANSI/AWWA C702-10, Standard for Cold Water Meters-Compound
   Type.
- .3 CSA Group (CSA)
  .1 CSA-B64 Series-11, Backflow Preventers and Vacuum Breakers.
  .2 CSA B79-08, Commercial and Residential Drains and Cleanouts.
  .3 CAN/CSA-B356-10, Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .4 Efficiency Valuation Organization (EVO) .1 International Performance Measurement and Verification Protocol (IPMVP). .1 IPMVP 2007 Version.
- .5 National Research Council Canada (NRC) .1 National Plumbing Code of Canada 2015 (NPC).
- .6 Plumbing and Drainage Institute (PDI) .1 PDI-G101-R2010, Testing and Rating Procedure for Grease Interceptors with Appendix of Installation and Maintenance. .2 PDI-WH201-R2010, Water Hammer Arresters Standard.

# 1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
| Bissett Lake Wastewater        | PLUMBING SPECIALTIES | Section 22 05 15 |
|--------------------------------|----------------------|------------------|
| Pump Station -Cole Harbour, NS | AND ACCESSORIES      | Page 2           |
| Project No. 201-08639-00       |                      | 2021-07-30       |

.1 Submit manufacturer's instructions, printed product literature and data sheets for plumbing products and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in ProvinceTerritory, Canada. .2 Indicate on drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions construction and assembly details and accessories for following: soap dispensing system.

- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Manufacturers' Field Reports: manufacturers' field reports specified.

## 1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for plumbing specialties and accessories for incorporation into manual.
  - .1 Description of plumbing specialties and accessories,
  - giving manufacturers name, type, model, year and capacity.
  - .2 Details of operation, servicing and maintenance.
  - .3 Recommended spare parts list.

## 1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:

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.1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect plumbing materials from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

# PART 2 - PRODUCTS

## 2.1 FLOOR DRAINS

- .1 Floor Drains and Trench Drains: to CSA B79.
- .2 Type 1: general duty; cast iron body round,, adjustable head, nickel bronze strainer, integral seepage pan, and clamping collar.
- .3 Type 2: combination funnel floor drain; cast iron body with integral seepage pan, clamping collar, nickel-bronze adjustable head strainer with integral funnel.

## 2.2 CLEANOUTS

.1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.

### 2.3 NON-FREEZE WALL HYDRANTS

.1 Surface mountwith integral vacuum breaker, NPS 3/4 hose outlet, removable operating key. Polished bronze finish.

## 2.4 WATER HAMMER ARRESTORS

.1 Copper construction, bellowstype: to PDI-WH201.

### 2.5 VACUUM BREAKERS

.1 Breakers: to CSA-B64 Series, vacuum breaker atmospherichose connectionlaboratory faucet intermediate.

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## 2.6 TRAP SEAL PRIMERS

.1 Brass, with integral vacuum breaker, NPS 1/2 solder ends, NPS 1/2 drip line connection.

#### PART 3 - EXECUTION

#### 3.1 EXAMINATION

Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for plumbing specialities and accessories installation in accordance with manufacturer's written instructions.
.1 Inform Consultant of unacceptable conditions immediately upon discovery.
.2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

### 3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

#### 3.3 INSTALLATION

- .1 Install in accordance with National Plumbing Code of Canada (NPC), provincial codes, and local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.

#### 3.4 CLEANOUTS

.1 Bring cleanouts to wall or finished floor unless serviceable from below floor.

#### 3.5 NON-FREEZE WALL HYDRANTS

.1 Install 900 mm above finished grade.

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## 3.6 WATER HAMMER ARRESTORS

.1 Install on branch supplies to fixtures or group of fixtures.

### 3.7 TRAP SEAL PRIMERS (Electric)

- .1 Install for floor drains and elsewhere, as indicated. Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Departmental RepresentativeDCC RepresentativeConsultant.
- .2 Install soft copperorplastic tubing to floor drain.

## 3.8 START-UP

- .1 General: .1 In accordance with Section 01 91 13 - General Commissioning Requirements: General Requirements, supplemented as specified herein.
- .2 Timing: start-up only after:
  - .1 Pressure tests have been completed.
  - .2 Disinfection procedures have been completed.
  - .3 Certificate of static completion has been issued.
  - .4 Water treatment systems operational.
- .3 Provide continuous supervision during start-up.

#### 3.9 TESTING AND ADJUSTING

.1 General:

.1 Test and adjust plumbing specialties and accessories in accordance with Section 01 91 13 - General Commissioning Requirements: General Requirements, supplemented as specified.

- .2 Timing:
  - .1 After start-up deficiencies rectified.

.2 After certificate of completion has been issued by authority having jurisdiction.

## .3 Application tolerances:

- .1 Pressure at fixtures: +/- 70 kPa.
- .2 Flow rate at fixtures: +/- 20%.
- .4 Adjustments:
  - .1 Verify that flow rate and pressure meet design criteria.

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.2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.

.5 Floor drains:

.1 Verify operation of trap seal primer.

.2 Prime, using trap primer. Adjust flow rate to suit site conditions.

.3 Check operations of flushing features.

.4 Check security, accessibility, removability of strainer.

- .5 Clean out baskets.
- .6 Cleanouts: .1 Verify covers are gas-tight, secure, yet readily removable.
- .7 Water hammer arrestors: .1 Verify proper installation of correct type of water hammer arrester.

## 3.10CLOSEOUT ACTIVITIES

- .1 Commissioning Reports: in accordance with Section 01 91 13 General Commissioning Requirements: reports, supplemented as specified.
- Training: provide training in accordance with Section 01 91 13

   General Commissioning Requirements: Training of O&M
   Personnel, supplemented as specified.

## 3.11CLEANING

- Progress Cleaning: clean in accordance with Section 01 74 00 Cleaning.
   .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 Cleaning.

## 3.12PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by plumbing specialties and accessories installation.

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#### 1.1 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers International (ASME) ANSI/ASME B16.15-13, Cast Cooper Alloy Threaded Fittings, .1 Classes 125 and 250. ANSI/ASME B16.18-12, Cast Copper Alloy Solder Joint .2 Pressure Fittings. ANSI/ASME B16.22-13, Wrought Copper and Copper Alloy .3 Solder Joint Pressure Fittings. ANSI/ASME B16.24-11, Cast Copper Alloy Pipe Flanges and .4 Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500. ASME B16.26-13, Cast Copper Alloy Fittings for Flared .5 Copper Tubes. ASME B31.9-14, Building Services Piping. .6 .7 ASME B36.19M-04, Stainless Steel Pipe. .2 ASTM International (ASTM) ASTM A 182/A 182M-16, Standard Specification for Forged or .1 Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service. ASTM A 269-15a, Standard Specification for Seamless and .2 Welded Austenitic Stainless Steel Tubing for General Service. ASTM A 307-14, Standard Specification for Carbon Steel .3 Bolts and Studs, 60,000 PSI Tensile Strength. ASTM A 312/A 312M-16, Seamless, Welded, and Heavily Cold .4 Worked Austenitic Stainless Steel Pipes. .5 ASTM A 351/A 351M-16, Castings, Austenitic, for Pressure Containing Parts. .6 ASTM A 403/A 403M-16, Wrought Austenitic Stainless Steel Piping Fittings. .7 ASTM A 536-84(2014), Standard Specification for Ductile Iron Castings. ASTM B 32-08(2014), Standard Specification for Solder .8 Metal. .9 ASTM B 42-15a, Seamless Copper Tube, Standard Sizes. .10 ASTM B 88M-14, Standard Specification for Seamless Copper Water Tube (Metric). .11 ASTM F 876-15, Standard Specification for Crosslinked Polyethylene (PEX) Tubing. .12 ASTM F 877-11, Standard Specification for Crosslinked Polyethylene (PEX) Hot and Cold Water Distribution System. American National Standards Institute/American Water Works .3 Association (ANSI) / (AWWA) ANSI/AWWA C111/A21.11-12, Rubber-Gasket Joints for .1

Ductile-Iron Pressure Pipe and Fittings.

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.2 ANSI/AWWA C151/A21.51-09, Ductile Iron Pipe, Centrifugally Cast, for Water. .3 AWWA C904-06, Crosslinked Polyethylene (PEX) Pressure Pipe, ½ In. (12 mm) through 3 In. (76mm), for Water Service.

- .4 Canada Green Building Council (CaGBC)

  .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).
  .2 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .5 CSA Group (CSA)
  .1 CSA B137.5-13, Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications.
  .2 CSA B242-05, Groove and Shoulder Type Mechanical Pipe Couplings.
- .6 Underwriters Laboratories of Canada (ULC)

   .1 CAN/ULC S101-07, Fire Endurance Tests of Buildings
   Construction and Materials.
   .2 CAN/ULC S102.2-10, Method of Test for Surface Burning
   Characteristics of Flooring, Floor Coverings and Miscellaneous
   Materials and Assemblies.
   .3 CAN/ULC S115-11, Standard Method of Fire Tests of
   Firestop.
- .7 Department of Justice Canada (Jus) .1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).
- .8 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
   .1 Safety Data Sheets (SDS).
- Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
  .1 MSS-SP-67-02a, Butterfly Valves.
  .2 MSS-SP-70-06, Grey Iron Gate Valves, Flanged and Threaded Ends.
  .3 MSS-SP-71-05, Grey Iron Swing Check Valves, Flanged and Threaded Ends.
  .4 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.
- .10 National Research Council (NRC) .1 National Plumbing Code of Canada (NPC) 2015.
- .11 Transport Canada (TC) .1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

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## 1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data

.1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Closeout Submittals:
 .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

# PART 2 - PRODUCTS

# 2.1 PIPING

- .1 Domestic hot, cold and recirculation systems, within building. .1 Above ground:
  - .1 Copper tube, hard drawn, type L: to ASTM B 88M.
  - .2 PEX Piping to CSA B137.5.

# 2.2 FITTINGS

- .1 Bronze pipe flanges and flanged fittings, Class 150and300: to ANSI/ASME B16.24.
- .2 Cast bronze threaded fittings, Class 125and250: to ANSI/ASME B16.15.
- .3 Cast copper, solder type: to ANSI/ASME B16.18.
- .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
- .5 NPS 2 and larger: .1 ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242. .2 PEX fittings to CSA B137.5 and F1960.
- .6 NPS 1 ½ and smaller: .1 Wrought copper to ANSI/ASME B16.22cast copper to ANSI/ASME B16.18; with 301 stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa. .2 PEX fittings to CSA B137.5.

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## 2.3 JOINTS

- .1 Rubber gaskets, latex-free1.6 mm thick: to AWWA C111.
- .2 Bolts, nuts, hex head and washers: to ASTM A 307, heavy series.
- .3 Solder: 95/5tin copper alloy.
- .4 Teflon tape: for threaded joints.
- .5 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.
- .6 NPS 1 ½ and smaller: PEX fittings to CSA B137.5.
- .7 NPS 2 and larger: PEX fittings to CSA B137.5 and ASTM F 1960. Elbows, adapters, couplings, plugs, tees, multi-port tees and valves.

### 2.4 BALL VALVES

.1 NPS 2 and under, soldered: .1 To ANSI/ASME B16.18, Class 150. .2 Bronze body, chrome plated brass or stainless steel ball, PTFE adjustable packing, brass gland and PTFEseat, steel lever handle, with NPT to copper adaptors as specified Section 23 05 23.01 - Valves - Bronze.

## PART 3 - EXECUTION

## 3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

# 3.2 INSTALLATION

- .1 Install in accordance with NPCandlocal authority having jurisdiction.
- .2 Install pipe work in accordance with Section 23 05 15 Common Installation Requirements for HVAC Pipework, supplemented as specified herein.

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- .3 Assemble piping using fittings manufactured to ANSI and Standard Council of Canada (SCC) standards.
- .4 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.
- .5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.
- .6 Valves .1 Isolate equipment, fixtures and branches with ball valves.

## 3.3 PRESSURE TESTS

.1 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

#### 3.4 FLUSHING AND CLEANING

.1 Flush entire system for 8 h. Ensure outlets flushed for 2 hours. Let stand for 24 hours, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean to Provincialpotable water guidelines. Let system flush for additional 2 hours, then draw off another sample for testing.

## 3.5 PRE-START-UP INSPECTIONS

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.
- .3 Ensure that pressure booster systems are operating properly.
- .4 Ensure that air chambers, expansion compensators are installed properly.

### 3.6 DISINFECTION

.1 Flush out, disinfect and rinse system to requirements of authority having jurisdictionapproval of Departmental Representative.

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.2 Upon completion, provide laboratory test reports on water quality for Consultant approval.

## 3.7 START-UP

- .1 Timing: start up after:
  - .1 Pressure tests have been completed.
  - .2 Disinfection procedures have been completed.
  - .3 Certificate of static completion has been issued.
  - .4 Water treatment systems operational.
- .2 Provide continuous supervision during start-up.
- .3 Start-up procedures:
  - .1 Establish circulation and ensure that air is eliminated.
  - .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
  - .3 Bring HWS storage tank up to design temperature slowly.

.4 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.

.5 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

## 3.8 PERFORMANCE VERIFICATION

.1 Scheduling:

.1 Verify system performance after pressure and leakage tests and disinfection are completed, and Certificate of Completion has been issued by authority having jurisdiction.

.2 Procedures:

.1 Verify that flow rate and pressure meet Design Criteria.

.2 TAB HWC in accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.3 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.

.4 Sterilize HWS and HWC systems for Legionella control.

- .5 Verify performance of temperature controls.
- .6 Verify compliance with safety and health requirements.

.7 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.

.8 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.

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.3 Reports:

.1 In accordance with Section 01 91 13 - General
Commissioning (Cx) Requirements: Reports, using report forms as specified in Section 01 91 13 - General Commissioning (Cx)
Requirements: Report Forms and Schematics.
.2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

## 3.9 OPERATION REQUIREMENTS

.1 Co-ordinate operation and maintenance requirements including, cleaning and maintenance of specified materials and products with Section 23 05 15 - Common Installation Requirements for HVAC Pipework.

## 3.10CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

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### 1.1 REFERENCE STANDARDS

- ASTM International (ASTM)

   ASTM B 32-08, Standard Specification for Solder Metal.
   ASTM B 306-02, Standard Specification for Copper Drainage Tube (DWV).
   ASTM C 564-03a, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .2 CSA Group (CSA)

   .1 CSA B67-1972(R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
   .2 CAN/CSA-B70-06, Cast Iron Soil Pipe, Fittings and Means of Joining.
   .3 CAN/CSA-B125.3-05, Plumbing Fittings.
- .3 Green Seal Environmental Standards (GSES) .1 Standard GS-36-00, Commercial Adhesives.
- .4 National Research Council Canada (NRC) .1 National Plumbing Code of Canada 2015 (NPC).

## 1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data: .1 Provide manufacturer's printed product literature and datasheets for adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

## 1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

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## PART 2 - PRODUCTS

### 2.1 SUSTAINABLE MATERIAL

- .1 Sustainable Requirements: materials and products in accordance with Section 01 47 15 Sustainable Requirements: Construction.
- .2 Adhesives and Sealants: in accordance with Section 07 92 00 Joint Sealants.

## 2.2 COPPER TUBE AND FITTINGS

.1 Above ground sanitaryand vent Type DWV to: ASTM B 306. .1 Fittings. .1 Cast brass: to CAN/CSA-B125.3. .2 Wrought copper: to CAN/CSA-B125.3. .2 Solder: tin-lead, 50:50, type 50Alead free, tin- 95:5, type TA, to ASTM B 32.

# 2.3 CAST IRON PIPING AND FITTINGS

- .1 Above ground sanitaryand vent: to CAN/CSA-B70.
  - .1 Joints:
    - .1 Hub and spigot:
      - .1 Caulking lead: to CSA B67.
      - .2 Mechanical joints:
        - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

## PART 3 - EXECUTION

## 3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

# 3.2 INSTALLATION

.1 In accordance with Section 23 05 15 - Common installation requirements for HVAC pipework.

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.2 Install in accordance with National Plumbing Codeandlocal authority having jurisdiction.

# 3.3 TESTING

- .1 Pressure test buried systems before backfilling.
- .2 Hydraulically test to verify grades and freedom from obstructions.

## 3.4 PERFORMANCE VERIFICATION

- .1 Cleanouts: .1 Verify that cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.
- .3 Ensure that fixtures are properly anchored, connected to system and effectively vented.
- .4 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

## 3.5 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

### 1.1 REFERENCE STANDARDS

- ASTM International (ASTM)

   ASTM D 2235-04, Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
   ASTM D 2564-04e1, Standard Specification for Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .2 CSA Group (CSA) .1 CAN/CSA-Series B1800- 06, Thermoplastic Nonpressure Pipe Compendium - B1800 Series.
- .3 Green Seal Environmental Standards (GSES) .1 Standard GS-36-00, Commercial Adhesives.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
   .1 Safety Data Sheets (SDS).
- .5 National Research Council Canada (NRC) .1 National Plumbing Code of Canada 2015 (NPC).

# 1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data: .1 Provide manufacturer's printed product literature and datasheets for piping and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

### 1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Store at temperatures and conditions recommended by manufacturer.

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## PART 2 - PRODUCTS

### 2.1 MATERIAL

- .1 Sustainable Requirements: materials and products in accordance with Section 01 47 15 Sustainable Requirements: Construction.
- .2 Adhesives and Sealants: in accordance with Section 07 92 00 Joint Sealants.

## 2.2 PIPING AND FITTINGS

.1 For above ground DWV piping to: .1 CAN/CSA B1800.

## 2.3 JOINTS

- .1 Solvent weld for PVC: to ASTM D 2564.
- .2 Solvent weld for ABS: to ASTM D 2235.

## PART 3 - EXECUTION

#### 3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

## 3.2 INSTALLATION

- .1 In accordance with Section 23 05 15 Common installation requirements for HVAC pipework.
- .2 Install in accordance with National Plumbing Codeandlocal authority having jurisdiction.

# 3.3 TESTING

.1 Pressure test buried systems before backfilling.

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.2 Hydraulically test to verify grades and freedom from obstructions.

# 3.4 PERFORMANCE VERIFICATION

- .1 Cleanouts: .1 Verify cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.
- .3 Ensure fixtures are properly anchored, connected to system and effectively vented.
- .4 Affix applicable label (storm, sanitary, vent, pump discharge) c/w directional arrows every floor or 4.5 m (whichever is less).

# 3.5 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning. .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

### 1.1 REFERENCE STANDARDS

.1 American National Standards Institute/CSA Group (ANSI/CSA) ANSI Z21.10.1-2004 /CSA 4.1-2004, Gas Water Heaters -.1 Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less. ANSI Z21.10.1A-2006 /CSA 4.1A-2006, Addenda 1 to ANSI .2 Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less. .3 ANSI Z21.10.1b-2006 /CSA 4.1b-2006, Addenda 2 to ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters - Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less. ANSI Z21.10.3A-2007 /CSA 4.3-2007, Gas Water Heaters -.4 Volume III - Storage Water Heaters, with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous. CSA Group (CSA) .2 .1 CSA B51-03(R2007), Boiler, Pressure Vessel, and Pressure Piping Code. CAN/CSA-B139-04, Installation Code for Oil Burning .2 Equipment. CAN/CSA-B140.0-03, Oil Burning Equipment: General .3 Requirements. CAN/CSA-B149.1-05, Natural Gas and Propane Installation .4 Code. .5 CAN/CSA-B149.2-05, Propane Storage and Handling Code. .6 CSA B140.12-03, Oil-Burning Equipment: Service Water Heaters for Domestic Hot Water, Space Heating, and Swimming Pools. CAN/CSA C22.2 No.110-94(R2004), Construction and Test of .7 Electric Storage Tank Water Heaters. CAN/CSA-C191-04, Performance of Electric Storage Tank .8 Water Heaters for Household Service. CAN/CSA-C309-M90(R2003), Performance Requirements for .9 Glass-Lined Storage Tanks for Household Hot Water Service. National Research Council Canada (NRC) .3

.1 National Plumbing Code of Canada 2015 (NPC).

# 1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

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- .2 Product Data: .1 Provide manufacturer's printed product literature and datasheets for domestic water heater, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

## 1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals .

# 1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section01 61 00 Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

# 1.5 WARRANTY

- .1 For the Work of this Section 22 33 00 Electric Domestic Water Heaters, 12 months warranty period prescribed in subsection GC 32.1 of General Conditions "C" is extended to number of years specified for each product.
- .2 Contractor hereby warrants domestic water heaters in accordance with CCDC2, but for number of years specified for each product.

## PART 2 - PRODUCTS

## 2.1 COMPONENTS

.1 Sustainable Requirements: .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

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## 2.2 ELECTRIC WATER HEATER

- .1 To CAN/CSA C22.2 No.110, CAN/CSA-C191 and CAN/CSA-C309 for glass-lined storage tanks, with immersion type elements, W each, and surface mounted or immersion type adjustable thermostats.
- .2 Tank: L, glass nickel polymerized, fluorocarbon or combination lined steel, mm diameter x mm high, 50 mm mineral wool or fibreglass insulation, enamelled steel jacket, 3 year warranty certificate.

#### 2.3 TRIM AND INSTRUMENTATION

- .1 Drain valve: NPS 1 with hose end.
- .2 Thermometer: 100 mm dial type with red pointer and thermowell filled with conductive paste.
- .3 Pressure gauge: 75 mm dial type with red pointer, syphon, and shut-off cock.
- .4 Thermowell filled with conductive paste for control valve temperature sensor.
- .5 ASME rated temperature and pressure relief valve sized for full capacity of heatercontrol valve, having discharge terminating over floor drain and visible to operators.
- .6 Magnesium anodes adequate for 20 years of operation and located for easy replacement.

## 2.4 ANCHOR BOLTS AND TEMPLATES

.1 Supply anchor bolts and templates for installation in concrete support padin accordance with Section 03 30 00 - Cast-in-Place Concrete.

# PART 3 - EXECUTION

# 3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

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# 3.2 INSTALLATION

- .1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.
- .2 Provide structural steel for for instantaneous heaters.

# 3.3 FIELD QUALITY CONTROL

.1 Manufacturer's factory trained to start up and commission DHW heaters.

# 3.4 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning. .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

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| Pump Station -Cole Harbour, NS | CLOSETS, URINALS, AND | Page 1           |
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### 1.1 REFERENCE STANDARDS

- .1 CSA Group (CSA)

   CAN/CSA-B45 Series-02(R2013), Plumbing Fixtures, (Consists of B45.0, B45.1, B45.2, B45.3, B45.4, B45.5, B45.6, B45.7, B45.8 and B45.9).
   CSA B125.3-12, Plumbing Fittings.
   CSA B651-12, Accessible Design for the Built Environment.
- .2 Green Seal (GS) .1 GS-36-2013, Adhesives for Commercial Use.
- .3 National Research Council Canada (NRC) .1 National Building Code of Canada 2015 (NBC).

# 1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for washroom fixtures and include product characteristics, performance criteria, physical size, finish and limitations.

- .2 Indicate fixtures and trim:

  .1 Dimensions, construction details, roughing-in dimensions.
  .2 Factory-set water consumption per flush at recommended pressure.
  .3 (For water closets, urinals): minimum pressure required for flushing.
- 1.3 CLOSEOUT SUBMITTALS
  - .1 Include:

.1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.

- .2 Details of operation, servicing, maintenance.
- .3 List of recommended spare parts.

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| Pump Station -Cole Harbour, NS | CLOSETS, URINALS, AND | Page 2           |
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## 1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirementsandwith manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:

  .1 Store materials off groundindoorsin dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  .2 Store and protect specified materials from nicks, scratches, and blemishes.
  .3 Replace defective or damaged materials with new.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURED UNITS

- .1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2 Trim, fittings: manufacture in accordance with CSA B125.3.
- .3 Exposed plumbing brass to be chrome plated.
- .4 Number, locations: as indicated.
- .5 Fixtures in any one location to be product of one manufacturer and of same type.
- .6 Trim in any one location to be product of one manufacturer and of same type.
- .7 Water closets:

| WC   | Mounti | Bowl  | Flush | Flush | Handic |        |   |   |
|------|--------|-------|-------|-------|--------|--------|---|---|
| type | ng     |       | valve | tank  | apped  |        |   |   |
|      | Wall   | Floor | Elong | Reg   | Exp'd  | Conc'd |   |   |
| WC-1 | Х      |       | Х     |       | Х      |        |   |   |
| WC-2 | Х      |       | Х     |       |        | Х      |   |   |
| WC-3 |        | Х     | Х     | Х     |        |        | Х |   |
| WC-4 |        | Х     | Х     |       | Х      |        |   | Х |
| WC-5 |        | Х     | Х     |       |        |        | Х | Х |

.1 WC-1: floor-mounted, flush tank.

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.1 Bowl: vitreous china, syphon jet, elongatedrim, close-coupled combination, bowl and bolt caps.
.2 Closet tank: vitreous china with tank liner, flapper type flush valve assembly for ultra low flush cycle: adjustable from 3.8 - 17 litres/flush, factory set to 5.7 litres/flush.

- Water Closet Seats. .1 Seat: blackwhite, elongatedregular, openclosed front, moulded solid plastic, less cover, stainless steel check hinges, stainless steelsolid brass insert post.
- .9 Washroom Lavatories:

.8

- .1 L-1: Wall-hung, integral back: .1 Vitreous china, with splash lip, soap depressions, supply openings on 200 mm centres, overflow. Size: 500 x 450 mm.
- .10 Washroom Lavatory Trim:

.1 Chrome plated brass, combination supply and waste fittings, mixing spout, washerless, pop-up waste, aerator, metalindexed handles.

- .1 Provide accessories to limit maximum flow rate to
- 8.35 l/minute at 413 kPa.
- .2 Waste fitting: pop-upplug and chain.
- .2 Chrome plated brass, single handed mixing faucet, mixing spout, washerless, aerator, handle.
  - .1 Provide accessories to limit maximum flow rate to
  - 8.35 l/minute at 413 kPa.
  - .2 Waste fitting: Pop-upplug and chain.
- .11 Fixture piping:
  - .1 Hot and cold water supplies to fixtures:
    - .1 Chrome plated flexible supply pipes with handwheel stop, reducers, escutcheon.
  - .2 Waste:
    .1 Brass P trap with clean out on fixtures not having integral trap.
    .2 Chrome plated in exposed places.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for washroom fixtures installation in accordance with manufacturer's written instructions.

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.1 Visually inspect substrate in presence of Consultant.
.2 Inform Consultant of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

# 3.2 INSTALLATION

.1 Mounting heights: .1 Wall-hung fixtures: as indicated, measured from finished floor.

# 3.3 ADJUSTING

- .1 Conform to water conservation requirements specified this section.
- .2 Adjustments:
  - .1 Adjust water flow rate to design flow rates.
  - .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
  - .3 Adjust flush valves to suit actual site conditions.
- .3 Checks:
  - .1 Water closets: flushing action.
  - .2 Aerators: operation, cleanliness.

.3 Vacuum breakers, backflow preventers: operation under all conditions.

.4 Thermostatic controls: .1 Verify temperature settings, operation of control, limit and safety controls.

# 3.4 CLEANING

- Progress Cleaning: clean in accordance with Section 01 74 00 -Cleaning.
   .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

### 1.1 REFERENCE STANDARDS

- Canada Green Building Council (CaGBC)

   LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).
   LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .2 CSA Group (CSA)
  - .1 CAN/CSA-B45 Series-02(R2008), Plumbing Fixtures.
  - .2 CAN/CSA-B125.3-05, Plumbing Fittings.

.3 CAN/CSA-B651-04, Accessible Design for the Built Environment.

.3 National Research Council Canada (NRC) .1 National Building Code of Canada 2015 (NBC).

## 1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data: .1 Provide manufacturer's printed product literature and

datasheets for fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.

## 1.3 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data in accordance with Section 01 78 00 Closeout Submittals.
- .2 Include:

.1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.

- .2 Details of operation, servicing, maintenance.
- .3 List of recommended spare parts.

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## 1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section01 61 00 Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and returnby manufacturer of palletscratespaddingandpackaging materials in accordance with Section 01 74 19 Waste Management and Disposal.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURED UNITS

- .1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.
- .3 Exposed plumbing brass to be chrome plated.
- .4 Number, locations: architectural drawings to govern.
- .5 Fixtures to be product of one manufacturer.
- .6 Trim to be product of one manufacturer.

## .7 Stainless steel counter top sinks.

- .1 S-1: single compartment, ledge-back. .1 From 1.0 mm thick type 302 stainless steel, self-rimming, undercoated, clamps. Overall sizes: 520 x 510 x 180 mm. .2 Trim: chrome plated brass, with swing spout, aerator, single lever handle, washerless controls, accessories to limit maximum flow rate to 8.35 litres/minute at 413 kPa, spray fitting. .3 Waste fitting: integral stainless steel basket strainer/stopper, tailpiece, cast brass P-trap with cleanout.
- .8 Fixture piping:
  - .1 Hot and cold water supplies to each fixture: .1 Chrome plated flexible supply pipes each with handwheel stop, reducers, escutcheon.
  - .2 Waste:

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.1 Brass P trap with clean out on each fixture not having integral trap..2 Chrome plated in all exposed places.

.9 Chair carriers: .1 Factory manufactured floor-mounted carrier systems for all wall-mounted fixtures.

## PART 3 - EXECUTION

## 3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

### 3.2 ADJUSTING

- .1 Conform to water conservation requirements specified this section.
- .2 Adjustments:

.1 Adjust water flow rate to design flow rates.

- .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
- .3 Checks:

.1 Aerators: operation, cleanliness.

.2 Vacuum breakers, backflow preventers: operation under all conditions.

.3 Wash fountains: operation of flow-actuating devices.

.4 Thermostatic controls: .1 Verify temperature settings, operation of control, limit and safety controls.

# 3.3 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning. .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

## 1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in ProvinceTerritory, Canada.

- .2 Indicate on drawings:
  - .1 Mounting arrangements.
  - .2 Operating and maintenance clearances.
- .3 Shop drawings and product data accompanied by: .1 Detailed drawings of bases, supports, and anchor bolts.
  - .2 Acoustical sound power data, where applicable.
  - .3 Points of operation on performance curves.
  - .4 Manufacturer to certify current model production.
  - .5 Certification of compliance to applicable codes.

.4 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

## 1.2 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

.1 Operation and maintenance manual approved by, and final copies deposited with, Consultant before final inspection.

.2 Operation data to include:

.1 Control schematics for systems including environmental controls.

- .2 Description of systems and their controls.
- .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
- .4 Operation instruction for systems and component.
- .5 Description of actions to be taken in event of equipment failure.

| Bissett Lake Wastewater       | COMMON WORK RESULTS | Section 23 05 00 |
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.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.3 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment..2 Data to include schedules of tasks, frequency, tools required and task time.

.4 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.5 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental RepresentativeDCC RepresentativeConsultant for approval. Submission of individual data will not be accepted unless directed by Departmental RepresentativeDCC RepresentativeConsultant. .2 Make changes as required and re-submit as directed by Departmental RepresentativeDCC RepresentativeConsultant.

.6 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.7 Site records:

.8

.1 Consultant will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection. As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings. .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date). .3 Submit to Consultant for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

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.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals. .9 Submit copies of as-built drawings for inclusion in final TAB report.

### 1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 Closeout Submittals.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers.

## 1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirementsandwith manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements: .1 Store materials off ground, indoorsin dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## PART 2 - PRODUCTS

## 2.1 NOT USED

.1 Not used:

# PART 3 - EXECUTION

### 3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

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| Pump Station -Cole Harbour, NS | FOR HVAC            | Page 4           |
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.1 Visually inspect substrate in presence of Consultant.
.2 Inform Consultant of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

# 3.2 PAINTING REPAIRS AND RESTORATION

- .1 Do painting in accordance with Section 09 91 23 Interior Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

## 3.3 SYSTEM CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

## 3.4 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

## 3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 Cleaning.
  - .1 Leave Work area clean at end of each day.

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| Pump Station -Cole Harbour, NS | FOR HVAC            | Page 5           |
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.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

# 3.6 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

### 1.1 SUMMARY

Section Includes:

1 Electrical motors, drives and guards for mechanical equipment and systems.
2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.
3 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 22 and 23. Refer to Division 26 for quality of materials and workmanship.

## 1.2 REFERENCE STANDARDS

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) .1 ASHRAE 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).
- .2 Electrical Equipment Manufacturers' Association Council (EEMAC)
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Safety Data Sheets (SDS).

### 1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data: .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations. .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Quality Control: in accordance with Section 01 45 00 Quality Control.

| Bissett Lake Wastewater        | COMMON MOTOR          | Section 23 05 13 |
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| Pump Station -Cole Harbour, NS | REQUIREMENTS FOR HVAC | Page 2           |
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.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Closeout Submittals .1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 78 00 -Closeout Submittals.

#### 1.4 QUALITY ASSURANCE

- .1 Regulatory Requirements: work to be performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial /Territorial regulations.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 -Health and Safety Requirements.

## 1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading: .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements. .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

# PART 2 - PRODUCTS

### 2.1 GENERAL

.1 Motors: high efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.

#### 2.2 MOTORS

- .1 Provide motors for mechanical equipment as specified.
- .2 Motors under 373 W1/2 HP: speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.
| Bissett Lake Wastewater        | COMMON MOTOR          | Section 23 05 13 |
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.3 Motors 373 W1/2 HP and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 degrees C, 3 phase, 575 V, unless otherwise indicated.

## 2.3 BELT DRIVES

- .1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.
- .2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.
- .3 For motors under 7.5 kW10 HP: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.
- .4 For motors 7.5 kW10 HP and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.
- .5 Correct size of sheave determined during commissioning.
- .6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.
- .7 Motor slide rail adjustment plates to allow for centre line adjustment.
- .8 Supply one set of spare belts for each set installed in accordance with Section 01 78 00 Closeout Submittals.

## 2.4 DRIVE GUARDS

- .1 Provide guards for unprotected drives.
- .2 Guards for belt drives;
  - .1 Expanded metal screen welded to steel frame.
  - .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
  - .3  $\,$  38 mm dia holes on both shaft centres for insertion of tachometer.
  - .4 Removable for servicing.
- .3 Provide means to permit lubrication and use of test instruments with guards in place.

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| Pump Station -Cole Harbour, NS | REQUIREMENTS FOR HVAC | Page 4           |
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- .4 Install belt guards to allow movement of motors for adjusting belt tension.
- .5 Guard for flexible coupling:
  - .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
  - .2 Securely fasten in place.
  - .3 Removable for servicing.
- .6 Unprotected fan inlets or outlets:
  - .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
  - .2 Net free area of guard: not less than 80% of fan openings.
  - .3 Securely fasten in place.
  - .4 Removable for servicing.

## PART 3 - EXECUTION

### 3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

## 3.2 INSTALLATION

- .1 Fasten securely in place.
- .2 Make removable for servicing, easily returned into, and positively in position.

## 3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services: .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS. .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions. .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

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# 3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 00 Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

## PART 1 - GENERAL

### 1.1 REFERENCE STANDARDS

- .1 Canadian General Standards Board (CGSB) .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .2 CSA Group (CSA) .1 CAN/CSA B139-04, Installation Code for Oil Burning Equipment.
- .3 Green Seal Environmental Standards (GSES) .1 Standard GS-11-2008, 2nd Edition, Environmental Standard for Paints and Coatings.
- .4 National Research Council Canada (NRC) .1 National Fire Code of Canada 2015 (NFC).

### 1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data: .1 Provide manufacturer's printed product literature, specifications and datasheets for piping and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

## 1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirementsandwith manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

## PART 2 - PRODUCTS

## 2.1 MATERIAL

.1 Not Used.

## PART 3 - EXECUTION

### 3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

## 3.2 CONNECTIONS TO EQUIPMENT

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
- .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

### 3.3 CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and National Fire Code of CanadaCAN/CSA B139.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer,CAN/CSA B139 and as indicated without interrupting operation of other system, equipment, components.

## 3.4 DRAINS

- .1 Install piping with grade in direction of flow except as indicated.
- .2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.
- .3 Pipe each drain valve discharge separately to above floor drain..1 Discharge to be visible.
- .4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

## 3.5 AIR VENTS

- .1 Install manual air vents to CAN/CSA B139at high pointsin piping systems.
- .2 Install isolating valve at each automatic air valve.
- .3 Install drain piping to approved location and terminate where discharge is visible.

### 3.6 DIELECTRIC COUPLINGS

- .1 General: compatible with system, to suit pressure rating of system.
- .2 Locations: where dissimilar metals are joined.
- .3 NPS 2 and under: isolating unions or bronze valves.
- .4 Over NPS 2: isolating flanges.

## 3.7 PIPEWORK INSTALLATION

- .1 Install pipework to CAN/CSA B139.
- .2 Screwed fittings jointed with Teflon tape.
- .3 Protect openings against entry of foreign material.
- .4 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .5 Assemble piping using fittings manufactured to ANSI standards.
- .6 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main..1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .7 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .8 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .9 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

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- .10 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .11 Group piping wherever possible and as indicated.
- .12 Ream pipes, remove scale and other foreign material before assembly.
- .13 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .14 Provide for thermal expansion as indicated.

## .15 Valves:

- .1 Install in accessible locations.
- .2 Remove interior parts before soldering.

.3 Install with stems above horizontal position unless indicated.

.4 Valves accessible for maintenance without removing adjacent piping.

- .5 Install globe valves in bypass around control valves.
- .16 Check Valves:

.1 Install silent check valves on discharge of pumpsandin vertical pipes with downward flow and as indicated..2 Install swing check valves in horizontal lines on discharge of pumps and as indicated.

### 3.8 SLEEVES

- .1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.
- .2 Material: schedule 40 black steel pipe.
- .3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.
- .4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Installation:

.1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
.2 Other floors: terminate 25 mm above finished floor.

.3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.

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- .6 Sealing:
  - .1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.
  - .2 Elsewhere:
    - .1 Provide space for fire stopping.
    - .2 Maintain the fire-resistance rating integrity of the fire separation.
  - .3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.
  - .4 Ensure no contact between copper pipe or tube and sleeve.

## 3.9 ESCUTCHEONS

- .1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.
- .2 Construction: one piece type with set screws. .1 Chrome or nickel plated brass or type 302 stainless steel..
- .3 Sizes: outside diameter to cover opening or sleeve. .1 Inside diameter to fit around pipe or outside of insulation if so provided.

# 3.10PREPARATION FOR FIRE STOPPING

- .1 Coordinate the installation of fire stopping around pipes, insulation and adjacent fire separation in accordance with Section 07 84 00 - Fire Stopping.
- .2 Pipes subject to movement: conform to fire stop system design listing to ensure pipe movement without damaging fire stopping material or installation.
- .3 Insulated pipes: ensure integrity of insulation and vapour barriers.

## 3.11FLUSHING OUT OF PIPING SYSTEMS

- .1 Flush system in accordance with Section 23 08 16 Cleaning and Start-Up of HVAC Piping Systems.
- .2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 00 - Cleaning supplemented as specified in relevant mechanical sections.

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.3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

### 3.12PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

- .1 Advise Consultant48 hours minimum prior to performance of pressure tests.
- .2 Pipework: test as specified in relevant sections of heating, ventilating and air conditioning work.
- .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
- .5 Conduct tests in presence of Consultant.
- .6 Pay costs for repairs or replacement, retesting, and making good. Consultant to determine whether repair or replacement is appropriate.
- .7 Insulate or conceal work only after approval and certification of tests by Consultant.

#### 3.13EXISTING SYSTEMS

- .1 Connect into existing piping systems at times approved by Consultant.
- .2 Request written approval by Consultant10 days minimum, prior to commencement of work.
- .3 Be responsible for damage to existing plant by this work.

# 3.14CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning. .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

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## PART 1 - GENERAL

#### 1.1 REFERENCE STANDARDS

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME) .1 ANSI/ASME B1.20.1-1983(R2006), Pipe Threads, General Purpose (Inch). .2 ANSI/ASME B16.18-2001, Cast Copper Alloy Solder Joint Pressure Fittings.
- ASTM International (ASTM)

  ASTM A 276-08, Standard Specification for Stainless Steel
  Bars and Shapes.
  ASTM B 62-02, Standard Specification for Composition
  Bronze or Ounce Metal Castings.
  ASTM B 283-08a, Standard Specification for Copper and
  Copper Alloy Die Forgings (Hot-Pressed).
  ASTM B 505/B 505M-08a, Standard Specification for
- Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
   .1 MSS-SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.
   .2 MSS-SP-80-2008, Bronze Gate Globe, Angle and Check Valves.
   .3 MSS-SP-110-1996, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

### 1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit WHMIS SDS - Safety Data Sheets in accordance with Section 02 81 00 - Hazardous Materials.

- .3 Shop Drawings: .1 Submit data for valves specified in this Section.
- .4 Sustainable Design Submittals: .1 LEED Canada-NC Version 1.0CI Version 1.0 Submittals: in accordance with Section 01 35 21 - LEED Requirements.

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### 1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

## 1.4 MAINTENANCE MATERIAL SUBMITTALS

### 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirementsandwith manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- .1 Valves: .1 Except for specialty valves, to be single manufacturer. .2 Products to have CRN registration numbers.
- .2 End Connections:

.1 Connection into adjacent piping/tubing:

.1 Steel pipe systems: screwed ends to ANSI/ASME B1.20.1..2 Copper tube systems: solder endsgrooved ends to ANSI/ASME B16.18.

.3 Gate Valves:

.1 Requirements common to gate valves, unless specified otherwise:

- .1 Standard specification: MSS SP-80.
- .2 Bonnet: union with hexagonal shoulders.
- .3 Connections: screwed with hexagonal shoulders.

.4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.

- .5 Packing: non-asbestos.
- .6 Handwheel: non-ferrous.
- .7 Handwheel Nut: bronze to ASTM B 62.

.2 NPS 2 and under, non-rising stem, solid wedge disc, Class 125

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Body: with long disc guides, screwed bonnet with stem .1 retaining nut. Operator: Handwheel. .2 NPS 2 and under, non-rising stem, solid wedge disc, Class .3 150: Body: with long disc guides, screwed bonnet with stem .1 retaining nut. .2 Operator: handwheel. NPS 2 and under, rising stem, split wedge disc, Class 125: .4 Body: with long disc guides, screwed bonnet. .1 Disc: split wedge, bronze to ASTM B 283, loosely .2 secured to stem. .3 Operator: handwheellockshield. NPS 2 and under, rising stem, solid wedge disc, Class 125: .5 Body: with long disc guides, screwed bonnet. .1 Operator: handwheel. .2 NPS 2 and under, rising stem, solid wedge disc, Class 150: .6 .1 Body: with long disc guides, screwedunion bonnet. .2 Operator: handwheel. Check Valves: .1 Requirements common to check valves, unless specified otherwise: .1 Standard specification: MSS SP-80. .2 Connections: screwed with hexagonal shoulders. NPS 2 and under, swing type, bronze disc, Class 125: .2 Body: Y-pattern with integral seat at 45 degrees, .1 screw-in cap with hex head. Disc and seat: renewable rotating disc, two-piece .2 hinge disc construction; seat: regrindable. NPS 2 and under, swing type, bronze disc: .3 Body: Y-pattern with integral seat at 45 degrees, .1 screw-in cap with hex head. .2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable. NPS 2 and under, swing type, composition disc, Class 200: .4 Body: Y-pattern with integral seat at 45 degrees, .1 screw-in cap with hex head. Disc: renewable rotating disc of number 6 composition .2 to suit service conditions, bronze two-piece hinge disc construction. .5 NPS 2 and under, horizontal lift type, composition disc, Class 150: .1 Body: with integral seat, union bonnet ring with hex shoulders, cap. Disc: renewable PTFEno. 6 composition rotating disc .2 in disc holder having guides top and bottom, of bronze to ASTM B 62. .6 NPS 2 and under, vertical lift type, bronze disc, Class 125:

.4

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.1 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.

- .5 Ball Valves:
  - .1 NPS 2 and under:
    - .1 Body and cap: cast high tensile bronze to ASTM B 62.
    - .2 Pressure rating: Class1252760-kPa CWP4140-kPa CWP, 860 kPa steam.

.3 Connections: screwed ends to ANSI B1.20.1 and with hexagonal shoulderssolder ends to ANSI.

- .4 Stem: tamperproof ball drive.
- .5 Stem packing nut: external to body.

.6 Ball and seat: replaceable stainless steelhard chrome solid ball and Teflon seats.

- .7 Stem seal: TFE with external packing nut.
- .8 Operator: removable lever handle.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- .1 Install rising stem valves in upright position with stem above horizontal.
- .2 Remove internal parts before soldering.
- .3 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

#### 3.2 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning. .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

## PART 1 - GENERAL

#### 1.1 REFERENCE STANDARDS

- .1 American Society of Mechanical Engineers (ASME) .1 ASME B31.1-07, Power Piping.
- .2 ASTM International (ASTM)

  .1 ASTM A 125-1996(2007), Standard Specification for Steel
  Springs, Helical, Heat-Treated.
  .2 ASTM A 307-07b, Standard Specification for Carbon Steel
  Bolts and Studs, 60,000 PSI Tensile Strength.
  .3 ASTM A 563-07a, Standard Specification for Carbon and
  Alloy Steel Nuts.
- .3 Factory Mutual (FM)
- Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

  MSS SP 58-2002, Pipe Hangers and Supports - Materials,
  Design and Manufacture.
  MSS SP 69-2003, Pipe Hangers and Supports - Selection and
  Application.
  MSS SP 89-2003, Pipe Hangers and Supports - Fabrication
  and Installation Practices.
- .5 National Research Council Canada (NRC) .1 National Plumbing Code of Canada 2015 (NPC).
- .6 Underwriter's Laboratories of Canada (ULC)

### 1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

- .3 Shop Drawings:
  - .1 Submit shop drawings for:
    - .1 Bases, hangers and supports.
    - .2 Connections to equipment and structure.
    - .3 Structural assemblies.

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.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

- .5 Manufacturers' Instructions:
  - .1 Provide manufacturer's installation instructions. .1 Consultant will make available 1 copy of systems supplier's installation instructions.

## 1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

## 1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirementsandwith manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

## PART 2 - PRODUCTS

### 2.1 SYSTEM DESCRIPTION

.1 Design Requirements: .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies. .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP 58. Ensure that supports, guides, anchors do not transmit .3 excessive quantities of heat to building structure. Design hangers and supports to support systems under .4 conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment. Provide for vertical adjustments after erection and during .5 commissioning. Amount of adjustment in accordance with MSS SP 58.

### 2.2 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with MSS SP 58. ANSI B31.1 and
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

### 2.3 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports: galvanizedafter manufacture..2 Use electro-plating galvanizing process or hot dipped galvanizing process..3 Ensure steel hangers in contact with copper piping are epoxy coated.

.2 Upper attachment structural: suspension from lower flange of I-Beam:

.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut andcarbon steel retaining clip.

.1 Rod: 13 mm FM approved. .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, FM approvedto MSS-SP 58andMSS-SP 69.

.3 Upper attachment structural: suspension from upper flange of I-Beam:

.1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, FM approvedto MSS SP 69. .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut FM approved.

.4 Upper attachment to concrete:

.1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter..2 Concrete inserts: wedge shaped body with knockout protector plate FM approved to MSS SP 69.

- .5 Shop and field-fabricated assemblies:
  - .1 Trapeze hanger assemblies:.
  - .2 Steel brackets:.
  - .3 Sway braces for seismic restraint systems: to Section.

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.6 Hanger rods: threaded rod material to MSS SP 58:
.1 Ensure that hanger rods are subject to tensile loading only.
.2 Provide linkages where lateral or axial movement of pipework is anticipated.
.3 Do not use 22 mm or 28 mm rod.

## .7 Pipe attachments: material to MSS SP 58:

- .1 Attachments for steel piping: carbon steel galvanized.
- .2 Attachments for copper piping: copper plated black steel.
- .3 Use insulation shields for hot pipework.
- .4 Oversize pipe hangers and supports.
- .8 Adjustable clevis: material to MSS SP 69 FM approved, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
  .1 Ensure "U" has hole in bottom for rivetting to insulation shields.
- .9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP 69.
- .10 U-bolts: carbon steel to MSS SP 69 with 2 nuts at each end to ASTM A 563.
  .1 Finishes for steel pipework: galvanized.
  .2 Finishes for copper, glass, brass or aluminum pipework: galvanized, with formed portion plastic coatedepoxy coated.
- .11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP 69.

#### 2.4 RISER CLAMPS

- .1 Steel or cast iron pipe: galvanizedcarbon steel to MSS SP 58, type 42, FM approved.
- .2 Copper pipe: carbon steel copper plated to MSS SP 58, type 42.
- .3 Bolts: to ASTM A 307.
- .4 Nuts: to ASTM A 563.

### 2.5 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping: .1 64 kg/m<sup>3</sup> density insulation plus insulation protection shield to: MSS SP 69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

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.2 Insulated hot piping: .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP 69.

### 2.6 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings. Submit calculations with shop drawings.

### 2.7 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

## 2.8 HOUSE-KEEPING PADS

- .1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.
- .2 Concrete: to Section 03 30 00 Cast-in-Place Concrete.

## 2.9 OTHER EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings.
- .2 Submit structural calculations with shop drawings.

## PART 3 - EXECUTION

# 3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

# 3.2 INSTALLATION

.1 Install in accordance with:

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- .1 Manufacturer's instructions and recommendations.
- .2 Clamps on riser piping:

  .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
  .2 Bolt-tightening torques to industry standards.
  .3 Steel pipes: install below coupling or shear lugs welded to pipe.
  .4 Cast iron pipes: install below joint.
- .3 Clevis plates: .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .4 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .5 Use approved constant support type hangers where:
  .1 Vertical movement of pipework is 13 mm or more,
  .2 Transfer of load to adjacent hangers or connected equipment is not permitted.
- .6 Use variable support spring hangers where:
  .1 Transfer of load to adjacent piping or to connected equipment is not critical.
  .2 Variation in supporting effect does not exceed 25 % of total load.

## 3.3 HANGER SPACING

- .1 Plumbing piping: to National Plumbing Code of Canada (NPC).
- .2 Copper piping: up to NPS 1/2: every 1.5 m.

| Maximum Pipe Size: NPS | Maximum Spacing Steel | Maximum Spacing Copper |
|------------------------|-----------------------|------------------------|
| up to 1-1/4            | 2.4 m                 | 1.8 m                  |
| 1-1/2                  | 3.0 m                 | 2.4 m                  |
| 2                      | 3.0 m                 | 2.4 m                  |
| 2-1/2                  | 3.7 m                 | 3.0 m                  |
| 3                      | 3.7 m                 | 3.0 m                  |
| 3-1/2                  | 3.7 m                 | 3.3 m                  |
| 4                      | 3.7 m                 | 3.6 m                  |
| 5                      | 4.3 m                 |                        |
| 6                      | 4.3 m                 |                        |
| 8                      | 4.3 m                 |                        |
| 10                     | 4.9 m                 |                        |
| 12                     | 4.9 m                 |                        |

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.3 Pipework greater than NPS 12: to MSS SP 69.

#### 3.4 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

## 3.5 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

## 3.6 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:.1 Ensure that rod is vertical under operating conditions..2 Equalize loads.
- .2 Adjustable clevis:
  .1 Tighten hanger load nut securely to ensure proper hanger performance.
  .2 Tighten upper nut after adjustment.
- .3 C-clamps: .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps: .1 Hammer jaw firmly against underside of beam.

## 3.7 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

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.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

## 3.8 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning. .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

## PART 1 - GENERAL

### 1.1 SUMMARY

.1 Section Includes: .1 Vibration isolation materials and components, seismic control measures and their installation.

### 1.2 REFERENCE STANDARDS

- Health Canada/Workplace Hazardous Materials Information System (WHMIS)
   .1 Safety Data Sheets (SDS)
- .2 National Fire Protection Association (NFPA) .1 NFPA 13-2002, Standard for the Installation of Sprinkler Systems.
- .3 National Research Council Canada (NRC) .1 National Building Code of Canada 2015 (NBC).

#### 1.3 ACTION AND INFORMATIONAL SUBMITTALS

| .1  | Submittals: in accordance with Section 01 33 00 - Submittal Procedures.                                      |
|-----|--------------------------------------------------------------------------------------------------------------|
|     | .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section |
|     | 01 33 00 - Submittal Procedures. Include product                                                             |
|     | characteristics, performance criteria, and limitations.                                                      |
| .2  | Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.                             |
|     | .1 Shop drawings: Submit drawings stamped and signed by                                                      |
|     | professional engineer registered or licensed in Nova-Scotia, Canada.                                         |
|     | .2 Provide separate shop drawings for each isolated                                                          |
|     | systemcomplete with performance and product data.                                                            |
| .3  | Quality assurance submittals: submit following in accordance                                                 |
| • • | with Section 01 33 00 - Submittal Procedures.                                                                |
|     | .1 Certificates: submit certificates signed by manufacture                                                   |

certifying that materials comply with specified performance characteristics and physical properties. .2 Instructions: submit manufacturer's installation instructions.

.3 Manufacturer's Field Reports: manufacturer's field reports specified.

### 1.4 QUALITY ASSURANCE

.1 Health and Safety: .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

## 1.5 DELIVERY, STORAGE, AND HANDLING

Packing, shipping, handling and unloading:

Deliver, store and handle in accordance with Section
61 00 - Common Product Requirements.
Deliver, store and handle materials in accordance with manufacturer's written instructions.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

.1 Size and shape of bases type and performance of vibration isolation as indicated.

## 2.2 ELASTOMERIC PADS

- .1 Type EP1 neoprene waffle or ribbed; 9 mm minimum thick; 50 durometer; maximum loading 350 kPa.
- .2 Type EP2 rubber waffle or ribbed; 9 mm minimum thick; 30 durometer natural rubber; maximum loading 415 kPa.
- .3 Type EP3 neoprene-steel-neoprene; 9 mm minimum thick neoprene bonded to 1.71 mm steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa.
- .4 Type EP4 rubber-steel-rubber; 9 mm minimum thick rubber bonded to 1.71 mm steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa.

#### 2.3 ELASTOMERIC MOUNTS

.1 Type M1 - colour coded; neoprene in shear; maximum durometer of 60; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.

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### 2.4 SPRINGS

- .1 Design stable springs: ratio of lateral to axial stiffness is equal to or greater than 1.2 times ratio of static deflection to working height. Select for 50% travel beyond rated load. Units complete with levelling devices.
- .2 Ratio of height when loaded to diameter of spring between 0.8 to 1.0.
- .3 Cadmium plate for outdoor100% relative humidity installations.
- .4 Colour code springs.

# 2.5 SPRING MOUNT

- .1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.
- .2 Type M2 stable open spring: support on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad.
- .3 Type M3 stable open spring: 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; levelling bolt for rigidly mounting to equipment.
- .4 Type M4 restrained stable open spring: supported on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.
- .5 Type M5 enclosed spring mounts with snubbers for isolation up to 950 kg maximum.

## 2.6 HANGERS

- .1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30 degrees arc without metal to metal contact.
- .2 Type H1 neoprene in-shear, moulded with rod isolation bushing which passes through hanger box.
- .3 Type H2 stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.

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- .4 Type H3 stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.
- .5 Type H4 stable spring, elastomeric element with precompression washer and nut with deflection indicator.

### 2.7 ACOUSTIC BARRIERS FOR ANCHORS AND GUIDES

.1 Acoustic barriers: between pipe and support, consisting of 25 mm minimum thick heavy duty duck and neoprene isolation material.

## 2.8 HORIZONTAL THRUST RESTRAINT

- .1 Spring and elastomeric element housed in box frame; assembly complete with rods and angle brackets for equipment and ductwork attachment; provision for adjustment to limit maximum start and stop movement to 9 mm.
- .2 Arrange restraints symmetrically on either side of unit and attach at centerline of thrust.

## PART 3 - EXECUTION

### 3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

### 3.2 INSTALLATION

- .1 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.
- .2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.
- .3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:

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.1 Up to NPS4: first 3 points of support. NPS5 to NPS8: first 4 points of support. NPS10 and Over: first 6 points of support. .2 First point of support: static deflection of twice deflection of isolated equipment, but not more than 50 mm.

- .4 Where isolation is bolted to floor use vibration isolation rubber washers.
- .5 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

## 3.3 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

## PART 1 - GENERAL

### 1.1 SUMMARY

.1 Section Includes: .1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.

### 1.2 REFERENCE STANDARDS

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.
  - .2 CAN/CGSB-24.3-92, Identification of Piping Systems.

### 1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
- .2 Submittals: in accordance with Section 01 33 00 Submittal Procedures.
- .3 Product data to include paint colour chips, other products specified in this section.

## 1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading: .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements. .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

## PART 2 - PRODUCTS

# 2.1 SUSTAINABLE REQUIREMENTS

.1 Materials and products in accordance with Section 01 47 15 -Sustainable Requirements: Construction. .1 .

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### 2.2 MANUFACTURER'S EQUIPMENT NAMEPLATES

- Metal or plastic laminate nameplate mechanically fastened to .1 each piece of equipment by manufacturer.
- Lettering and numbers raised or recessed. .2
- .3 Information to include, as appropriate: Equipment: manufacturer's name, model, size, serial .1 number, capacity. .2
  - Motor: voltage, Hz, phase, power factor, duty, frame size.

### 2.3 SYSTEM NAMEPLATES

- Colours: .1 .1 Hazardous: red letters, white background. .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- Construction: .2

.1 3 mm thick laminated plasticorwhite anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

- .3 Sizes:
  - .1 Conform to following table:

| Size # mm | Sizes (mm)      | No. of<br>Lines | Height of<br>Letters<br>(mm) |
|-----------|-----------------|-----------------|------------------------------|
| 1         | 10 x 50         | 1               | 3                            |
| 2         | 13 x 75         | 1               | 5                            |
| 3         | 13 x 75         | 2               | 3                            |
| 4         | 20 x 100        | 1               | 8                            |
| 5         | 20 x 100        | 2               | 5                            |
| 6         | 20 x 200        | 1               | 8                            |
| 7         | 25 x 125        | 1               | 12                           |
| 8         | 25 x 125        | 2               | 8                            |
| 9         | $35 \times 200$ | 1               | 20                           |

Use maximum of 25 letters/numbers per line. .2

- .4 Locations:
  - .1 Terminal cabinets, control panels: use size # 5.
  - Equipment in Mechanical Rooms: use size # 9. .2
- .5 Identification for PSPC Preventive Maintenance Support System (PMSS):

.1 Use arrangement of Main identifier, Source identifier, Destination identifier.

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- .2 Equipment in Mechanical Room:
  - .1 Main identifier: size #9.
    - .2 Source and Destination identifiers: size #6.
    - .3 Terminal cabinets, control panels: size #5.
- .3 Equipment elsewhere: sizes as appropriate.

## 2.4 EXISTING IDENTIFICATION SYSTEMS

- .1 Apply existing identification system to new work.
- .2 Where existing identification system does not cover for new work, use identification system specified this section.
- .3 Before starting work, obtain written approval of identification system from Consultant.

## 2.5 IDENTIFICATION OF PIPING SYSTEMS

- .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.
- .2 Pictograms: .1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.
- .3 Legend: .1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.
- .4 Arrows showing direction of flow:
  .1 Outside diameter of pipe or insulation less than 75 mm:
  100 mm long x 50 mm high.
  .2 Outside diameter of pipe or insulation 75 mm and greater:
  150 mm long x 50 mm high.
  .3 Use double-headed arrows where flow is reversible.
- .5 Extent of background colour marking:
  .1 To full circumference of pipe or insulation.
  .2 Length to accommodate pictogram, full length of legend and arrows.
- .6 Materials for background colour marking, legend, arrows: .1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.

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.2 Other pipes: pressure sensitive plastic-coated with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.

- .7 Colours and Legends:
  - .1 Where not listed, obtain direction from Consultant.
  - .2 Colours for legends, arrows: to following table:

| Background<br>colour: | Legend, | arrows: |
|-----------------------|---------|---------|
| Yellow                | BLACK   |         |
| Green                 | WHITE   |         |
|                       |         |         |

Red WHITE

.3 Background colour marking and legends for piping systems:

| Contents                      | Background colour<br>marking | Legend         |
|-------------------------------|------------------------------|----------------|
| Domestic hot water<br>supply  | Green                        | DOM. HW SUPPLY |
| Domestic cold water<br>supply | Green                        | DOM. CWS       |
| Sanitary                      | Green                        | SAN            |
| Plumbing vent                 | Green                        | SAN. VENT      |
| Refrigeration suction         | Yellow                       | REF. SUCTION   |
| Refrigeration liquid          | Yellow                       | REF. LIQUID    |

### 2.6 IDENTIFICATION DUCTWORK SYSTEMS

- .1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.
- .2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

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### 2.7 VALVES, CONTROLLERS

- .1 Brass tags with 12 mm stamped identification data filled with black paint.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

### 2.8 CONTROLS COMPONENTS IDENTIFICATION

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.

### 2.9 LANGUAGE

.1 Identification in English.

## PART 3 - EXECUTION

#### 3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

### 3.2 TIMING

.1 Provide identification only after painting specified Section 09 91 23 - Interior Painting has been completed.

## 3.3 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

#### 3.4 NAMEPLATES

.1 Locations:

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.1 In conspicuous location to facilitate easy reading and identification from operating floor.

- .2 Standoffs: .1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection: .1 Do not paint, insulate or cover.

#### 3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification easily and accurately readable from usual operating areas and from access points.
  .1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

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### 3.6 VALVES, CONTROLLERS

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental RepresentativeDCC RepresentativeConsultant. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

# 3.7 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

## PART 1 - GENERAL

### 1.1 SUMMARY

.1 Section Includes: .1 Materials and methods for pressure testing ducts over 5 m in length, forming part of a supply, return or exhaust ductwork system directly or indirectly connected to air handling equipment.

### 1.2 REFERENCE STANDARDS

- Health Canada/Workplace Hazardous Materials Information System (WHMIS)
   .1 Safety Data Sheets (SDS).
- Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
   .1 SMACNA HVAC Air Duct Leakage Test Manual, 1985.

### 1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Co-ordinate submittal requirements and provide submittals required by Section 01 47 15 Sustainable Requirements: Construction.
- .3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties. Include pressure test information and results as follows:

.1 Submit proposed report form and test report format to Consultant for approval at least three months before proposed date of first series of tests. Do not start tests until approval received in writing from Consultant.

.2 Prepare report of results and submit to Consultant within 24 hours of completion of tests. Include:

- .1 Schematic of entire system.
- .2 Schematic of section under test showing test site.
- .3 Required and achieved static pressures.
- .4 Orifice differential pressure at test sites.
- .5 Permissible and actual leakage flow rate (L/s) for test sites.
- .6 Witnessed certification of results.

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.3 Include test reports in final TAB report.
.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.5 Instructions: submit manufacturer's installation instructions.

# PART 2 - PRODUCTS

## 2.1 TEST INSTRUMENTS

- .1 Test apparatus to include:
  - .1 Fan capable of producing required static pressure.
  - .2 Duct section with calibrated orifice plate mounted and accurately located pressure taps.
  - .3 Flow measuring instrument compatible with the orifice plate.
  - .4 Calibration curves for orifice plates used.
  - .5 Flexible duct for connecting to ductwork under test.
  - .6 Smoke bombs for visual inspections.
- .2 Test apparatus: accurate to within +/- 3 % of flow rate and pressure.
- .3 Submit details of test instruments to be used to Consultant at least three months before anticipated start date.
- .4 Test instruments: calibrated and certificate of calibration deposited with Consultant no more than 28 days before start of tests.
- .5 Re-calibrated every six months thereafter.

## PART 3 - EXECUTION

#### 3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

#### 3.2 TEST PROCEDURES

.1 Maximum lengths of ducts to be tested consistent with capacity of test equipment.

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- .2 Section of duct to be tested to include: .1 Fittings, branch ducts, tap-ins.
- .3 Repeat tests until specified pressures are attained. Bear costs for repairs and repetition to tests.
- .4 Base partial system leakage calculations on SMACNA HVAC Air Duct Leakage Test Manual.
- .5 Seal leaks that can be heard or felt, regardless of their contribution to total leakage.

### 3.3 SITE TOLERANCES

- .1 System leakage tolerances specified are stated as percentage of total flow rate handled by system. Pro-rate specified system leakage tolerances. Leakage for sections of duct systems: not to exceed total allowable leakage.
- .2 Leakage tests on following systems not to exceed specified leakage rates..1 Large low pressure duct systems up to 500 Pa: leakage 2%.
- .3 Evaluation of test results to use surface area of duct and pressure in duct as basic parameters.

## 3.4 TESTING

- .1 Test ducts before installation of insulation or other forms of concealment.
- .2 Test after seals have cured.
- .3 Test when ambient temperature will not affect effectiveness of seals, and gaskets.

#### 3.5 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
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#### 1.1 REFERENCE STANDARDS

- American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

   ANSI/ASHRAE/IESNA 90.1-04, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 ASTM International (ASTM)

ASTM B 209M-07, Standard Specification for Aluminum and .1 Aluminum-Alloy Sheet and Plate (Metric). ASTM C 335-05ae1, Standard Test Method for Steady State .2 Heat Transfer Properties of Pipe Insulation. .3 ASTM C 411-05, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation. ASTM C 449/C 449M-00, Standard Specification for Mineral .4 Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement. ASTM C 547-07el, Standard Specification for Mineral Fiber .5 Pipe Insulation. .6 ASTM C 553-02e1, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications. ASTM C 612-04e1, Standard Specification for Mineral Fiber .7 Block and Board Thermal Insulation. ASTM C 795-03, Standard Specification for Thermal .8 Insulation for Use in Contact with Austenitic Stainless Steel. ASTM C 921-03a, Standard Practice for Determining the .9 Properties of Jacketing Materials for Thermal Insulation.

- .3 Canadian General Standards Board (CGSB)
   .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .4 Green Seal Environmental Standards (GSES) .1 Standard GS-36-00, Commercial Adhesives.
- .5 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).
- .6 Underwriters Laboratories of Canada (ULC) .1 CAN/ULC-S102-03, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies. .2 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

### 1.2 DEFINITIONS

.1 For purposes of this section: .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces. .2 "EXPOSED" - means "not concealed" as previouslydefined. .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

- .2 TIAC Codes:
  - .1 CRD: Code Round Ductwork,
  - .2 CRF: Code Rectangular Finish.

## 1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.

.1 Description of equipment giving manufacturer's name, type, model, year and capacity.

- .2 Details of operation, servicing and maintenance.
- .3 Recommended spare parts list.

## .3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in ProvinceTerritory, Canada.

- .4 Manufacturers' Instructions: .1 Provide manufacture's written duct insulation jointing recommendations. and special handling criteria, installation sequence, cleaning procedures and.
- .5 Sustainable Design Submittals: .1 LEED Submittals: in accordance with Section 01 35 21 -LEED Requirements.

## 1.4 QUALITY ASSURANCE

.1 Qualifications: .1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standardsmember of TIAC.

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### 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address and ULC markings.

### PART 2 - PRODUCTS

### 2.1 FIRE AND SMOKE RATING

- .1 To CAN/ULC-S102:
  - .1 Maximum flame spread rating: 25.
  - .2 Maximum smoke developed rating: 50.

### 2.2 INSULATION

- .1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C 335.
- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C 612, withwithout factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).
- .4 TIAC Code C-2: Mineral fibre blanket to ASTM C 553 faced withwithout factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
   .1 Mineral fibre: to ASTM C 553.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to ASTM C 553.

### 2.3 JACKETS

- .1 Aluminum:
  - .1 To ASTM B 209 withandwithout moisture barrier as scheduled
  - in PART 3 of this section.
  - .2 Thickness: 0.50 mm sheet.
  - .3 Finish: SmoothStucco embossedCorrugated.
  - .4 Jacket banding and mechanical seals: 1219 mm wide, 0.5 mm thick stainless steel.
    - .1 Stainless steel:

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.5 Type: 304316.
.6 Thickness: 0.250.50 mm sheet.
.7 Finish: SmoothCorrugatedStucco embossed.
.8 Jacket banding and mechanical seals: 1219 mm wide, 0.5 mm thick stainless steel.

### 2.4 ACCESSORIES

- .1 Vapour retarder lap adhesive: .1 Water based, fire retardant type, compatible with insulation.
- .2 Indoor Vapour Retarder Finish: .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C 449.
- .4 Tape: self-adhesive, aluminum, plainreinforced, 5075 mm wide minimum.
- .5 Contact adhesive: quick-setting
- .6 Tie wire: 1.5 mm stainless steel.
- .7 Banding: 12mm wide, 0.5 mm thick stainless steel.
- .8 Facing: 25 mm stainlesssteel hexagonal wire mesh stitched on one faceof insulationone face of insulation with expanded metal lath on other face.
- .9 Fasteners: 2mm diameter pins with35 mm diameterclips, length to suit thickness of insulation.

### PART 3 - EXECUTION

### 3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

### 3.2 PRE-INSTALLATION REQUIREMENTS

.1 Pressure test ductwork systems complete, witness and certify.

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.2 Ensure surfaces are clean, dry, free from foreign material.

### 3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and as indicated.
- .3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  .1 Ensure hangers, and supports are outside vapour retarder jacket.
- .5 Hangers and supports in accordance with Section 23 05 29 -Hangers and Supports for HVAC Piping and Equipment.
  .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.

## 3.4 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: conform to following table:

| TIAC Code                                                                  | Vapour Retarder | Thickness | (mm) |
|----------------------------------------------------------------------------|-----------------|-----------|------|
| Supply, return<br>and exhaust<br>ducts exposed in<br>space being<br>served | none            |           |      |
| Outside air<br>ducts to fan                                                | C-1             | yes       | 25   |
| Exhaust duct<br>between dampers<br>and louvres                             | C-1             | no        | 25   |

.2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:

| Bissett Lake Wastewater        | DUCT | INSULATION | Section | 23  | 07 | 13 |
|--------------------------------|------|------------|---------|-----|----|----|
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.1 Use TIAC code C-1 insulation, scored to suit diameter of duct. .1 Finishes: conform to following table: TIAC Code Rectangular Round Indoor CRF/1 CRD/2

## 3.5 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning. .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

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### 1.1 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

.1 In accordance with Section 23 08 16 - Cleaning and Start-Up of HVAC Piping Systems.

### 1.2 POTABLE WATER SYSTEMS

.1 When cleaning is completed and system filled:

.1 Verify performance of equipment and systems as specified elsewhere in Division 23.
.2 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or recharge air chambers. Repeat for each outlet and flush valve.
.3 Confirm water quality consistent with supply standards, verifying that no residuals remain resulting from flushing and/or cleaning.

## 1.3 SANITARY AND STORM DRAINAGE SYSTEMS

- .1 Ensure that traps are fully and permanently primed.
- .2 Ensure that fixtures are properly anchored, connected to system.
- .3 Cleanouts: refer to Section 22 05 15 Plumbing Specialities and Accessories.

## 1.4 REPORTS

.1 In accordance with Section 01 91 13 - General Commissioning Requirements: Reports, supplemented as specified herein.

### PART 2 - PRODUCTS

### 2.1 NOT USED

.1 Not Used.

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## PART 3 - EXECUTION

# 3.1 NOT USED

.1 Not Used.

### 1.1 SUMMARY

.1 Section Includes: .1 Procedures and cleaning solutions for cleaning mechanical piping systems.

### 1.2 REFERENCE STANDARDS

- .1 ASTM International (ASTM)
   .1 ASTM E 202-[00], Standard Test Methods for Analysis of
   Ethylene Glycols and Propylene Glycols.
- Health Canada/Workplace Hazardous Materials Information System (WHMIS)
   .1 Safety Data Sheets (SDS).

## 1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data: .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section [01 33 00 - Submittal Procedures]. Include product characteristics, performance criteria, and limitations.

## 1.4 QUALITY ASSURANCE

.1 Health and Safety: .1 Do construction occupational health and safety in accordance with Section [01 35 29.06 - Health and Safety Requirements].

## 1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading: .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section [01 61 00 -Common Product Requirements].

## PART 2 - PRODUCTS

### 2.1 CLEANING SOLUTIONS

- .1 Tri-sodium phosphate: 0.40 kg per 100 L water in system.
- .2 Sodium carbonate: 0.40 kg per 100 L water in system.
- .3 Low-foaming detergent: 0.01 kg per 100 L water in system.

## PART 3 - EXECUTION

## 3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

### 3.2 CLEANING HYDRONIC AND STEAM SYSTEMS

- .1 Timing: systems operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.
- .2 Cleaning Agency: .1 Retain qualified water treatment specialist to perform system cleaning.
- .3 Install instrumentation such as flow meters, orifice plates, pitot tubes, flow metering valves only after cleaning is certified as complete [by water treatment specialist].
- .4 Cleaning procedures:

.1 Provide detailed report outlining proposed cleaning procedures at least [4] weeks prior to proposed starting date. Report to include:

- .1 Cleaning procedures, flow rates, elapsed time.
- .2 Chemicals and concentrations used.
- .3 Inhibitors and concentrations.
- .4 Specific requirements for completion of work.

.5 Special precautions for protecting piping system materials and components.

.6 Complete analysis of water used to ensure water will not damage systems or equipment.

.5 Conditions at time of cleaning of systems:

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.1 Systems: free from construction debris, dirt and other foreign material.
.2 Control valves: operational, fully open to ensure that terminal units can be cleaned properly.
.3 Strainers: clean prior to initial fill.
.4 Install temporary filters on pumps not equipped with permanent filters.
.5 Install pressure gauges on strainers to detect plugging.

.6 Report on Completion of Cleaning: .1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.

## 3.3 FIELD QUALITY CONTROL

- .1 Verification requirements in accordance with Section [01 33 29
   Sustainable Design Reporting], include:
  - .1 Materials and resources.
  - .2 Storage and collection of recyclables.
  - .3 Construction waste management.
  - .4 Resource reuse.
  - .5 Recycled content.
  - .6 Local/regional materials.
  - .7 Certified wood.
  - .8 Low-emitting materials.

## 3.4 CLEANING

- .1 Proceed in accordance with Section [01 74 00 Cleaning].
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

### 1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for electric and electronic control system for HVAC and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

## 1.2 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:

  Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  Store and protect electric and electronic control systems from nicks, scratches, and blemishes.
  Replace defective or damaged materials with new.

## PART 2 - PRODUCTS

## 2.1 THERMOSTAT (LOW VOLTAGE)

- .1 Low voltage wall thermostat:
  - .1 For use on 24 V circuit at 1.5 A capacity.
  - .2 With heat anticipator adjustable 0.1 to 1.2 A.
  - .3 Temperature setting range: 10 degrees C to 25 degrees C.
  - .4 Without sub-base.

### 2.2 HIGH LIMIT TEMPERATURE ALARM

- .1 High limit temperature alarm with:
  - .1 Rating 10 A at 120 V6 A at 240 V.
  - .2 Positive lock-out.
  - .3 Manual reset only after 14 degrees C drop-in temperature.
  - .4 Cutout setting: 50 degrees C.

### PART 3 - EXECUTION

### 3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for electric and electronic control systems installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

### 3.2 INSTALLATION

- .1 Install control devices.
- .2 On outside wall, mount thermostats on bracket or insulated pad 25 mm from exterior wall.
- .3 Install remote sensing device and capillary tube in metallic conduit. Conduit enclosing capillary tube must not touch heater or heating cable.

#### 3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 Cleaning.

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### 1.1 REFERENCE STANDARDS

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- ASTM International (ASTM)

  ASTM A 480/A 480M-12, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
  ASTM A 635/A 635M-09b, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.
  ASTM A 653/A 653M-11, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 Green Seal Environmental Standards (GS) .1 GS-36-11, Standard for Adhesives for Commercial Use.
- .4 National Fire Protection Association (NFPA)
  .1 NFPA 90A-12, Standard for the Installation of Air-Conditioning and Ventilating Systems.
  .2 NFPA 90B-12, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
  .3 NFPA 96-11, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
  .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2005.
  .2 SMACNA HVAC Air Duct Leakage Test Manual, 2012.

## 1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for metal ducts and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

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.1 Submit drawings stamped and signed by professional engineer registered or licensed in ProvinceTerritory, Canada.

- .4 Test and Evaluation Reports:
  - .1 Certification of Ratings: .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

### 1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:

  .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  .2 Store and protect metal ducts from nicks, scratches, and blemishes.
  .3 Replace defective or damaged materials with new.

•• Replace delective of damaged materials with

## PART 2 - PRODUCTS

### 2.1 SEAL CLASSIFICATION

.1 Classification as follows:

| Maximum | Pressure | Ра | SMACNA | Seal  | Clas |
|---------|----------|----|--------|-------|------|
|         | 500      |    |        | С     |      |
|         | 250      |    |        | С     |      |
|         | 125      |    |        | С     |      |
|         | 125      |    | Unse   | ealed |      |

.2 Seal classification:

.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

.2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant, tapeor combination thereof.

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.3 Class C: transverse joints and connections made air tight with gaskets, sealant, tapeor combination thereof. Longitudinal seams unsealed..4 Unsealed seams and joints.

## 2.2 SEALANT

.1 Sustainability Characteristics: .1 Adhesives and sealants: in accordance with Section 07 92 00 - Joint Sealants.

## 2.3 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

## 2.4 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

## 2.5 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows: .1 Rectangular: standard radius. .2 Round: smooth radius, centreline radius: 1.5 times diameter.
- .3 Branches:

  .1 Rectangular main and branch: with radius on branch 1.5 times width of duct, 45 degrees entry on branch.
  .2 Round main and branch: enter main duct at 45 degrees with conical connection.
  .3 Provide volume control damper in branch duct near connection to main duct.
  .4 Main duct branches: with splitter damper.
- .4 Transitions:
  - .1 Diverging: 20 degrees maximum included angle.
  - .2 Converging: 30 degrees maximum included angle.
- .5 Offsets: .1 Short radiused elbowsas indicated.
- .6 Obstruction deflectors: maintain full cross-sectional area.

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.1 Maximum included angles: as for transitions.

### 2.6 FIRE STOPPING

- .1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 Fire Stopping.
- .2 Coordinate with 07 84 00 Fire Stopping to ensure fire stopping materials and installation does not distort duct.

## 2.7 GALVANIZED STEEL

- .1 Lock forming quality: to ASTM A 653/A 653M, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNAproprietary manufactured duct joint. Proprietary manufactured flanged duct joint to be considered to be a class A seal.

### 2.8 STAINLESS STEEL

- .1 TO ASTM A 480/A 480M, Type 304.
- .2 Finish: number 4.
- .3 Thickness, fabrication and reinforcement: to SMACNAas indicated.
- .4 Joints: to SMACNA.

## 2.9 BLACK STEEL

- .1 TO ASTM A 635/A 635M.
- .2 Thickness: 1.2 mm .
- .3 Fabrication: ducts and fittings to SMACNA.
- .4 Joints: continuous weld.

### 2.10HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29 -Hangers and Supports for HVAC Piping and Equipment.

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.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.

- .1 Maximum size duct supported by strap hanger: 500.
- .2 Hanger configuration: to ASHRAEandSMACNA.
- .3 Hangers: galvanized steel angle with galvanized steel rods

to ASHRAEandSMACNAfollowing table:

| Duct Size     | Angle Size  | Rod Size |
|---------------|-------------|----------|
| (mm)          | (mm)        | (mm)     |
| up to 750     | 25 x 25 x 3 | 36       |
| 751 to 1050   | 40 x 40 x 3 | 36       |
| 1051 to 1500  | 40 x 40 x 3 | 3 10     |
| 1501 to 2100  | 50 x 50 x 3 | 3 10     |
| 2101 to 2400  | 50 x 50 x 5 | 5 10     |
| 2401 and over | 50 x 50 x 6 | 5 10     |

.4 Upper hanger attachments: .1 For concrete: manufactured concrete inserts. .2 For steel joist: manufactured joist clampsteel plate washer.

.3 For steel beams: manufactured beam clamps:

## PART 3 - EXECUTION

## 3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for metal duct installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

### 3.2 GENERAL

- .1 Do work in accordance withNFPA 90A, NFPA 90B, ASHRAE, SMACNA and as indicated.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods..1 Insulate strap hangers 100 mm beyond insulated ductEnsure diffuser is fully seated.
- .3 Support risers in accordance with SMACNA and as indicated.

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- .4 Install breakaway joints in ductwork on sides of fire separation.
- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

### 3.3 HANGERS

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with SMACNAas follows:

| Duct Size     | Spacing |
|---------------|---------|
| (mm)          | (mm)    |
| to 1500       | 3000    |
| 1501 and over | 2500    |

## 3.4 WATERTIGHT DUCT

.1 Provide watertight duct for: .1 Fresh air intake.

### 3.5 SEALING AND TAPING

- .1 Apply sealant in accordance with SMACNAandto manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

### 3.6 LEAKAGE TESTS

- .1 Refer to Section 23 05 94 Pressure Testing of Ducted Air Systems.
- .2 In accordance with SMACNA HVAC Duct Leakage Test Manual.
- .3 Do leakage tests in sections.
- .4 Make trial leakage tests as instructed to demonstrate workmanship.

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- .5 Do not install additional ductwork until trial test has been passed.
- .6 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows.
- .7 Complete test before performance insulation or concealment Work.

### 3.7 CLEANING

- Progress Cleaning: clean in accordance with Section 01 74 00 -Cleaning.
   .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 Cleaning.

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### 1.1 REFERENCE STANDARDS

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, [2005].

## 1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section [01 33 00 Submittal Procedures].
- .2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for [air duct accessories] and include product characteristics, performance criteria, physical size, finish and limitations.

- .2 Indicate:
  - .1 Flexible connections.
  - .2 Duct access doors.

## 1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section [01 61 00 - Common Product Requirements][and][with manufacturer's written instructions].
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:

  .1 Store materials [off ground], [indoors], [in dry location]
  and in accordance with manufacturer's recommendations in clean,
  dry, well-ventilated area.
  .2 Store and protect [air duct accessories] from [nicks,
  scratches, and blemishes].
  .3 Replace defective or damaged materials with new.

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## PART 2 - PRODUCTS

### 2.1 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

### 2.2 FLEXIBLE CONNECTIONS

- .1 Frame: galvanized sheet metal frame [\_\_\_\_] mm thick with fabric clenched by means of double locked seams.
- .2 Material: .1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus [40] degrees C to plus [90] degrees C, density of [1.3] kg/m<sup>2</sup>.

### 2.3 ACCESS DOORS IN DUCTS

- .1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.
- .2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.
- .3 Gaskets: [neoprene] [foam rubber].
- .4 Hardware: .1 Up to [300 x 300] mm: two sash locks [complete with safety chain]. .2 [301 to 450] mm: four sash locks [complete with safety chain]. [451 to 1000] mm: piano hinge and minimum two sash locks. .3 Doors over [1000] mm: piano hinge and two handles operable .4 from both sides. .5 Hold open devices. .6 [[300 x 300] mm glass viewing panels].

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## PART 3 - EXECUTION

### 3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air duct accessories installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of [Consultant].
  - .2 Inform [Consultant] of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from [Consultant]].

## 3.2 INSTALLATION

- .1 Flexible Connections:
  - .1 Install in following locations:
    - .1 Inlets and outlets to supply air units and fans.
    - .2 Inlets and outlets of exhaust and return air fans.
    - .3 As indicated.
  - .2 Length of connection: [100] mm.
  - .3 Minimum distance between metal parts when system in operation: [75] mm.
  - .4 Install in accordance with recommendations of SMACNA.
  - .5 When fan is running:
    - .1 Ducting on sides of flexible connection to be in alignment.
      - .2 Ensure slack material in flexible connection.
- .2 Access Doors and Viewing Panels:
  - .1 Size:
    - .1 [\_\_\_\_] x [\_\_\_\_] mm for person size entry.
    - .2 [\_\_\_\_] x [\_\_\_\_] mm for servicing entry.
    - .3 [\_\_\_\_] x [\_\_\_\_] mm for viewing.
    - .4 As indicated.
  - .2 Locations:
    - .1 Fire and smoke dampers.
    - .2 Control dampers.
    - .3 Devices requiring maintenance.
    - .4 Required by code.
    - .5 Elsewhere as indicated.

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## 3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section [01 74 00 Cleaning].
   .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section [01 74 00 Cleaning].

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### 1.1 REFERENCE STANDARDS

.1 Sheet Metal and Air Conditioning National Association (SMACNA) .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-2013.

### 1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data: .1 Submit manufacturer's instructions, printed product literature and data sheets for dampers and include product characteristics, performance criteria, physical size, finish and limitations.

## 1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for dampers for incorporation into manual.

## 1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements: .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area. .2 Store and protect dampers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

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## PART 2 - PRODUCTS

### 2.1 GENERAL

.1 Manufacture to SMACNA standards.

## 2.2 SPLITTER DAMPERS

- .1 Fabricate from same material as duct but one sheet metal thickness heavier, with appropriate stiffening.
- .2 Singlethickness construction.
- .3 Control rod with locking device and position indicator.
- .4 Rod configuration to prevent end from entering duct.
- .5 Pivot: piano hinge.
- .6 Folded leading edge.

#### 2.3 SINGLE BLADE DAMPERS

- .1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height 100 mmas indicated.
- .3 Locking quadrant with shaft extension to accommodate insulation thickness.
- .4 Inside and outside nylonend bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for damper installation in accordance with manufacturer's written instructions.

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.1 Visually inspect substrate in presence of Consultant.
.2 Inform Consultant of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

## 3.2 INSTALLATION

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.
- .4 Dampers: vibration free.
- .5 Ensure damper operators are observable and accessible.
- .6 Corrections and adjustments conducted by Consultant.

## 3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 Cleaning.

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### 1.1 REFERENCE STANDARDS

.1 ASTM International (ASTM) .1 ASTM A 653/A 653M-[11], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

### 1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section [01 33 00 Submittal Procedures].
- .2 Product Data: .1 Submit manufacturer's instructions, printed product literature and data sheets for [dampers] and include product characteristics, performance criteria, physical size, finish and limitations.

## 1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section [01 78 00 Closeout Submittals].
- .2 Operation and Maintenance Data: submit operation and maintenance data for [dampers] for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section [01 61 00 - Common Product Requirements][and][with manufacturer's written instructions].
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:

  .1 Store materials [off ground], [indoors], [in dry location]
  and in accordance with manufacturer's recommendations in clean,
  dry, well-ventilated area.
  .2 Store and protect [dampers] from [nicks, scratches, and
  blemishes].
  .3 Replace defective or damaged materials with new.

| Bissett Lake Wastewater        | DAMPERS - OPERATING | Section 23 33 15 |
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## PART 2 - PRODUCTS

### 2.1 MULTI-LEAF DAMPERS

- .1 [Opposed]]blade type as indicated.
- .2 [Extruded aluminum], interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, [extruded aluminum] frame.
- .3 Pressure fit self-lubricated bronze bearings.
- .4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.
- .5 Operator: to Section [23 09 43 Pneumatic Control System for HVAC].
- .6 Performance:

.1 Leakage: in closed position less than 2% of rated air flow at [\_\_\_\_] Pa differential across damper. .2 Pressure drop: at full open position less than [\_\_\_] Pa differential across damper at [\_\_\_] m/s.

.7 Insulated aluminum dampers:

.1 Frames: insulated with extruded polystyrene foam with RSI
0.88.
.2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI
0.88.

#### 2.2 DISC TYPE DAMPERS

- .1 Frame: [insulated] brake formed, welded, 1.6 mm thick, galvanized steel to ASTM A 653/A 653M.
- .2 Disc: [insulated] spin formed, 1.6 mm thick, galvanized steel to ASTM A 653/A 653M.
- .3 Gasket: extruded neoprene, field replaceable, with 10 year warranty.
- .4 Bearings: roller self lubricated and sealed.
- .5 Operator: compatible with damper, linear stroke operator, [spring loaded] actuator, zinc-aluminum foundry alloy casting cam follower.

| Bissett Lake Wastewater        | DAMPERS - OPERATING | Section 23 33 15 |
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.6 Performance: .1 Leakage: in closed position less than 0.001% of rated air flow at [\_\_\_\_\_] kPa pressure differential across damper. .2 Pressure drop: at full open position less than [\_\_\_\_] kPa differential across damper at [\_\_\_\_] m/s.

### 2.3 BACK DRAFT DAMPERS

.1 [Automatic gravity operated,][multi]leaf, [aluminum]construction with [nylon] bearings, [centre pivoted] and [spring assisted].

## PART 3 - EXECUTION

## 3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for damper installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of [Consultant].
.2 Inform [Consultant] of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from [Consultant]].

### 3.2 INSTALLATION

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.
- .3 Seal multiple damper modules with silicon sealant.
- .4 Install access door adjacent to each damper. See Section [23 33 00 Air Duct Accessories].
- .5 Ensure dampers are observable and accessible.

## 3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section [01 74 00 - Cleaning].

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|--------------------------------|---------------------|------------------|
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.1 Leave Work area clean at end of each day.

## 1.1 REFERENCE STANDARDS

- .1 National Fire Protection Association (NFPA) .1 NFPA 90A-[12], Standard for the Installation of Air Conditioning and Ventilating Systems.
- .2 Underwriters Laboratories of Canada (ULC)

  .1 CAN/ULC-S112-[10], Standard Test Method of Fire Test of
  Fire Damper Assemblies.
  .2 CAN/ULC-S112.2-[07], Standard Method of Fire Test of
  Ceiling Fire Stop Flap Assemblies.
  .3 ULC-S505-[1974], Standard for Fusible Links for Fire
  Protection Service.

## 1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section [01 33 00 Submittal Procedures].
- .2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for [fire and smoke dampers] and include product characteristics, performance criteria, physical size, finish and limitations.

- .2 Indicate the following:
  - .1 Fire dampers.
  - .2 Smoke dampers.
  - .3 Fire stop flaps.
  - .4 Operators.
  - .5 Fusible links.
  - .6 Design details of break-away joints.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

## 1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section [01 78 00 Closeout Submittals].
- .2 Operation and Maintenance Data: submit operation and maintenance data for [fire and smoke dampers] for incorporation into manual.

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### 1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials: .1 Submit maintenance materials in accordance with Section [01 78 00 - Closeout Submittals]. .2 Provide: .1 [6] fusible links of each type.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section [01 61 00 - Common Product Requirements][and][with manufacturer's written instructions].
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:

  .1 Store materials [off ground], [indoors], [in dry location]
  and in accordance with manufacturer's recommendations in clean,
  dry, well-ventilated area.
  .2 Store and protect [fire and smoke dampers] from [nicks,
  scratches, and blemishes].
  .3 Replace defective or damaged materials with new.

### PART 2 - PRODUCTS

### 2.1 FIRE DAMPERS

- .1 Fire dampers: arrangement Type [A][B][C], [listed][and][bear label of [ULC][UL][Warnock Hersey]], meet requirements of [[provincial fire authority][Fire Commissioner of Canada (FCC)][CFFM][and NFPA 90A]][authorities having jurisdiction]. Fire damper assemblies fire tested in accordance with CAN/ULC-S112.
- .2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
  .1 Fire dampers: [1-1/2] hour fire rated unless otherwise indicated.
  .2 Fire dampers: automatic operating type and have dynamic rating suitable for maximum air velocity and pressure differential to which it will be subjected.

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- .3 Top hinged: offset [single damper], round or square; [multi-blade hinged][or][interlocking type;][roll door type;][guillotine type;] sized to maintain full duct cross section [as indicated].
- .4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.
- .5 [40 x 40 x 3] mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.
- .6 Equip fire dampers with steel sleeve or frame installed disruption ductwork or impair damper operation.
- .7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.
- .8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.
- .9 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition of floor slab depth or thickness.
- .10 Unless otherwise indicated, the installation details given in SMACNA Install Fire Damp HVAC and in manufacturer's instructions for fire dampers shall be followed.

### 2.2 FIRE STOP FLAPS

- .1 Fire smoke flaps: ULC listed and labelled and fire tested in accordance with CAN/ULC-S112.2.
- .2 Construct of minimum 1.5 mm thick sheet steel with 1.6 mm thick non-asbestos ULC listed insulation and corrosion-resistant pins and hinges.
- .3 Flaps held open with fusible link conforming to ULC-S505 and close at [74] degrees C [or as indicated].

## PART 3 - EXECUTION

### 3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for fire and smoke damper installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of [Consultant].

.2 Inform [Consultant] of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from [Consultant]].

### 3.2 INSTALLATION

- .1 Install in accordance with NFPA 90A and in accordance with conditions of ULC listing.
- .2 Maintain integrity of fire separation.
- .3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
- .4 Install access door adjacent to each damper. See Section [23 33 00 Air Duct Accessories].
- .5 Coordinate installation of fire stopping with Section [07 84 00 Fire Stopping].
- .6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.
- .7 Install break-away joints of approved design on each side of fire separation.

### 3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section [01 74 00 -Cleaning]. .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section [01 74 00 Cleaning].

## 1.1 REFERENCE STANDARDS

- American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)

  ANSI/AMCA Standard 99-[2010], Standards Handbook.
  ANSI/ASHRAE 51-[07] (Â ANSI/AMCA 210-[07]), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
  ANSI/AMCA Standard 300-[2008], Reverberant Room Method for Sound Testing of Fans.
  ANSI/AMCA Standard 301-[1990], Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .2 The Master Painters Institute (MPI) .1 Architectural Painting Specification Manual - [current edition].

.1 MPI #18, Primer, Zinc Rich, Organic.

## 1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section [01 33 00 Submittal Procedures].
- .2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for [HVAC fans] and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in [Province][Territory], Canada.

- .2 Provide:
  - .1 Fan performance curves showing point of operation, [kW] and efficiency.
  - .2 Sound rating data at point of operation.
- .3 Indicate:
  - .1 Motors, sheaves, bearings, shaft details [\_\_\_\_]. .2 Minimum performance achievable with [variable speed controllers][and][variable inlet vanes][as appropriate].

## 1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:
| Bissett Lake Wastewater        | HVAC FANS | Section 23 34 00 |
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Submit in accordance with Section [01 78 00 - Closeout .1 Submittals]. Provide: .1 Matched sets of belts. .1 .2 Furnish list of individual manufacturer's recommended spare parts for equipment, include: Bearings and seals. .1 .2 Addresses of suppliers. List of specialized tools necessary for .3 adjusting, repairing or replacing.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section [01 61 00 - Common Product Requirements][and][with manufacturer's written instructions].
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:

  .1 Store materials [off ground], [indoors], [in dry location]
  and in accordance with manufacturer's recommendations in clean,
  dry, well-ventilated area.
  .2 Store and protect [HVAC fans] from [nicks, scratches, and
  blemishes].
  .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

#### 2.1 SYSTEM DESCRIPTION

Performance Requirements: .1 .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force. .2 Capacity: flow rate, [total] [static] pressure, [W], efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule. .3 Fans: statically and dynamically balanced, constructed in conformity with ANSI/AMCA Standard 99. .4 Sound ratings: comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300. [Supply unit with ANSI/AMCA certified sound rating seal].

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.5 Performance ratings: based on tests performed in accordance with ANSI/AMCA Standard 210. [Supply unit with ANSI/AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter].

#### 2.2 FANS GENERAL

- Motors: .1 In accordance with Section [23 05 13 - Common Motors .1 Requirements for HVAC Equipment] supplemented as specified herein. .2 For use with variable speed controllers. .3 Sizes as [indicated]. .4 Two speed with two windings and speeds of approximately [[\_\_\_\_] r/min low][and][[\_\_\_\_] r/min high][as indicated]. Two speed with split winding, [constant .5 horsepower][constant or variable torque] and speeds of [\_\_\_\_] r/min.
- .2 Accessories and hardware: matched sets of V-belt drives, adjustable [slide rail] motor bases, belt guards, coupling guards fan [inlet][and][outlet] safety screens as indicated and as specified in Section [23 05 13 - Common Motor Requirements for HVAC Equipment], [outlet] dampers and vanes and as indicated.
- .3 Factory primed before assembly in colour standard to manufacturer.
- .4 Scroll casing drains: as indicated.
- .5 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.
- .6 Vibration isolation: to Section [23 05 48 Vibration and Seismic Controls for HVAC Piping and Equipment].
- .7 Flexible connections: to Section [23 33 00 Air Duct Accessories].

2.3 CENTRIFUGAL FANS (FRP)

| 1 | Fan wheels:                                                  |
|---|--------------------------------------------------------------|
|   | .1 Welded [steel][aluminum] construction.                    |
|   | .2 Maximum operating speed of centrifugal fans not more than |
|   | [40][50]% of first critical speed.                           |
|   | .3 [Air foil][forward curved][backward inclined] blades, as  |
|   | indicated.                                                   |

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- .2 Bearings: [heavy duty][split pillow-block][flange mounted] grease lubricated ball or roller self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of [80,000][100,000][200,000] hours.
- .4 Housings:

.1 Volute with inlet cones: fabricated steel for wheels 300 mm or greater, [cast iron,][steel,][aluminum,] for smaller wheels, braced, and with welded supports.
.2 For horizontally and vertically split housings provide flanges on each section for bolting together, with gaskets of non-oxidizing non-flammable material.
.3 Provide [bolted][latched] airtight access doors with handles.

- .5 Variable volume control devices:
  - .1 Mounted by fan manufacturer.

.2 Adjustable inlet vanes: operated from a [centre] mechanism linked to each damper vane. [Support each vane at ends in bronze bearings]. On DWDI fans interconnect vanes to operate in unison. Provide locking devices for manual operation. .3 Variable speed drives: refer to Section [\_\_\_\_].

### 2.4 CENTRIFUGAL FANS

- .1 Fan wheels: .1 Welded [steel][aluminum] construction. .2 Maximum operating speed of centrifugal fans not more than [40][50]% of first critical speed. .3 [Air foil][forward curved][backward inclined] blades, as indicated.
- .2 Bearings: [heavy duty][split pillow-block][flange mounted] grease lubricated ball or roller self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of [80,000][100,000][200,000] hours.
- .3 Shaft seals on [laboratory fume hood][and][biological safety cabinet] exhaust fans: .1 [Single disc][multi-disc labyrinth][water-cooled][stuffing box][carbon ring with [nitrogen][air] purging] seals.
- .4 Housings:

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.1 Volute with inlet cones: fabricated steel for wheels 300 mm or greater, [cast iron,][steel,][aluminum,] for smaller wheels, braced, and with welded supports.
.2 For horizontally and vertically split housings provide flanges on each section for bolting together, with gaskets of non-oxidizing non-flammable material.
.3 Provide [bolted][latched] airtight access doors with handles.

- .5 Variable volume control devices:
  - .1 Mounted by fan manufacturer.

.2 Adjustable inlet vanes: operated from a [centre] mechanism linked to each damper vane. [Support each vane at ends in bronze bearings]. On DWDI fans interconnect vanes to operate in unison. Provide locking devices for manual operation. .3 Variable speed drives: refer to Section [\_\_\_\_].

#### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for HVAC fans installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of [Consultant].
  - .2 Inform [Consultant] of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from [Consultant]].

#### 3.2 FAN INSTALLATION

- .1 Install fans as indicated, complete with resilient mountings specified in Section [23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment], flexible electrical leads and flexible connections in accordance with Section [23 33 00 - Air Duct Accessories].
- .2 Provide sheaves and belts required for final air balance.
- .3 Bearings and extension tubes to be easily accessible.
- .4 Access doors and access panels to be easily accessible.

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### 3.3 ANCHOR BOLTS AND TEMPLATES

.1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified [\_\_\_\_].

#### 3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section [01 74 00 Cleaning].
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section [01 74 00 Cleaning].

### PART 1 - GENERAL

#### 1.1 REFERENCE STANDARDS

American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)

ANSI/AMCA Standard 99-[2010], Standards Handbook.
ANSI/ASHRAE 51-[07] (Â ANSI/AMCA 210-[07]), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
ANSI/AMCA Standard 300-[2008], Reverberant Room Method for Sound Testing of Fans.
ANSI/AMCA Standard 301-[1990], Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

### 1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section [01 33 00 Submittal Procedures].
- .2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for [roof and wall exhausters] and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in [Province][Territory], Canada.

.2 Include:

.1 Fan performance curves showing specified point of operation..2 Sound rating data.

### 1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials: .1 Submit in accordance with Section [01 78 00 - Closeout Submittals]. .1 Furnish list of individual manufacturer's recommended spare parts for equipment, include: .1 Bearings and seals. .2 Addresses of suppliers. .3 List of specialized tools necessary for adjusting, repairing or replacing.

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#### 1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section [01 61 00 - Common Product Requirements][and][with manufacturer's written instructions].
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:

  .1 Store materials [off ground], [indoors], [in dry location]
  and in accordance with manufacturer's recommendations in clean,
  dry, well-ventilated area.
  .2 Store and protect [roof and wall exhausters] from [nicks,
  scratches, and blemishes].
  .3 Replace defective or damaged materials with new.

### PART 2 - PRODUCTS

### 2.1 SYSTEM DESCRIPTION

- Performance Requirements:

  1 Catalogued or published ratings for manufactured items:
  obtained from tests carried out by manufacturer or those
  ordered by manufacturer from independent testing agency
  signifying adherence to codes and standards in force. Provide
  confirmation of testing.
  2 Capacity: [flow rate, [total][static] pressure Pa, r/min,
  [W], [model and size] and sound ratings][as indicated on
  schedule].
- .2 Statically and dynamically balanced. Constructed to ANSI/AMCA Standard 99.
- .3 Sound ratings: comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300. [Unit shall bear AMCA certified sound rating seal].
- .4 Bearings: [sealed lifetime [heavy duty grease lubricated ball or roller bearings] of self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of [100,000] hours.

### 2.2 WALL EXHAUSTERS (FRP)

- [Centrifugal backward inclined] [or] [axial] fan units, [V .1 belt driven. .1 [Spun aluminum] [FRP] [PVC] housings, complete with resilient mounted motor and fan. [12] mm mesh [2.0] mm diameter aluminum birdscreen. .2 .3 [Motorized] [Automatic] gasketted aluminum backdraft dampers. Disconnect switch within fan housing. .4 [Cadmium plated] [Stainless steel] securing bolts and .5 screws.
- .2 Eisenheiss coated wheel for fume service [with motor out of air stream].
- .3 Housings:

.1 Provide with rubber or neoprene grommets for wiring passages, integral attachment collar, or angle ring mounted to mating flanged wall sleeve with full gasketting.
.2 Discharge pattern: away from building.

.4 Two speed motors: two windings or split windings with speeds of approximately [[\_\_\_\_] r/min high][and][[\_\_\_] r/min low][as indicated].

### 2.3 WALL EXHAUSTERS

- [Centrifugal backward inclined] [or] [axial] fan units, [V .1 belt driven. .1 [Spun aluminum] [FRP] [PVC] housings, complete with resilient mounted motor and fan. [12] mm mesh [2.0] mm diameter aluminum birdscreen. .2 .3 [Motorized] [Automatic] gasketted aluminum backdraft dampers. Disconnect switch within fan housing. .4 .5 [Cadmium plated] [Stainless steel] securing bolts and screws.
- .2 Eisenheiss coated wheel for fume service [with motor out of air stream].
- .3 Housings:

.1 Provide with rubber or neoprene grommets for wiring passages, integral attachment collar, or angle ring mounted to mating flanged wall sleeve with full gasketting..2 Discharge pattern: away from building.

| Bissett Lake Wastewater       | PACKAGED ROOF AND WALL | Sect 23 34 23.13 |
|-------------------------------|------------------------|------------------|
| Pump Station -Cole Harbour,NS | EXHAUSTERS             | Page 4           |
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.4 Two speed motors: two windings or split windings with speeds of approximately [[\_\_\_\_] r/min high][and][[\_\_\_] r/min low][as indicated].

#### PART 3 - EXECUTION

#### 3.1 EXAMINATION

Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for roof and wall exhausters installation in accordance with manufacturer's written instructions.
Visually inspect substrate in presence of [Consultant].
Inform [Consultant] of unacceptable conditions immediately upon discovery.
Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from [Consultant]].

#### 3.2 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

### 3.3 ANCHOR BOLTS AND TEMPLATES

.1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified in Section [\_\_\_\_].

#### 3.4 CLEANING

- Progress Cleaning: clean in accordance with Section [01 74 00 Cleaning].
   .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section [01 74 00 Cleaning].

| Bissett Lake Wastewater        | DIFFUSERS, REGISTERS | Section 23 37 13 |
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| Pump Station -Cole Harbour, NS | AND GRILLES          | Page 1           |
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<u>SPEC NOTE</u>: DESCRIPTION: Includes supply grilles and registers, return and exhaust grilles and registers, diffusers, linear grilles, and residential grilles, registers and diffusers.

<u>SPEC NOTE</u>: Specifier to co-ordinate with Section 08 90 00 - Louvres and Vents, to ensure design free areas are specified.

<u>SPEC NOTE</u>: This Section specifies environmentally responsible material choices, utilizing the three R's (reduce, reuse and recycle) whenever possible, and providing generally available disposal options. For construction and demolition waste management practices in Federal Government projects refer to PWGSC's Report on Plans and Priorities which presents the department's response to the Federal Sustainable Development Strategy. The Report on Plans and Priorities is where these requirements have been specifically targeted as an element in the commitment to use tools such as LEED and Green Globes in project delivery.

<u>SPEC NOTE</u>: This Section includes general requirements and procedures for compliance with the Canada Green Building Council's (CaGBC) - LEED Program. Co-ordinate with Section 01 35 21 - LEED Requirements.

#### PART 1 - GENERAL

#### 1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section [01 33 00 - Submittal Procedures].

<u>SPEC NOTE</u>: Include requests for relevant data to be furnished by the Contractor, before, during or after construction.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for [diffusers, registers and grilles] and include product characteristics, performance criteria, physical size, finish and limitations.

<u>SPEC NOTE</u>: For following paragraph, insert list of required product data.

- .2 Indicate following:
  - .1 Capacity.
  - .2 Throw and terminal velocity.
  - .3 Noise criteria.
  - .4 Pressure drop.
  - .5 Neck velocity.
  - .6 [\_\_\_\_].

- .3 Samples: Samples are required for following: .1 .1 [ ]. .2 Submit duplicate [300 x 300] mm samples of [each type]. SPEC NOTE: Co-ordinate the following paragraph with Section 01 35 21 - LEED Requirements. Sustainable Design Submittals: .4 .1 LEED Canada submittals: in accordance with [Section 01 35 21 - LEED Requirements]. Construction Waste Management: .2 Submit project [Waste Management Plan] [Waste .1 Reduction Workplan] highlighting recycling and salvage requirements. Submit calculations on end-of-project recycling .2 rates, salvage rates, and landfill rates demonstrating that [50][75]% of construction wastes were recycled or salvaged. Recycled Content: .3 Submit listing of recycled content products used, .1
  - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of [post-consumer][and][post-industrial] content, and total cost of materials for project.

.4 Regional Materials: submit evidence that project incorporates required percentage [\_\_\_\_] % of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

### 1.2 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section
  - [01 78 00 Closeout Submittals].
  - .2 Include:
    - .1 Keys for volume control adjustment.
    - .2 Keys for air flow pattern adjustment.

### 1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section [01 61 00 - Common Product Requirements][and][with manufacturer's written instructions].

| Bissett Lake Wastewater       | DIFFUSERS, REGISTERS | Section 23 37 13 |
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| Pump Station -Cole Harbour,NS | AND GRILLES          | Page 3           |
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- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:

  .1 Store materials [off ground], [indoors], [in dry location]
  and in accordance with manufacturer's recommendations in clean,
  dry, well-ventilated area.
  .2 Store and protect [diffuser, registers and grilles] from
  [nicks, scratches, and blemishes].
  .3 Replace defective or damaged materials with new.

<u>SPEC NOTE</u>: Co-ordinate the following paragraph with Section 01 35 21 - LEED Requirements.

### PART 2 - PRODUCTS

### 2.1 SYSTEM DESCRIPTION

.1 Performance Requirements: .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

#### 2.2 GENERAL

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity [as indicated].
- .2 Colour: [as directed by [Consultant]].

#### 2.3 MANUFACTURED UNITS

.1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

2.4 SUPPLY GRILLES AND REGISTERS

- .1 General: with [opposed blade dampers].
- .2 Type SA: [steel][aluminum], [21][25][32] mm border, double deflection with airfoil shape, horizontal face and vertical rear bars. Finish: [\_\_\_\_]. Model: [\_\_\_\_].

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| Pump Station -Cole Harbour, NS | AND GRILLES          | Page 4           |
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- .3 Type SB: [steel][aluminum], [21][25][32] mm border, double deflection with airfoil shape, vertical face and horizontal rear bars. Finish: [\_\_\_\_]. Model: [\_\_\_\_].
- .4 Type SC: [steel][aluminum,][21][25][32] mm border, single deflection with airfoil shape horizontal face bars. Finish: [\_\_\_\_\_]. Model: [\_\_\_\_\_].
- .5 Type SD: [steel][aluminum,][21][25][32] mm border, single deflection with airfoil shape vertical face bars. Finish: [\_\_\_\_\_]. Model: [\_\_\_\_\_].

#### 2.5 RETURN AND EXHAUST GRILLES AND REGISTERS

- .1 General: with [opposed blade dampers].
- .2 Type RA: [steel][aluminum,][19] mm border, single [0][45] degrees deflection, horizontal face bars. Finish: [\_\_\_\_]. Model: [\_\_\_\_].
- .3 Type RB: [steel][aluminum,][19] mm border, single [0][45] degrees deflection, vertical face bars. Finish: [\_\_\_\_]. Model: [\_\_\_\_].
- .4 Type RC: [steel][aluminum,][19] mm border, [25 x 25] mm egg crate type face bars. Finish: [\_\_\_\_]. Model: [\_\_\_\_].

#### 2.6 DIFFUSERS

- .1 General: volume control dampers with flow straightening devices [and blank-off quadrants] and gaskets.
- .2 Type DA: [steel][aluminum,] round type, having [adjustable][fixed] pattern, [lay-in][and][or][surface] mounted. Finish: [\_\_\_\_]. Model: [\_\_\_\_].
- .3 Type DB: [steel][aluminum,] square type, having [adjustable][fixed] pattern, [lay-in][and][or][surface] mounted. Finish: [\_\_\_\_]. Model: [\_\_\_\_].
- .4 Type DC: [steel][aluminum,][square][rectangular] multi-pattern [lay-in][and][or][surface] mounted. Finish: [\_\_\_\_]. Model: [\_\_\_\_].
- .5 Type DD: [steel][aluminum,][square][lay-in][and][or][su rface] mounted, perforated type. Finish: [\_\_\_\_]. Model: [\_\_\_\_].

#### PART 3 - EXECUTION

#### 3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for diffuser, register and grille installation in accordance with manufacturer's written instructions. .1 Visually inspect substrate in presence of [Departmental Representative] [DCC Representative] [Consultant]. Inform [Departmental Representative] [DCC .2 Representative][Consultant] of unacceptable conditions immediately upon discovery. .3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from [Departmental Representative] [DCC Representative [Consultant]].

### 3.2 INSTALLATION

- .1 Install in accordance with manufacturers instructions.
- .2 Install with [stainless steel]screws in countersunk holes where fastenings are visible.
- .3 Bolt grilles, registers and diffusers, in place, in gymnasium and similar game rooms.
- .4 Provide concealed safety chain on each grille, register and diffuser in gymnasium and similar game rooms [and elsewhere as indicated].

### 3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section [01 74 00 -Cleaning]. .1 Leave Work area clean at end of each day.
  - Final Cleaning: upon completion remove surplus materials,
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section [01 74 00 - Cleaning].

| Bissett Lake Wastewater        | LOUVRES, | INTAKES AND | Section 23 37 20 |
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<u>SPEC NOTE</u>: DESCRIPTION: Includes administrative procedures, materials, accessories and installation procedures for mechanical louvres, intakes and vents. Also includes reinforcement and bracing for air vents, intakes and gooseneck hoods for wind speed, in accordance with National Building Code of Canada (NBC) for location. Does not include architectural louvres and vents; refer to section 08 90 00 - Louvres and Vents for specification information.

<u>SPEC NOTE</u>: Ventilation systems should be designed to meet or exceed those specified in MD 15000 standards.

<u>SPEC NOTE</u>: This Section specifies environmentally responsible material choices, utilizing the three R's (reduce, reuse and recycle) whenever possible, and providing generally available disposal options. For construction and demolition waste management practices in Federal Government projects refer to PWGSC's Report on Plans and Priorities which presents the department's response to the Federal Sustainable Development Strategy. The Report on Plans and Priorities is where these requirements have been specifically targeted as an element in the commitment to use tools such as LEED and Green Globes in project delivery.

SPEC NOTE: This Section includes general requirements and procedures for compliance with the Canada Green Building Council's (CaGBC) - LEED Program. Co-ordinate with Section 01 35 21 - LEED Requirements.

#### PART 1 - GENERAL

#### 1.1 REFERENCE STANDARDS

SPEC NOTE: Edit the following paragraphs for this specific project.

- .1 ASTM International (ASTM) .1 ASTM E 90-[09], Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .2 National Fire Protection Association (NFPA) .1 NFPA 96-[11], Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .3 National Research Council Canada (NRC) .1 National Building Code of Canada [2015] (NBC).
- .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

| Bissett Lake Wastewater        | LOUVRES, | INTAKES AND | Section 23 37 20 |
|--------------------------------|----------|-------------|------------------|
| Pump Station -Cole Harbour, NS | VENTS    |             | Page 2           |
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.5 Society of Automotive Engineers (SAE)

#### 1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section [01 33 00 - Submittal Procedures].

<u>SPEC NOTE</u>: Include requests for relevant data to be furnished by the Contractor, before, during or after construction.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for [louvers, intakes and vents] and include product characteristics, performance criteria, physical size, finish and limitations.

SPEC NOTE: Insert list of required items.

- .2 Indicate following:
  - .1 Pressure drop.
  - .2 Face area.
  - .3 Free area.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Test Reports: submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E 90.

<u>SPEC NOTE</u>: Co-ordinate the following paragraph with Section 01 35 21 - LEED Requirements.

### 1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section [01 61 00 - Common Product Requirements][and][with manufacturer's written instructions].
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements: .1 Store materials [off ground], [indoors], [in dry location] and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

| Bissett Lake Wastewater        | LOUVRES, | INTAKES AND | Section 23 37 20 |
|--------------------------------|----------|-------------|------------------|
| Pump Station -Cole Harbour, NS | VENTS    |             | Page 3           |
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.2 Store and protect [louvers, intakes and vents] from [nicks, scratches, and blemishes]..3 Replace defective or damaged materials with new.

SPEC NOTE: Co-ordinate the following paragraph with Section 01 35 21
- LEED Requirements.

## PART 2 - PRODUCTS

### 2.1 SYSTEM DESCRIPTION

.1 Performance Requirements: .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

#### 2.2 FIXED LOUVRES - ALUMINUM

- .1 Construction: welded with exposed joints ground flush and smooth.
- .2 Material: extruded aluminum alloy [6063-T5].
- .3 Blade: [stormproof pattern with centre watershed in blade], reinforcing bosses and maximum blade length of [1500] mm.
- .4 Frame, head, sill and jamb: [150] mm deep one piece extruded aluminum, minimum [3] mm thick [with approved caulking slot, integral to unit].
- .5 Mullions: at [1500] mm maximum centres.
- .6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.
- .7 Screen: [[12] mm exhaust][[19] mm intake] mesh, [2] mm diameter wire aluminum birdscreen on [inside] face of louvres in formed U-frame.
- .8 Finish: [factory applied enamel. Colour: to [Consultant's] approval.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for louvres, intakes and vents installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of [Consultant]..2 Inform [Consultant] of unacceptable conditions immediately

upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from [Consultant]].

#### 3.2 INSTALLATION

- .1 In accordance with manufacturer's and SMACNA recommendations.
- .2 Reinforce and brace as indicated.

<u>SPEC NOTE</u>: The California South Coast Air Quality Management Rule #1168 provides acceptable standards for products that provide reduced environmental impacts.

.3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

#### 3.3 CLEANING

- Progress Cleaning: clean in accordance with Section [01 74 00 Cleaning].
   .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section [01 74 00 Cleaning].

### PART 1 - GENERAL

#### 1.1 REFERENCE STANDARDS

- .1 CSA Group (CSA) .1 CSA C22.2 No.46-[M1988(R2006)], Electric Air-Heaters.
- .2 National Electrical Manufacturers Association (NEMA) .1 NEMA 250-[08], Enclosures for Electrical Equipment (1000 V Maximum).

#### 1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section [01 33 00 Submittal Procedures].
- .2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for [unit heaters] and include product characteristics, performance criteria, physical size, finish and limitations.

### 1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section [01 78 00 Closeout Submittals].
- .2 Operation and Maintenance Data: submit operation and maintenance data for [unit heaters] for incorporation into manual.

### 1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section [01 61 00 - Common Product Requirements][and][with manufacturer's written instructions].
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements: .1 Store materials [off ground], [indoors], [in dry location] and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

| Bissett Lake Wastewater        | UNIT HEATERS - ELECTRIC | Sect 23 82 39.23 |
|--------------------------------|-------------------------|------------------|
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.2 Store and protect [unit heaters] from [nicks, scratches, and blemishes].

.3 Replace defective or damaged materials with new.

### PART 2 - PRODUCTS

### 2.1 UNIT HEATERS

- .1 Unit heater: to CSA C22.2 No.46, [horizontal discharge complete with adjustable louvers finished to match cabinet], [explosion proof].
- .2 Fan type unit heaters with built-in high-heat limit protection, [fan-delay switches].
- .3 Fan motor: [totally enclosed,] [permanently lubricated ball bearing], [sleeve bearing] type with resilient mount [explosion proof].
  .1 Built-in fan motor thermal overload protection.
- .4 Hangers: as indicated.
- .5 Elements: mineral insulated sheath with [aluminum],
   [single][continuous helical] brazed fins.
   .1 Explosion proof with sealed steel tube core with aluminum
   fin.
- .6 Cabinet: [aluminum][steel], [\_\_\_\_] mm thick, fitted with [\_\_\_\_] brackets for rod or wall mounting. .1 Phosphatized and finished with [\_\_\_\_] coats [air-dry][baked] enamel in [\_\_\_\_] colour.

#### 2.2 CONTROLS

.1 Wall mounted thermostats: type [[low] voltage][electronic], [Energy Star certified], to Section [23 09 33 - Electric and Electronic Control System for HVAC].
.1 Explosion proof in accordance with NEMA [7] or [9] as per [NEMA 250] with cast aluminum enclosure.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for unit heaters installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of [Consultant].
.2 Inform [Consultant] of unacceptable conditions immediately
upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from [Consultant]].

### 3.2 INSTALLATION

- .1 Suspend unit heaters from ceiling or mount on wall as indicated.
- .2 Install thermostats in locations [indicated].
- .3 Make power and control connections.

### 3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section [26 05 00 Common Work Results for Electrical].
- .2 Test cut-out protection when air movement is obstructed.
- .3 Test fan delay switch to assure dissipation of heat after element shut down.
- .4 Test unit cut-off when fan motor overload protection has operated.
- .5 Ensure heaters and controls operate correctly.

### 3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section [01 74 00 Cleaning].
  - .1 Leave Work area clean at end of each day.

| Bissett Lake Wastewater        | UNIT HEATERS - ELECTRIC | Sect 23 82 39.23 |
|--------------------------------|-------------------------|------------------|
| Pump Station -Cole Harbour, NS |                         | Page 4           |
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.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section [01 74 00 - Cleaning].

### 3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by unit heaters installation.

# PART 1 GENERAL

# 1.1 RELATED SECTIONS

.1 None

# **1.2 REFERENCE STANDARDS**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.1-018, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.
  - .2 CAN3-C235-83(R2000), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
  - .2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
    - .1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.
  - .3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
    - .1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

# **1.3 DEFINITIONS**

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

# 1.4 DESIGN REQUIREMENTS

- .1 Operating Voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
  - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English.

# 1.5 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Nova Scotia.
  - .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

- .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
- .4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
- .3 Quality Control: in accordance with Section 01 45 00 Quality Control.
  - .1 Provide CSA certified equipment and material.
  - .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction inspection for special approval before delivery to site.
  - .3 Submit test results of installed electrical systems and instrumentation.
  - .4 Permits and fees: in accordance with General Conditions of contract.
  - .5 Submit, upon completion of Work, load balance report as described in PART 3 LOAD BALANCE.
  - .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

# **1.6 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01450 Quality Control.
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.
  - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
  - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

# 1.7 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide consultant with schedule within 2 weeks after award of Contract.

# 1.8 SYSTEM START-UP

- .1 Instruct operating personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service representative to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant will aspects of its care and operation.

# **1.9 OPERATING INSTRUCTIONS**

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

- .2 Operating instructions to include the following:
  - .1 Wiring diagrams, control diagrams and control sequence for each principal system and item of equipment.
    - .1 Start up, proper adjustment, operating, lubrication and shutdown procedures.
    - .2 Safety precautions.
    - .3 Procedures to be followed in event of equipment failure.
    - .4 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
- .4 Post instructions where directed.
- .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
- .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

# PART 2 PRODUCTS

## 2.1 MATERIALS AND EQUIPMENT

- .1 Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 SUBMITTALS.
- .2 Factory assemble control panels and component assemblies. Type: 600V and 250V LT, 3 phase, 4 wire, as indicated.

# 2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and coordination responsibilities related to motors, equipment and controls, as indicated.

# 2.3 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of authority having jurisdiction.
- .2 Porcelain enamel signs, minimum size 175 x 250 mm.

## 2.4 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

## 2.5 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
  - .1 Nameplates: plastic laminate 3 mm thick plastic engraving sheet black face, white core, lettering accurately aligned and engraved into core.
  - .2 Sizes as follows:

### NAMEPLATE SIZES

| Size 1 | 10 x 50 mm  | 1 line  | 3 mm high letters  |
|--------|-------------|---------|--------------------|
| Size 2 | 12 x 70 mm  | 1 line  | 5 mm high letters  |
| Size 3 | 12 x 70 mm  | 2 lines | 3 mm high letters  |
| Size 4 | 20 x 90 mm  | 1 line  | 8 mm high letters  |
| Size 5 | 20 x 90 mm  | 2 lines | 5 mm high letters  |
| Size 6 | 25 x 100 mm | 1 line  | 12 mm high letters |
| Size 7 | 25 x 100 mm | 2 lines | 6 mm high letters  |
|        |             |         |                    |

- .3 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .4 Allow for minimum of 25 letters per nameplate and label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .7 Terminal cabinets and pull boxes: indicate system and voltage.
- .8 Transformers: indicate capacity, primary and secondary voltages.

## 2.6 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour Coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

# 2.7 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

|                        | PRIME  | AUXILIARY |
|------------------------|--------|-----------|
| Up to 250 V            | Yellow |           |
| Up to 600 V            | Yellow | Green     |
| Fire Alarm             | Red    |           |
| Emergency Voice        | Red    | Blue      |
| Other Security Systems | Red    | Yellow    |
| HVAC Control Conduit   | White  |           |

## 2.8 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
  - .1 Paint outdoor electrical equipment "equipment green" finish.
  - .2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

# PART 3 - EXECUTION

# 3.1 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1, except where specified otherwise.

# 3.2 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

# 3.3 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete.
  - .1 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit and protruding 50 mm.
- .2 If plastic sleeves are used in fire-rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

## 3.4 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with Section 26 05 34 Boxes.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .4 Locate light switches on latch side of doors.
- .5 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

# 3.5 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
  - .1 Local switches: 1200 mm.
  - .2 Wall receptacles:
    - .1 General: 300 mm.
  - .3 Panelboards: as required by Code or as indicated.
  - .4 Fire alarm bells: 2100 mm.

# 3.6 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Department and ESA necessary number of drawings and specifications for examination and approval.

- .2 Submit to Electrical Inspection Department and ESA necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .3 Pay associated fees.
- .4 Provide drawings and specifications required by Electrical Inspection department and ESA at no cost.
- .5 Notify Department Representative of changes required by Electrical Inspection department prior to making changes.
- .6 Furnish Certificates of Acceptance from Electrical Inspection Department on completion of work to Department Representative.

# 3.7 FIELD QUALITY CONTROL

- .1 Load Balance:
  - .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
  - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
  - .3 Provide upon completion of work, load balance report as directed in PART 1 -SUBMITTALS: phase and neutral currents on panelboards, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests in accordance with Section 01 45 00 Quality Control.
  - .1 Power distribution system including phasing, voltage, grounding and load balancing.
  - .2 Circuits originating from branch distribution panels.
  - .3 Lighting and its control.
  - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
  - .5 Systems: fire alarm system.
  - .6 Insulation resistance testing:
    - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
    - .2 Check resistance to ground before energizing.
- .3 Carry out tests in presence of Owner.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports.

- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits, to review Work, as directed.

# 3.8 CLEANING

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

# 3.9 **PREPARATION**

.1 Provide cutting, patching and coring of all walls, ceilings and other surfaces required to fit the electrical equipment. Check with Building Management prior to core drilling and cutting of floor, regarding building requirements and policies. Prior to slab cutting or coring first X-Ray the slab and coordinate drilling to minimize cutting of the reinforcing steel. Fire stop all new fire rated penetrations. The contractor is to include in tender price all work associated with core drilling. Obtain written verification of the location from the Architect prior to drilling, cutting torches shall not be used for making holes. Patch all holes through slab with fire-stop caulking (ULC listed). Patched surfaces are to be prime finished ready for final covering by others.

# 3.10 EXAMINATION

- .1 Verification of Conditions:
  - .1 Where any parts of systems and/or pieces of equipment are located by dimensions on drawings, check and verify such dimensions at site.
  - .2 Notify Consultant before proceeding further if any discrepancy or interference with other equipment is found which will necessitate revision in or deviation from work as indicates or specified.
  - .3 Location of conduit, raceway, wiring and other equipment shall be altered without charge to Owner if so directed by Consultant provided change is ordered before installation and does not necessitate additional labour and material.

# END OF SECTION

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- .1 Building wires are to be in conduit system.
- .2 AC 90 cable. Maximum length to be 1.5 meters run parallel to building lines.
- .3 Metal clad cable.
- .4 Wiring connectors and connections.

## **1.2 RELATED SECTIONS**

- .1 Section 01 33 00 Submittal Procedures
- .2 Section 01 45 00 Quality Control
- .3 Section 01 73 03 Execution
- .4 Section 26 05 53 Electrical Identification

## **1.3 REFERENCES**

- .1 CSA C22.2-09 Canadian Electrical Code, Part I (2018, 24thEdition), Safety Standard for Electrical Installations
- .2 CSA C22.2 No. 0.3 Test Methods for Electrical Wires and Cables.
- .3 CSA C22.2 No. 48-M90 (R2000) Non-metallic Sheathed Cable.
- .4 CSA C22.2 No. 51 Armoured Cables.
- .5 CSA C22.2 No. 52-96 (R2000) Underground Service-Entrance Cables.
- .6 CAN/CSA C22.2 No. 65-03 Wire Connectors.
- .7 CSA C22.2 No. 75-03 Thermoplastic-Insulated Wires and Cables.
- .8 CSA C22.2 No. 123 Aluminum Sheathed Cables. CSA C22.2 No. 131 Type RW 90 XLPE Cable. CSA C22.2 No. 208-03 Fire Alarm and Signal Cable.
- .9 NECA (National Electrical Contractors Association) Standard of Installation.
- .10 NETA (International Electrical Testing Association) ATS-2003 Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

## 1.4 QUALIFICATIONS

.1 Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

### **1.5 REGULATORY REQUIREMENTS**

- .1 Conform to CSA C22.1
- .2 Provide products listed and classified by as suitable for the purpose specified and indicated.

## **1.6 PROJECT CONDITIONS**

.1 Verify that field measurements are as indicated.

### 1.7 COORDINATION

.1 Where wire and cable destination are indicated and routing is not shown, determine exact routing and lengths required.

### PART 2 PRODUCTS

2.1 NOT USED

### PART 3 EXECUTION

### 3.1 EXAMINATION

- .1 Verification of existing conditions before starting work.
- .2 Verify that interior of building has been protected from weather.
- .3 Verify that mechanical work likely to damage wire and cable has been completed.
- .4 Verify that raceway installation is complete and supported.

## 3.2 PREPARATION

.1 Completely and thoroughly swab raceway before installing wire.

### 3.3 INSTALLATION

- .1 As per Manufacturer's instructions.
- .2 Route wire and cable as required to meet project conditions.
- .3 Install cable to the CSA C22.1.

- .4 Use solid conductor for feeders and branch circuits 10 AWG and smaller.
- .5 Use stranded conductors for control circuits (above 50 volts).
- .6 Use conductor not smaller than 12 AWG for power and lighting circuits.
- .7 Use conductor not smaller than 16 AWG for control circuits.
- .8 Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 25 m (75 feet).
- .9 Pull all conductors into raceway at same time.
- .10 Use suitable wire pulling lubricant for building wire 4 AWG and larger.
- .11 Protect exposed cable from damage.
- .12 Support cables above accessible ceiling, using spring metal clips or plastic cable ties to support cables from structure or ceiling suspension system. Do not rest cable on ceiling panels.
- .13 Use suitable cable fittings and connectors.
- .14 Neatly train and lace wiring inside boxes, equipment, and panelboards.
- .15 Clean conductor surfaces before installing lugs and connectors.
- .16 Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise. Identify and colour code wire and cable to Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

### **3.4 FIELD QUALITY CONTROL**

.1 Field inspection, testing, adjusting to Section 01 45 00 – Quality Control.

## END OF SECTION

# PART 1 GENERAL

## 1.1 RELATED REQUIREMENTS

.1 Section 26 05 00 – Common Work Results for Electrical.

## **1.2 REFERENCES**

- .1 Canadian Standards Association (CSA International):
  - .1 CSA C22.2 No 24<sup>th</sup> Edition (2018).
  - .2 CSA C22.2 No. 41-M1987(R1999), Grounding and Bonding Equipment.

## **1.3 PRODUCT DATA**

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

## 1.4 CERTIFICATES

.1 Obtain inspection certificate of compliance covering high voltage stress coning from inspection authority and include it with as-built drawings.

# 1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 -Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, corrugated cardboard, packaging material for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.

## PART 2 PRODUCTS

### 2.1 CONNECTORS AND TERMINATIONS

- .1 Copper compression connectors to CSA C22.2 No. as required sized for conductors.
- .2 4 way joint boxes dry location type in accordance with Section 26 05 33 Raceway and Boxes for Electrical Systems.
- .3 Bond and ground as required.

## PART 3 EXECUTION

# 3.1 INSTALLATION

- .1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.
- .2 Bond and ground as required to CSA C22.2 No.41.

# **END OF SECTION**

# PART 1 GENERAL

## 1.1 RELATED REQUIREMENTS

.1 Section 26 05 00 – Common Work Results for Electrical.

## 1.2 **REFERENCES**

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
- .2 ANSI/IEEE 837-1989(R1996), Qualifying Permanent Connections Used in Substation Grounding.
- .3 Canadian Standards Association, (CSA International)
- .4 CAN/CSA Z32-1999, Electrical Safety and Essential Electrical Systems in Health Care Facilities.

### 1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 -Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

## PART 2 PRODUCTS

## 2.1 EQUIPMENT

- .1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- .2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, soft annealed, sized as per code.
- .3 Rod electrodes: copper clad steel 19 mm dia by 3 m long.
- .4 Grounding conductors: bare stranded copper.
- .5 Ground bus: copper, sized, complete with insulated supports, fastenings, connectors.
- .6 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
  - .1 Grounding and bonding bushings.
  - .2 Protective type clamps.
  - .3 Bolted type conductor connectors.
  - .4 Thermit welded type conductor connectors.

- .5 Bonding jumpers, straps.
- .6 Pressure wire connectors.

## PART 3 EXECUTION

### 3.1 INSTALLATION – GENERAL

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process, permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE 837.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.
- .7 Install bonding wire for flexible conduit. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .9 Install separate ground conductor to outdoor lighting standards.
- .10 Install grounding resistance bank.
- .11 Connect building structural steel and metal siding to ground.
- .12 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .13 Bond single conductor, metallic armoured cables to cabinet at supply end.
- .14 Ground secondary service pedestals.

## 3.2 MANHOLES

- .1 Install conveniently located grounding stud, electrode, stranded copper conductor in each manhole.
- .2 Install ground rod in each manhole so that top projects through bottom of manhole. Provide with lug to which grounding connection can be made.
## **3.3 ELECTRODES**

- .1 Make ground connections to continuously conductive underground water pipe on street side of water meter.
- .2 Install water meter shunt.
- .3 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.
- .4 Install rod electrodes and make grounding connections.
- .5 Bond separate, multiple electrodes together.
- .6 Use size 4/0 AWG copper conductors for connections to electrodes.
- .7 Make special provision for installing electrodes that will give resistance to ground value where rock or sand terrain prevails. Ground as indicated.

#### 3.4 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of secondary 600 V system.

## 3.5 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

#### **3.6 GROUNDING BUS**

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room.
- .2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size 2/0AWG.

## 3.7 HOSPITALS

- .1 Grounding in hospital operating rooms: to CAN/CSA Z32.
- .2 Connect equipment [and leakage current devices] to building ground system [and supplementary grounding electrodes].
- .3 Install ground bus for conductive floor tile. Make connections from tile system to bus in accordance with tile manufacturer's instructions. Ground resistance to CAN/CSA Z32.

#### 3.8 COMMUNICATION SYSTEMS

.1 Install grounding connections for telephone, sound, fire alarm, intercommunication systems as follows:

- .1 Telephones: make telephone grounding system in accordance with telephone company's requirements.
- .2 Sound, fire alarm, intercommunication systems as indicated.

## **3.9 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 01 Common Work Results Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

## 1.1 SECTION INCLUDES

- .1 Conduit and equipment supports.
- .2 Anchors and fasteners.

## 1.2 **REFERENCES**

- .1 CSA C22.2 Canadian Electrical Code, Part I (2009, 21st Edition), Safety Standard for Electrical Installations
- .2 ESA Electrical Safety Authority
- .3 CECA Canadian Electrical Contractors Association.

## **1.3 REGULATORY REQUIREMENTS**

.1 Provide products listed and classified by CSA.

## PART 2 PRODUCTS

## 2.1 **PRODUCT REQUIREMENTS**

- .1 Materials and Finishes: Provide adequate corrosion resistance.
- .2 Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.
- .3 Anchors and Fasteners:
  - .1 Concrete Structural Elements: Use precast insert system, expansion anchors, powder actuated anchors and preset inserts.
  - .2 Steel Structural Elements: Use beam clamps, spring steel clips, steel ramset fasteners, and welded fasteners.
  - .3 Concrete Surfaces: Use self-drilling anchors and expansion anchors.
  - .4 Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
  - .5 Solid Masonry Walls: Use expansion anchors and preset inserts.
  - .6 Sheet Metal: Use sheet metal screws.
  - .7 Wood Elements: Use wood screws.

## PART 3 EXECUTION

## 3.1 INSTALLATION

.1 Install products to manufacturer's instructions.

- .2 Provide anchors, fasteners, and supports to CSA C22.1.
- .3 Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- .4 Obtain permission from Consultant before using powder-actuated anchors.
- .5 Obtain permission from Consultant before drilling or cutting structural members.
- .6 Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- .7 Install surface-mounted cabinets and panelboards with minimum of four anchors.
- .8 Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

## 1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results for Electrical

## 1.2 **REFERENCES**

- .1 Canadian Standards Association (CSA International):
  - .1 CSA C22.1-06 Canadian Electrical Code, Part 1, 20th Edition.

#### 1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide shop drawings: in accordance with Section 01 33 00 Submittal Procedures.
  - .1 Provide drawings stamped and signed by professional engineer registered or licensed in that Province of Canada.

### 1.4 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling.

## PART 2 PRODUCTS

## 2.1 SPLITTERS

- .1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Terminations: main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 Spare Terminals: minimum three spare terminals or lugs on each connection or lug block sized less than 400 A.

## 2.2 JUNCTION AND PULL BOXES

- .1 Construction: welded steel enclosure.
- .2 Covers Flush Mounted: 25 mm minimum extension all around.

.3 Covers Surface Mounted: screw-on flat or turned edge covers.

## 2.3 CABINETS

- .1 All outdoor panels shall be EEMAC3R, 316SS, weatherproof, double-door panel. Sized as required.
- .2 That shall be provided with adequate ventilation comprising of intake louver and exhaust fan.
- .3 SS-hoods on fan and filter to protect against weather. Panel to be insulated.
- .4 Manufactured by Hammond or approved equivalent.

## PART 3 EXECUTION

## 3.1 SPLITTER INSTALLATION

- .1 Mount plumb, true and square to building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.

## 3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.
- .3 Install terminal block as indicated in Type T cabinets.
- .4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

## 3.3 IDENTIFICATION

- .1 Equipment Identification: to Section 26 05 00 Common Work Results for Electrical.
- .2 Identification Labels: size 2 indicating system name, voltage and phase or as indicated.

## 1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results for Electrical

## 1.2 **REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.1-06, Canadian Electrical Code, Part 1, 20th Edition.

## 1.3 ACTION AND INFORMATION SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Submit samples for floor box in accordance with Section 01 33 00 Submittal Procedures.

## 1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling.

## PART 2 PRODUCTS

## 2.1 OUTLET AND CONDUIT BOXES – GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 347 V outlet boxes for 347 V switching devices.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.

#### 2.2 GALVANIZED STEEL OUTLET BOXES

- .1 One-piece electro-galvanized construction.
- .2 Single and multi-gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

- .3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .4 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .5 Extension and plaster rings for flush mounting devices in finished plaster or tile walls.

## 2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry single or multi gang boxes for devices flush-mounted in exposed block walls.

## 2.4 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete type boxes for flush-mount in concrete with matching extension and plaster rings as required.

## 2.5 FLOOR BOXES

- .1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brass, brushed aluminum faceplate. Device mounting plate to accommodate short or long ear duplex or single receptacles. Minimum depth: 73 mm for receptacles and communication outlets.
- .2 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 16, 21 and 27 mm conduit. Minimum size: 73 mm deep.

## 2.6 CONDUIT BOXES

.1 Cast FS or FD boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

## 2.7 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

.1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables.

## 2.8 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 35mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

## 2.9 SERVICE FITTINGS

- .1 'High tension' receptacle fitting made of 2 piece stainless steel with brushed aluminum housing finish for 1 single, 1 duplex, two duplex receptacles. Bottom plate with two knockouts for centered or offset installation. 12 x 102 mm extension piece as indicated.
- .2 Pedestal type 'low tension' fitting made of 2 piece stainless steel with brushed aluminum housing finish to accommodate one or two amphenol jack connectors.

#### PART 3 EXECUTION

#### 3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.
- .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .6 Identify systems for outlet boxes as required.

## 1.1 SECTION INCLUDES

- .1 Metal conduit.
- .2 Flexible metal conduit.
- .3 Electrical metallic tubing.

#### **1.2 RELATED SECTIONS**

- .1 Section 01 61 00 Common Product Requirements
- .2 Section 01 73 03 Execution Requirements
- .3 Section 26 05 34 Boxes
- .4 Section 26 05 29 Electrical Supporting Devices
- .5 Section 26 05 53 Electrical Identification

#### 1.3 **REFERENCES**

- .1 CSA C22.2-09 Canadian Electrical Code, Part I (2009, 21st Edition). Safety Standard for Electrical Installations.
- .2 CAN/CSA-C22.2 No. 18 Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
- .3 CSA C22.2 No.45 Rigid Metal Conduit
- .4 CSA C22.2 No. 45.1 Rigid Metal Conduit Steel.
- .5 CSA C22.2 No. 56 Flexible Metal Conduit and Liquid Tight Flexible Metal Conduit
- .6 CSA C22.2 N0. 83.1 Electrical Metallic Tubing –Steel.
- .7 CSA C22.2 No. 211.1 Rigid Types EB1 and DB2/ES2 PVC Conduit
- .8 CSA C22.2 No.211.2 Rigid PVC (Unplasticized) Conduit
- .9 CSA C22.2 No. 211.3 Reinforced Thermosetting Resin Conduit (RTRC) on Fittings.
- .10 CSA C22.2 No. 227.1 Electrical Nonmetallic Tubing
- .11 CSA C22.2 No. 227.2.1 Liquid-Tight Flexible Nonmetallic Conduit
- .12 NFPA 70 National Electrical Code.

### 1.4 **DESIGN REQUIREMENTS**

.1 Conduit Size: Canadian Electrical Code.

### **1.5 PROJECT RECORD DOCUMENTS**

- .1 Submit to Section 01 73 03 Execution Requirements
- .2 Accurately record actual routing of conduits larger than 51 mm (2 inches).

#### **1.6 REGULATORY REQUIREMENTS**

.1 Provide products listed and classified by CSA.

#### 1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store, protect, and handle Products to site to Section 01 61 00 Common Product Requirements.
- .2 Accept conduit on site. Inspect for damage.
- .3 Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- .4 Protect PVC conduit from sunlight.

#### **1.8 PROJECT CONDITIONS**

- .1 Verify that field measurements are as shown on Drawings.
- .2 Verify routing and termination locations of conduit prior to rough-in.
- .3 Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

#### PART 2 PRODUCTS

#### 2.1 CONDUIT REQUIREMENTS

- .1 Minimum Size: 19 mm (3/4 inch) unless otherwise specified.
- .2 Flexible metal conduit or AC-90 for drops to light fixtures only. (Not to exceed 1.5m)
- .3 Dry Locations:
  - .1 Concealed: Use electrical metallic tubing.
  - .2 Exposed: Use electrical metallic tubing.

## PART 3 EXECUTION

## 3.1 INSTALLATION

- .1 Install conduit to CSA C22.1.
- .2 Arrange supports to prevent misalignment during wiring installation.
- .3 Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- .4 Group related conduits; support using conduit rack.
- .5 Construct rack using steel channel provide space on each for 25 percent additional conduits.
- .6 Fasten conduit supports to building structure and surfaces to Section 26 05 29.
- .7 Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports
- .8 Do not attach conduit to ceiling support wires.
- .9 Arrange conduit to maintain headroom and present neat appearance.
- .10 Route exposed conduit parallel and perpendicular to walls.
- .11 Route conduit installed above accessible ceilings parallel and perpendicular to walls.
- .12 Maintain adequate clearance between conduit and piping.
- .13 Maintain300 mm (12 inch) clearance between conduit and surfaces with temperatures exceeding<40 degrees C 104 degrees F.
- .14 Cut conduit square using saw or pipe cutter; de-burr cut ends.
- .15 Bring conduit to shoulder of fittings; fasten securely.
- .16 Install no more than equivalent of three 90-degree bends between boxes.
  - .1 Use conduit bodies to make sharp changes in direction, as around beams.
  - .2 Use hydraulic one-shot bender to fabricate factory elbows for bends in metal conduit larger than 50 mm (2 inch) size.
- .17 Provide suitable pull string in each empty conduit except sleeves and nipples.
- .18 Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- .19 Identify conduit to Section 26 05 53.

## 3.2 INTERFACE WITH OTHER PRODUCTS

.1 Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket.

## 1.1 SECTION INCLUDES

- .1 Wall and ceiling outlet boxes.
- .2 Floor boxes.
- .3 Pull and junction boxes.

#### **1.2 RELATED SECTIONS**

- .1 Section 01 73 03 Execution Requirements
- .2 Section 01 74 11 Cleaning and Disinfecting
- .3 Section 26 27 26 Wiring Devices

#### **1.3 REFERENCES**

- .1 CAN/CSA-C22.2 No. 18 Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware. CSA C22.2 Canadian Electrical Code, Part I (2009, 21st Edition).
- .2 Safety Standard for Electrical Installations.
- .3 CSA C22.2 No. 18.1 Metallic Outlet Boxes.
- .4 CSA C22.2 No. 40 Cutout, Junction and Pull Boxes.
- .5 CAN/CSA-C22.2 No. 85 Rigid PVC Boxes and Fittings.

### 1.4 SUBMITTALS FOR CLOSE-OUT

.1 Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents.

#### **1.5 REGULATORY REQUIREMENTS**

.1 Provide products listed and classified by CSA.

## PART 2 PRODUCTS

### 2.1 OUTLET BOXES

- .1 Sheet Metal Outlet Boxes: CSA C22.2 No. 18, galvanized steel.
  - .1 Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 13 mm (1/2 inch) male fixture studs where required.
- .2 Non-metallic Outlet Boxes: CSA C22.2 No. 18.

|        | .3  | Wall Plates for Finished Areas: As specified in Section 26 27 26.                                                                                                           |
|--------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2.2    |     | PULL AND JUNCTION BOXES                                                                                                                                                     |
|        | .1  | Sheet Metal Boxes: CSA C22.2 No. 18, galvanized steel.                                                                                                                      |
| PART 3 |     | EXECUTION                                                                                                                                                                   |
| 3.1    |     | EXAMINATION                                                                                                                                                                 |
|        | .1  | Verify locations of boxes and outlets in offices, and work areas prior to rough-in.                                                                                         |
| 3.2    |     | INSTALLATION                                                                                                                                                                |
|        | .1  | Install boxes to CSA C22.1.                                                                                                                                                 |
|        | .2  | Install in locations as shown on drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.              |
|        | .3  | Set wall mounted boxes at elevations to accommodate mounting heights indicated.                                                                                             |
|        | .4  | Electrical boxes are shown on drawings in approximate locations unless dimensioned.<br>Adjust box location up to 3 m (10 feet) if required to accommodate intended purpose. |
|        | .5  | Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.                                                                                       |
|        | .6  | Maintain headroom and present neat mechanical appearance.                                                                                                                   |
|        | .7  | Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.                                                                               |
|        | .8  | Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.                                                                     |
|        | .9  | Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.                                                                                      |
|        | .10 | Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.                                                                                    |
|        | .11 | Label junction box covers with black magic marker indicating panel, voltage and circuits numbers.                                                                           |
|        | .12 | Use flush mounting outlet box in finished areas.                                                                                                                            |
|        | .13 | Locate flush mounting box in masonry wall to require cutting of masonry unit corner only.<br>Coordinate masonry cutting to achieve neat opening.                            |
|        | .14 | Do not install flush mounting box back-to-back in walls; provide minimum 150 mm separation. Provide minimum 600 mm separation in acoustic rated walls.                      |

- .15 Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- .16 Use stamped steel bridges to fasten flush mounting outlet box between studs.
- .17 Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- .18 Use adjustable steel channel fasteners for hung ceiling outlet box.
- .19 Do not fasten boxes to ceiling support wires.
- .20 Support boxes independently of conduit.
- .21 Use gang box where more than one device is mounted together. Do not use sectional box.
- .22 Use gang box with plaster ring for single device outlets.
- .23 Set floor boxes level.
- .24 Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

## 3.3 ADJUSTING

- .1 Adjusting installed work to Section 01 73 03 Execution Requirements
- .2 Adjust floor box flush with finish flooring material.
- .3 Adjust flush-mounting outlets to make front flush with finished wall material.
- .4 Install knockout closures in unused box openings.

## 3.4 CLEANING

- .1 Cleaning installed work to Section 01 74 11 Cleaning and Disinfection.
- .2 Clean interior of boxes to remove dust, debris, and other material.
- .3 Clean exposed surfaces and restore finish.

# 1.1 LOCATION

.1 Drawings indicating cable trays are in diagrammatic form only.

## 1.2 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Division 1.
- .2 Submit complete information on the product, c/w all accessories, including:
  - .1 Cable Tray.
  - .2 Barrier, barrier splice strips, horizontal bends, barrier clips, etc.
  - .3 Connecting hardware, connecting assemblies, etc.
  - .4 Aluminum adjustable horizontal splice plates.
  - .5 Aluminum vertical adjustable splice plates.
  - .6 Ladder drop outs and water fall assemblies.
  - .7 Grounding clamps.
  - .8 Cable tray clamps.
  - .9 Blind End Sections.
  - .10 Bonding jumpers.

## PART 2 PRODUCTS

## 2.1 CABLE TRAY

- .1 General Distribution (Not inside Telecommunications Rooms)
  - .1 Cable Trays and fittings: to EEMAC F5-1-1977.
  - .2 Ladder type, Class D1 to CSA C22.2 No. 126-M91.
  - .3 NEMA loading depth to be 127 mm (five inches).
  - .4 Aluminum ladder tray, 460 mm (18 inch) wide with a depth of 156 mm (6 inch). Rung spacing to be 230 mm (9 inch). Minimum inside usable depth to be 127 mm (5 inches). Provide barrier strips to divide the tray into two distinct sections as follows: Television system (4 inch, 100 mm), structured wiring system (14 inch, 350 mm).
  - .5 Horizontal elbows, end plates, drop outs, vertical riser and drops, tees, wyes expansion joints and reducers where required. Fittings: manufactured accessories for the cable tray supplied. Radii on fittings to be a minimum of 600 mm (24 inch).
  - .6 Adjustable vertical and horizontal splice plates where changes in direction preclude the use of standard fittings. Always use manufactured fittings. Do not use field modified fittings.
  - .7 Dead ends of cable trays shall be closed by the use of manufacturer fabricated blind end sections.

- .2 Manufacturers
  - .1 Standard of Acceptance:
    - .1 B-Line # 26-A-09-18-240 c/w:
      - .1 Bonding jumpers, # 99-N1.
      - .2 Barrier strips, #75A-120.
      - .3 Horizontal Barrier Bend, #75A-90HBFL.
      - .4 Barrier Strip clip, #9ZN-9002.
      - .5 Barrier Strip Splice, #99-9982.
      - .6 Aluminum adjustable horizontal splice plates, #9A-103-6.
      - .7 Aluminum adjustable vertical adjustable splice plates, #9A-1026.
      - .8 Ladder drop outs # 9A-1104-18.
      - .9 Grounding clamps #9A-2130.
      - .10 Blind End Sections # 9A-1086-18.
      - .11 Cable Tray Clamps #9A-1205.
      - .12 Connecting hardware, connecting assemblies, etc.
  - .2 Acceptable Manufacturers to the requirements above:
    - .1 CFRP Comtray.
    - .2 ElectroTray.
    - .3 Pilgrim.
    - .4 Canadian Electrical Raceways.
    - .5 Thomas and Betts.
    - .6 Legrand/Cablofil
- .3 Cable tray (within Telecommunications Rooms)
  - .1 Cable Trays and fittings: to EEMAC F5-1-1977.
  - .2 Wire basket of type and sizes indicated; with connector assemblies, clamp assemblies, connector plates, splice plates and splice bars. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.
  - .3 Straight sections and accessories shall be made from AISI Type 304 Stainless Steel.
  - .4 All straight section longitudinal wires shall be straight (with no bends).
  - .5 Wire basket dimension of 60mm (2.5 inch) side depth by 600mm (24 inch) wide, with a 50mm (2 inch) usable loading depth. Straight sections shall be 3000mm (10 feet) long. Tested load capacity of 30 kg (66 pound), with supports at 1500mm (5 feet) intervals.
  - .6 All fittings shall be field formed as needed.
  - .7 All splicing assemblies shall be the bolted type using serrated flange locknuts. Hardware shall be AISI Type 304 Stainless Steel.
  - .8 Wire basket supports shall be center support hangers, trapeze hangers or wall brackets.

- .9 Special accessories shall be furnished as required to protect, support and install a wire basket support system.
- .4 Manufacturers:
  - .1 Standard of Acceptance:
    - .1 Cooper B-Line stainless steel basket tray, WB224-SS4, c/w
      - .1 WB4CA connector assemblies.
      - .2 WB4CP clamp assemblies.
      - .3 WB4SP splice plate.
      - .4 WB12SB splice bar.
      - .5 WBTLC tab lock connector.
      - .6 WB42GC grounding clamp.
      - .7 WB224BE blind end.
      - .8 WB2RSPL radius shield.
      - .9 WB12DO drop out.
      - .10 B719EB rubber end cap.
  - .2 Acceptable Manufacturers, to the requirements above:
    - .1 CFRP Comtray.
    - .2 ElectroTray.
    - .3 Pilgrim.
    - .4 Canadian Electrical Raceways.
    - .5 Thomas and Betts.
    - .6 Legrand/Cablofil

## PART 3 EXECUTION

## 3.1 INSTALLATION

- .1 Prior to ordering cable tray the electrical contractor shall prepare a detailed sketch illustrating the following:
  - .1 Proposed method of installation.
  - .2 Proposed hanger type and dimensions.
  - .3 Proposed method of grounding cable tray.
  - .4 Proposed routing of cable tray.
- .2 Install complete cable tray system prior to pulling any cable.
- .3 Support cable tray on both sides, using trapeze support kits where installed from hangers.
- .4 Install cable tray clamps on each side of every support strut.
- .5 Wall mounted cable tray to be supported with angle brackets.
- .6 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

## 3.2 CONTINUITY OF CABLE TRAY

- .1 The entire run of cable tray is to be continuous. Include all required fittings, vertical splices, horizontal splices, offsets, etc., to allow for changes in elevation, direction, etc.
- .2 Always use manufactured fittings. Do not use field modified fittings. Where changes in direction preclude the use of standard fittings use adjustable vertical and horizontal splice plates.

## 3.3 COORDINATION WITH OTHER TRADES

- .1 Coordinate installation with mechanical services and equipment. Reroute cable tray as necessary to avoid conflict with the work of other trades.
- .2 Minimum clearances for cable trays shall be in strict accordance with CEC Rule 12-2200.

## 3.4 INSTALLATION OF CABLES

- .1 The cable tray shall be installed as a complete system before any cables are installed. This includes the following:
  - .1 All supports are complete;
  - .2 All hold down hardware complete;
  - .3 Installation of bonding conductor and associated components;
  - .4 Barrier strips are complete;
  - .5 Blind end sections.
- .2 Following the completion of the entire cable tray system and all related components, cables may be installed.
- .3 Lay cables into cable tray. Use rollers when necessary to pull cables.
- .4 Ensure adequate support for all cables both horizontally and vertically to comply with current standards.

#### **3.5 FIRE BARRIERS**

- .1 Arrange and make good fire rating of floors and walls after cables have been installed.
- .2 Where cable trays pass through fire separations, including, walls, membranes, etc., arrange and make good fire rating of floors and walls after cables have been installed.

## 3.6 BONDING

.1 Install a continuous #6 bare bonding conductor in all runs of cable tray, terminating on ground bars in telecommunications rooms. Connect each section of cable tray to the bonding conductor.

.2 Conduits containing horizontal distribution cables are to be bonded to the cable tray. Provide bonding bushing on the end of the conduit and connect to bonding conductor in tray using a mechanical type connector, similar to Burndy Tritap Servit Series KSA.

## 3.7 SUPPORTS

- .1 Provide trapeze and cantilever supports at 3 metre (10 foot) intervals.
- .2 Cut off excess rod within 13 mm (1/2 inch) of channel bottom.
- .3 Minimum sized threaded rods to be 9.5 mm (3/8 inch).
- .4 Sandwich channel between nuts and washers located on both upper and lower surfaces.
- .5 Provide hold down clips to secure tray to strut.

## **3.8 TERMINATION IN TELECOMMUNICATIONS ROOMS (TR).**

- .1 Provide sufficient length of ladder tray to enter each telecommunications room and allow easy transition to basket tray.
- .2 Provide ladder drop out components with 100 mm (4 inch) radius to provide a rounded surface to protect cables as they exit from tray.
- .3 Ensure that the basket tray within each TR is positioned over each rack. Provide waterfall assemblies for transition from basket tray to equipment racks.
- .4 Provide vertical sections of tray as required to fully support cables transitioning from each type of tray.

## 3.9 ATTACHMENT OF CONDUIT AND BOXES

.1 Attachment of conduit and electrical boxes to the strut supporting the cable tray is strictly prohibited.

## 1.1 **RELATED SECTIONS**

.1 Section 26 05 00 – Common Work Results for Electrical

## 1.2 **REFERENCES**

- .1 Canadian Standards Association, (CSA International)
- .2 Insulated Cable Engineers Association, Inc. (ICEA)

## 1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 Construction/ Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal] for recycling in accordance with Waste Management Plan.
- .4 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .5 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.
- .6 Do not dispose of preservative treated wood through incineration.
- .7 Do not dispose of preservative treated wood with other materials destined for recycling or reuse.
- .8 Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill approved by Departmental Representative.
- .9 Fold up metal banding, flatten and place in designated area for recycling.

## PART 2 PRODUCTS

## 2.1 CABLE PROTECTION

.1 38 x 140 mm planks pressure treated with clear or copper napthenate or 5% pentachlorophenol solution, water repellent preservative.

## 2.2 MARKERS

- .1 Concrete type cable markers: [600 x 600 x 100] mm with words: cable, joint or conduit impressed in top surface, with arrows to indicate change in direction of cable and duct runs.
- .2 150mm wide polyethylene Cable Marker Tape, red in colour with the following imprinted continuously over its entire length: "CAUTION BURIED ELECTRIC LINE BELOW."

## PART 3 EXECUTION

## 3.1 DIRECT BURIAL OF CABLES

- .1 After sand bed is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.
- .2 Provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 m run, maintaining minimum cable separation and bending radius requirements.
- .3 Underground cable splices not acceptable.
- .4 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.
- .5 Cable separation:
  - .1 Maintain 75 mm minimum separation between cables of different circuits.
  - .2 Maintain 300 mm horizontal separation between low and high voltage cables.
  - .3 When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position.
  - .4 At crossover, maintain 75 mm minimum vertical separation between low voltage cables and 150 mm between high voltage cables.
  - .5 Maintain 300 mm minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in upper position.
  - .6 Install treated planks on lower cables 0.6 m in each direction at crossings.
- .6 After sand protective cover specified in Section 31 23 33.01 Excavating, Trenching and Backfilling, is in place, install continuous row of overlapping 38 x 140 mm pressure treated plank as indicated to cover length of run.

#### 3.2 CABLE INSTALLATION IN DUCTS

- .1 Install cables as indicated in ducts.
  - .1 Do not pull spliced cables inside ducts.
- .2 Install multiple cables in duct simultaneously.

- .3 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .4 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.
- .5 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .6 After installation of cables, seal duct ends with duct sealing compound.

## 3.3 MARKERS

- .1 Mark cable every 150 m along cable or duct runs and changes in direction.
- .2 Mark underground splices.
- .3 Where markers are removed to permit installation of additional cables, reinstall existing markers.
- .4 Install concrete cable markers within 180 m from each side of runway centreline; 45 m from each side of taxi way centreline; 50 m from edge of taxi ramps or aprons.
- .5 Install cedar post type markers.
- .6 Lay concrete markers flat and centred over cable with top flush with finish grade.

## 3.4 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 Common Work Results Electrical.
- .2 Perform tests using qualified personnel. Provide necessary instruments and equipment.
- .3 Check phase rotation and identify each phase conductor of each feeder.
- .4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.
- .5 Pre-acceptance tests.
  - .1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.
  - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
- .6 Acceptance Tests
  - .1 Ensure that terminations and accessory equipment are disconnected.
  - .2 Ground shields, ground wires, metallic armour and conductors not under test.

- .3 High Potential (Hipot) Testing in accordance with [manufacturer's] [ICEA] recommendations.
- .4 Leakage Current Testing.
  - .1 Raise voltage in steps from zero to maximum values as specified by [ICEA] [manufacturer] for type of cable being tested.
  - .2 Hold maximum voltage as per manufacturer's standards.
  - .3 Record leakage current at each step.
- .7 Provide Consultant with list of test results showing location at which each test was made, circuit tested and result of each test.
- .8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

## 1.1 SECTION INCLUDES

- .1 Nameplates and labels.
- .2 Wire and cable markers.
- .3 Conduit markers.

## **1.2 REGULATORY REQUIREMENTS**

.1 Provide products listed and classified by CSA as suitable for purpose specified and shown.

## PART 2 PRODUCTS

## 2.1 NAMEPLATES AND LABELS

- .1 Nameplates: Engraved three-layer laminated plastic, black letters on white background.
- .2 Locations:
  - .1 Each electrical distribution and control equipment enclosure.
- .3 Letter Size:
  - .1 Use 3 mm (1/8 inch) letters for identifying individual equipment and loads.
  - .2 Use 6 mm ([1/4 inch) letters for identifying grouped equipment and loads.
- .4 Labels: Embossed adhesive tape, with 5 mm (3/16 inch) white letters on black background. Use only for identification of individual wall switches and receptacles and control device stations.

## 2.2 WIRE MARKERS

- .1 Description: Brady markers.
- .2 Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.
- .3 Legend:
  - .1 Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.

## PART 3 EXECUTION

## 3.1 PREPARATION

.1 Degrease and clean surfaces to receive nameplates and labels.

| 3.2 |    | APPLICATION                                                                                      |
|-----|----|--------------------------------------------------------------------------------------------------|
|     | .1 | Install nameplate and label parallel to equipment lines.                                         |
|     | .2 | Secure nameplate to equipment front using screws.                                                |
|     | .3 | Secure nameplate to inside surface of door on panelboard that is recessed in finished locations. |
|     | .4 | Paint coloured band on each conduit longer than 2 m (6 feet).                                    |
|     | .5 | Paint bands 6 m on centre.                                                                       |
|     | .6 | Paint conduits on each side when entering and leaving boxes.                                     |
|     | .7 | Paint conduits on each side when entering and leaving rooms & hallways.                          |
|     | 0  | Colour optime short up to 250V primary is vallow 250, 600 vallow and groop. Tale                 |

- .8 Colour coding chart up to 250V primary is yellow 250 600 yellow and green. Telephone is green. Communications is green and blue, fire alarm is red, other security system is red and yellow.
- .9 Control conduits are white.

## 1.1 SECTION INCLUDES

.1 Electrical connections to equipment specified under other sections.

## **1.2 RELATED SECTIONS**

- .1 Section 26 05 33 Conduit.
- .2 Section 26 05 19 Building Wire and Cable.
- .3 Section 26 05 34 Boxes.

## **1.3 REFERENCES**

- .1 CSA C22.2-09 Canadian Electrical Code, Part I (2009, 21st Edition), Safety Standard for Electrical Installations.
- .2 CSA C22.2 No. 127-99 (R2004) Equipment and Lead Wires.
- .3 NEMA WD 6-2002 Wiring Devices Dimensional Requirements.
- .4 NEMA WD 1-1999 General Colour Requirements for Wiring Devices.
- .5 Underwriters Laboratories of Canada Listings.

## 1.4 SUBMITTALS

- .1 Submit to Section 01 33 00 Submittal Procedures.
- .2 Product Data: Provide wiring device manufacturer's catalogue information showing dimensions, configurations, and construction.
- .3 Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

## **1.5 REGULATORY REQUIREMENTS**

.1 Provide products listed and classified by CSA as suitable for purpose specified and shown.

## 1.6 COORDINATION

- .1 Obtain and review shop drawings, product data, and manufacturer's instructions for equipment provided under other sections.
- .2 Determine connection locations and requirements.

- .3 Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.
- .4 Sequence electrical connections to coordinate with start-up schedule for equipment.

## PART 2 PRODUCTS

#### 2.1 CORDS AND CAPS

- .1 Cord Construction: NFPA 70, Type 501 multi-conductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
- .2 Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit over-current protection.

## PART 3 EXECUTION

#### 3.1 EXAMINATION

.1 Verify that equipment is ready for electrical connection, wiring, and energization.

## **3.2 ELECTRICAL CONNECTIONS**

- .1 Make electrical connections to equipment manufacturer's instructions.
- .2 Make conduit connections to equipment using flexible conduit. Use liquid-tight flexible conduit with watertight connectors in damp or wet locations.
- .3 Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment.
- .4 Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- .5 Install disconnect switches, controllers, control stations, and control devices as indicated.
- .6 Modify equipment control wiring with terminal block jumpers as indicated.
- .7 Provide interconnecting conduit and wiring between devices and equipment where indicated.
- .8 Refer to mechanical schedule of roof-top equipment and interior blowers.

## 1.1 GOVERNING CONDITIONS

- .1 The General Conditions of this Contract, Form of Tender, Information for Tenderers and General Requirements under Division 1, heretofore specified, in addition to any and all addenda, shall be read in conjunction with and shall apply to and govern each Section of this Division..2 CSA C22.2 No. 18 Outlet boxes, conduit boxes and fittings.
- .2 Pay particular attention to the following requirements as they relate to work under this Division.
  - .1 Materials or approved equal and substitutions of suppliers.
  - .2 Scheduling and completion.
  - .3 Changes and extra work.
  - .4 Delivery and protection of equipment.
  - .5 Scaffolding and access.
  - .6 Temporary power during construction.
  - .7 Shop drawings and review by Department Representative.
  - .8 Inspection and rejection of work.
  - .9 Completion and project close-out, manuals and record drawings.
  - .10 Pre-selected equipment.

## **1.2 SCOPE OF WORK**

- .1 All labour, materials, equipment, tools and services necessary to complete the supply, installation and connection of all electrical power, lighting, control and related equipment, as specified under all Sections of Division 26, and electrical wiring and connections to electrical and control equipment specified and supplied under other Divisions, and/or detailed on the drawings, unless otherwise specifically noted.
- .2 This Section also covers the removal of existing equipment made obsolete by this project and also the disconnecting and reconnecting of existing equipment either relocated or serviced from new equipment.
- .3 The work to be done under this Division of the Specifications includes the following major items at the Wastewater Treatment Plant.
  - .1 Provide and install MCC as per drawings. Provide and install VFD panels, all associated accessories and wiring as per schematic
  - .2 Provide and install PLC panel, all associated accessories and wiring as per schematic.
  - .3 Provide and install wiring for powering all motors, transmitters, instruments, etc.
  - .4 Provide standby generator, transfer switch and all associated wiring and controls for transfer of power.
  - .5 Wiring and connection to all HVAC equipment for power and signal, lighting systems, security, fire alarm, etc.

.6 Where equipment is provided under other Divisions and requires electrical power connections and services, provide these to meet requirements or approved supplier's drawings.

## **1.3 ELECTRICAL SYSTEMS**

- .1 Electrical System Comprise:
  - .1 Power distribution 600 volt AC, 3 phase, 4 wire, 60 Hz.
  - .2 Lighting and small power 240/120 volt AC, 1 phase, 3 wire, 60 Hz.
  - .3 Controls 120 volt AC, 1 phase and 24 volt AC and DC.

## 1.4 CODES, PERMITS AND INSPECTION

- .1 Comply with all local by-laws, codes, regulations, or ordinances applicable to electrical installations, including the Ministry of Labour, the local utility, the Electrical Safety Authority, and the Canadian Standards Association. Where regulations conflict, the maximum standard shall be applied.
- .2 Should any changes in the drawings and specifications be required to conform to the aforementioned laws, codes, regulations or ordinances, the Department Representative shall be notified before the time of submission of the bid. No extra charges will be allowed after the award of contract.
- .3 Obtain and pay for all required permits and inspections, both temporary and final. Following the completion of the work, submit a Certificate of Final Inspection from the Electrical Safety Authority to the Department Representative for review.
- .4 Supply and install warning signs and/or nameplates required by inspection authorities and Labour Laws.
- .5 All materials and equipment shall be new and shall have C.S.A. approval or shall be approved by the Special Inspection Branch of Electrical Safety Authority.
- .6 All materials and equipment shall conform to the applicable standards of ANSI, IEEE, NEMA and EEMAC.

## 1.5 MAINTENANCE MANUALS

- .1 Provide four complete sets of Manufacturers' drawings, maintenance instructions, list of manufacturers' representatives, parts lists, and operating instructions for all controls, equipment, etc., following completion of construction. These are in addition to the specified number of shop drawings required for construction approval.
- .2 Place information in hard cover three-ring binders, identified as "Electrical Maintenance Manuals", complete with neatly typed index page and indexing tabs.
- .3 General advertising literature will not be accepted. All maintenance data shall refer only to the specific model and type of equipment that has been installed on the project. All pertinent literature shall be prominently highlighted or underlined.

## 1.6 EXAMINATION OF SITE

.1 Failure by the Contractor to visit the sites of the works, as required in the Information for Tenderers, will not relieve the Contractor of the contingent liabilities and costs of additional work.

## 1.7 WORKING DRAWINGS

- .1 Prepare electrical working drawings, showing the layout, size and details of all conduit and cable runs, outlets and equipment connections immediately after the award of the Contract.
- .2 The drawings shall be of the same sheet size as the Contract Drawings and shall be fully labelled, complete with a Legend of Symbols.
- .3 The Contractor will not be authorized to proceed with the work until the working drawings have been submitted and reviewed by the Department Representative.
- .4 Install all conduits, cables, outlets, etc. in accordance with both the Contract Drawings and Working Drawings.

## 1.8 RECORD DRAWINGS

- .1 Obtain two sets of white prints of the Contract drawings. On the first set mark all changes and deviations from the Contract drawings. Record the changes as they are made so that a full record of the work is kept as the work progresses. The Consultant shall have access to these drawings at all times during the progress of the work.
- .2 On completion of the job, neatly transfer all changes and deviations to the second set of drawings, in coloured ink and turn over both sets to the Consultant before the issuance of the Completion Certificate.

## **1.9 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Division 1 of this specifications and as specified below, showing details of construction, weights, accurate dimensions, capacities, performances and wiring diagrams for each piece of equipment as listed in this Section.
- .2 Include the following information:
  - .1 Manufacturer's and Supplier's name.
  - .2 Catalogue model number.
  - .3 Project number and name.
  - .4 Number identifying item on the drawings and/or in the specifications such as equipment, item number, panel identification letters, etc.
- .3 Each shop drawing, shall be checked and stamped as being correct, by the trade purchasing the item and by the Contractor, before drawing is submitted. If the above

requirements are not complied with, shop drawings will be returned to the Contractor for re-submission.

- .4 Assume full responsibility for timely submission of the shop drawings. A minimum of four weeks shall be allowed for the review. Present a schedule of shop drawings not later than four weeks after the award of the Contract showing the anticipated dates when the drawings will be submitted for review.
- .5 Verify all pertinent information, such as physical dimensions, make, performance, electrical characteristics, etc. Assume responsibility for accuracy of equipment dimensions related to available space and accessibility, for maintenance and service, and compliance with Codes and Inspection Authorities.
- .6 Submit shop drawings for, but not limited to, the following items:
  - .1 Generator and Automatic transfer switch
  - .2 Instrumentation and control equipment
  - .3 Motor Control Centre and major equipment
  - .4 Wiring Devices and Motor Starters(VFD)
  - .5 Dry Type Transformer
  - .6 Panelboard
  - .7 Weatherproof Junction Boxes
  - .8 Safety disconnect switches
  - .9 VFD panels
  - .10 PLC (Programmable Logic Controller)
  - .11 Light fixtures

## 1.10 GROUNDING

- .1 The electrical system and equipment shall be grounded to the requirements of the Electrical Safety Authority.
- .2 The ground wire in multi-conductor cables shall serve as the equipment grounding conductor where used. Where flexible or PVC conduit is used, a separate copper ground wire and bonding jumper shall be installed, sized in accordance to conductor capacity and the Ontario Electrical Safety Code.
- .3 Ground conductors shall be stranded copper with green insulation. Bare copper wire shall be used only where specifically noted.
- .4 Ground rods, clamps and ground rod inspection boxes shall be provided where shown on drawings and as required by Code.
- .5 Solidly ground all equipment, generators, transformer neutrals, EYS seals and water piping.

## 1.11 PAINTING

- .1 Touch up all pre-finished electrical equipment marred during installation or shipment using the same colour and type of finish as originally used in the factory. Thoroughly stir all paint before application.
- .2 Surface preparation and painting shall be to the requirements of the Manufacturer and in accordance with other Divisions of this specification having jurisdiction.

#### 1.12 TESTING

- .1 Test all parts of the electrical systems for proper connection, operation and insulation to the approval of the Consultant. Correct all faults, unintentional grounds, etc., before acceptance of the work.
- .2 Test the entire control system before the scheduled "start-up" days required for commissioning the system to the Owner's satisfaction.
- .3 Bear any additional cost incurred or caused directly by non-compliance with the above.
- .4 Provide certificate of acceptance for all systems.

## 1.13 **REQUIREMENTS OF CONTRACT DRAWINGS**

- .1 The Drawings for electrical work are essentially performance drawings, partly schematic, intended to convey the scope and the extent of work. They only indicate general arrangement and approximate location of apparatus, fixtures and general typical sizes and locations of equipment and connections. The drawings do not intend to show architectural, structural, or mechanical details.
- .2 Do not scale the electrical drawings. Obtain information involving accurate dimensions to structure from details shown on Architectural and Structural drawings or by site measurements. Follow the electrical drawings in conjunction with the Contractor's own working drawings when laying out the work.
- .3 Any changes or additions to materials and/or equipment, necessary to accommodate structural conditions (runs around beams, columns, etc), shall be made at no additional cost to the Contract. Relocate materials and/or equipment, if necessary, up to 1.8 m, at no additional cost to the Contract, provided that the changes are made before installation and do not necessitate additional material or labour.
- .4 Clear space shall be left for, and work shall be done to accommodate, future materials and/or equipment as indicated, and to accommodate equipment and/or material supplied by other trades. Verify all equipment sizes in relation to space allowed, before proceeding with the work.
- .5 The exact location and mounting elevation of equipment and fixtures as related to Architectural or Structural details shall be confirmed on site. Confirm location of outlets and/or connection points for equipment supplied by other trades.

## 1.14 EXCAVATION AND BACKFILLING

- .1 Do excavation and backfilling required for the installation of conduits, ducts and cables outside of buildings and structures. Make all arrangements for the necessary excavation, pumping, supports, backfilling, etc., to the requirements of Division 2.
- .2 Install 150 mm wide, polyethylene Cable Marker Tape 150 mm below finished grade, above all underground ducts, conduits and cables. The tape shall be Allen Systems or approved equal as distributed by Young Utility Equipment Ltd., Agincourt, Ontario.
- .3 Tape used for Electrical ducts, conduits and cables shall be red in colour and shall be imprinted continuously over its entire length. "CAUTION BURIED ELECTRIC LINE BELOW".
- .4 Tape used for telephone/communication ducts and cables shall be orange in colour and shall be imprinted continuously over its entire length. "CAUTION BURIED TELEPHONE LINE BELOW".
- .5 Do backfilling in lifts and compact to 95% standard proctor density, to the approval of the Consultant.

## 1.15 CUTTING AND PATCHING

- .1 Provide chases, sleeves, anchor bolts and openings in the new construction to the Department Representative's approval.
- .2 Make sleeves waterproof where concrete work is subject to hydrostatic pressure.
- .3 Clean-up and repair any openings where required.

#### 1.16 HANGERS, INSERTS, SLEEVES AND SUPPORTS

- .1 Provide all foundations, supports, stands, platforms, etc., necessary for the proper installation of the work. They shall be concrete, masonry, steel, etc. as may be required and as approved by the Consultant or elsewhere shown or specified. Provide all hangers, inserts, etc. to support conduit, fixtures and equipment installed. Installed them so that all items will be in alignment and structurally sound.
- .2 All methods of hanging shall be to the approval of the Consultant. Where structural bearings do not exist, provide angle or channel iron of sufficient size from other structural bearings to support hangers or equipment. The use of wood, chain, strap or grappler bar hangers will not be permitted. Percussion type (fastenings set by explosive charge) may be used only with written permission of the Consultant.
- .3 All hardware used shall be stainless steel, cadmium plated or hot dipped galvanized.

## 1.17 FLASHING

.1 Flash all electrical parts passing through or built into a roof, an outside wall or a waterproof floor.
#### 1.18 RELATION TO OTHER TRADES

- .1 No trade shall carry out work beyond their expertise. Other sub-trade work shall be coordinated with electrical requirements to ensure that there is no interference between electrical and other trades and no delay caused by such work.
- .2 Provide all cutting and patching needed for electrical work in or for all structures and surfaces, where such openings and refinishings are not provided for use by other trades.
- .3 Notify responsible members of other subtrades of all openings, inserts, anchors, sleeves, hangers, foundations, etc., necessary for this installation. Ensure that these are provided and correctly installed at the proper time.

#### 1.19 NAMEPLATES

- .1 Provide white laminated textolite nameplates with bevelled edges and black engraved lettering on all disconnect switches, motor starters, panelboards, relays, pushbutton stations, control panels, pilot lights and any other control equipment. Lettering shall name loads fed or controlled with sufficient description on the nameplate to clearly identify the piece of equipment without reference to the drawing.
- .2 Secure nameplates with panhead self-tapping screws.
- .3 Submit a list of nameplate titles and sizes to the Department Representative for review before engraving.
- .4 In each power and lighting panel provide a neatly typed circuit schedule directly inside the door, enclosed in a clear plastic envelope, to identify the load associated with each branch circuit.

#### 1.20 PLANT START-UP

.1 When a complete system is ready for service, provide assistance for operating instruction and start-up procedures during scheduled start-up. Provide all assistance necessary to place the equipment into normal operating modes.

#### 1.21 CORROSION-PROOF EQUIPMENT AND CONTROLS

.1 All electrical equipment and controls installed within wet well shall be corrosion resistant.

#### 1.22 EXPLOSION-PROOF EQUIPMENT AND CONTROLS

.1 All electrical controls in areas designated as explosion proof shall meet Class I Group D, Division II requirements. All equipment in the pump chamber (wet well) shall meet this category.

#### **1.23** FIREPROOFING

.1 When cables or conduits pass through floors and fire rated walls, pack space between wiring and sleeve with approved material and seal with caulking to CGSB 19-GP-9Ma.

#### 1.24 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code: to CSA C22.1-1986.
- .4 Use colour coded wires in communication cables, matched throughout system.

#### 1.25 LOCATION OF OUTLETS

- .1 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .3 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

#### **1.26 MOUNTING HEIGHTS**

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
  - .1 Local switches: 1219 mm.
  - .2 Wall receptacles:
    - .1 General: 300 mm.
    - .2 Above top of continuous baseboard heater: 200 mm.
    - .3 Above top of counters or counter splash backs: 175 mm.
    - .4 In mechanical rooms: 1219 mm.
  - .3 Panelboards: as required by Code or 2000 mm.
  - .4 Telephone and interphone outlets: 300 mm in office.
  - .5 Wall mounted telephone and interphone outlets: 1219 mm in Pump Room, etc.

#### 1.27 LOAD BALANCE

.1 Measure phase current to panelboards with normal loads operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

- .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

# **1.28** COORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as over-current trips, relays and fuses, are installed to correct values and settings.
- .2 Pre-Service Testing:
  - .1 Clean the inside of all motor control centres, panels, dry type transformers; bus ducts, etc., using industrial type vacuum cleaners and other appropriate equipment.
  - .2 The following tests shall be made, prior to putting the equipment into service, to ensure that the distribution equipment has been installed in a satisfactory manner and suitable for placing into service, without either endangering personnel or the system, and that all protective devices coordinate properly.
    - .1 Service Entrance Board
      - .1 Test and verify main circuit breaker and ground fault protection.
      - .2 Set over current and short circuit current to correct valves.
    - .2 Motor Control Centres
      - .1 Test system circuit breaker functions, i.e. trip close, etc.
      - .2 Test moulded case breaker functions, i.e. two point on trip curve, close, reset, etc.
      - .3 Check operation of all motor starters.
    - .3 Primary Cables
      - .1 Verify phasing and grounding of concentric shield on all phases.
      - .2 Hi-pot test using a High Voltage D.C. source to CSA Specification.
- .3 Co-ordination Study as follows:
  - .1 Prepare a co-ordination study and submit for approval at the same time as the Electrical Distribution Equipment and Shop Drawings. The Coordination Study data shall be presented in tables and on composite charts and shall include and not be limited to the following:
    - .1 Maximum available short circuit current of systems.
    - .2 Maximum available ground fault current of systems.
    - .3 Feeder cables thermal short circuit damage curve.
    - .4 Primary fuse to power transformer.
    - .5 Power transformer thermal short circuit damage curve, 3 phase, phased to ground.
    - .6 Main secondary 600 volt system circuit breaker.

- .7 Largest 600 volt protective device and characteristics.
- .8 Largest distribution transformer thermal short circuit damage curve.
- .9 Maximum available fault current, 3 phase and phase to ground for the 600 volt system.
- .10 Largest 120/208 volt distribution breaker and characteristics.
- .11 Maximum available fault currents, 3 phase and phase-to-ground for the 120/208 volt system.
- .12 Maximum available fault current RMS symmetrical at each panel.
- .13 Set operating procedures and breakers characteristics.

# 1.29 LIABILITY

- .1 Assume full responsibility for the layout of work and for any damage caused to the property of the Owner, or other trades through the improper location of materials, equipment or carrying out of work.
- .2 Ensure that all pieces of equipment can be carried or hoisted into the specified location. Include for the cost of dismantling and re-assembling where required. Re-assembly shall be to the equipment manufacturer's approval.
- .3 All work shall be installed in strict accordance with the manufacturer's recommendations.

# **1.30** FINAL INSPECTION

- .1 Make request, in writing, to the Consultant to arrange for a final inspection of all electrical systems with timetable.
- .2 Do not issue this written request until:
  - .1 All deficiencies noted during the job inspection have been completed.
  - .2 All systems have been balanced and tested and are ready for operation.
  - .3 Operating and maintenance instructions have been submitted and approved.
  - .4 Identification of equipment and raceways is complete.
  - .5 Certificates have been submitted.
  - .6 Spare parts and replacement parts specified have been provided and receipt of same acknowledged.
  - .7 Record drawings are completed and approved.
  - .8 Owner's operating personnel have been instructed.
  - .9 Single line electrical diagrams are hung.

# 1.31 GUARANTEE

.1 Guarantee all equipment and material supplied and installed under this Division against any and all defects, deficiencies in equipment design, materials and workmanship which are not detected prior to formal acceptance of the system, but which may develop within one year after such acceptance. Make good any such defects and deficiencies at no additional cost to the Owner.

- .2 This general guarantee shall not act as a waiver of any specified guarantee for any greater length of time.
- .3 Guarantee any part of work accepted by the Owner, before completion of whole work, for one year from date of acceptance of that part of work.
- .4 The guarantee period shall not be presumed to commence where any equipment is operated temporarily for the purpose of testing or checking out of systems.

# END OF SECTION

# PART 1 GENERAL

## 1.1 RELATED SECTIONS

.1 Section 26 05 01

# 1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-C22.2 No.47-[M90(R2001)], Air-Cooled Transformers (Dry Type).
  - .2 CSA C9-[M1981(R2001)], Dry-Type Transformers.
- .2 National Electrical Manufacturers Association (NEMA)

# **1.3 PRODUCT DATA**

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

## 1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 Construction/ Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

#### PART 2 PRODUCTS

#### 2.1 TRANSFORMERS

- .1 Use transformers of one manufacturer throughout project.
- .2 Design:
  - .1 Type: ANN
  - .2 3 phase, KVA as indicated, 600 Volt primary, 208/120 Volt 3 phase 4 wire, 60 Hz secondary.
  - .3 Insulation: Class B or H
  - .4 Impedance: standard
  - .5 Taps: 4-2 1/2%, 2-FCAN and 2-FCBN.
  - .6 Enclosure: EEMAC 1, removable metal front panel.
  - .7 Wall mounting or on concrete pad.
  - .8 Finish: ANSI 61 grey and per Section: 16010.

# 2.2 MANUFACTURERS

- .1 Acceptable manufacturers:
  - .1 ABB
  - .2 Marcus Transformer of Canada Ltd.

#### .3 Hammond

# 2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 Common Work Results Electrical.
- .2 Label size: 7.

#### PART 3 EXECUTION

#### 3.1 INSTALLATION

- .1 Mount dry type transformers up to 75 kVA as indicated.
- .2 Mount dry type transformers above 75 kVA on floor.
- .3 Ensure adequate clearance around transformer for ventilation.
- .4 Install transformers in level upright position.
- .5 Remove shipping supports only after transformer is installed and just before putting into service.
- .6 Loosen isolation pad bolts until no compression is visible.
- .7 Make primary and secondary connections in accordance with wiring diagram.
- .8 Energize transformers after installation is complete.

#### **END OF SECTION**

# PART 1 GENERAL

## 1.1 SECTION INCLUDES

.1 Moulded case circuit breakers.

## **1.2 RELATED SECTIONS**

.1 Section 01 45 00 – Quality Control

#### **1.3 REFERENCES**

- .1 CSA C22.2-09 Canadian Electrical Code, Part I (2009, 21st Edition), Safety Standard for Electrical Installations.
- .2 CAN/CSA-C22.2 No. 5 Moulded Case Circuit Breakers.

#### 1.4 QUALITY ASSURANCE

.1 Perform work to CSA C22.1.

# **1.5 REGULATORY REQUIREMENTS**

.1 Provide products listed and classified by CSA as suitable for purpose specified and indicated.

#### PART 2 PRODUCTS

## 2.1 MOULDED CASE CIRCUIT BREAKER

.1 Circuit Breaker: Bolt-On type thermal magnetic trip circuit breakers. Do not use Tandem Circuit Breakers.

#### PART 3 EXECUTION

#### 3.1 INSTALLATION

- .1 Install enclosed circuit breakers where indicated, to manufacturer's instructions.
- .2 Install enclosed circuit breakers plumb. Provide supports to Section 26 05 29.
- .3 Provide engraved plastic nameplates under the provisions of Section 26 05 53.

#### **3.2 FIELD QUALITY CONTROL**

- .1 Field inspection and testing to Section 01 45 00 Quality Control.
- .2 Inspect and test each circuit breaker to CSA-C22.2 No. 5.

- .3 Inspect each circuit breaker visually.
- .4 Perform several mechanical ON-OFF operations on each circuit breaker.
- .5 Verify circuit continuity on each pole in closed position.

# **END OF SECTION**

# PART 1 GENERAL

# 1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Division 1.
- .2 Indicate on shop drawings.
  - .1 Floor anchoring method and foundation template.
  - .2 Dimensioned cable entry and exit locations.
  - .3 Dimensioned position and size of bus.
  - .4 Overall length, height and depth.
  - .5 Dimensional layout of internal and front panel mounted components.

# **1.2 MAINTENANCE DATA**

- .1 Provide data for incorporation into maintenance manual specified in Division 1.
- .2 Three copies maintenance data for complete assembly including components.

# **1.3 SOURCE QUALITY CONTROL**

- .1 Following manufacture but prior to shipping, the factory is to carry out a Switchboard Inspection and Test and produce a written report. This report will include as a minimum the following information:
  - .1 Date;
  - .2 Shop Order Number;
  - .3 Switchboard Identification Number;
  - .4 Bus Rating;
  - .5 Bus Bar Hardware Torqued;
  - .6 General Appearance;
  - .7 Hi Pot;
  - .8 Digital Meter Setup.
- .2 Submit three (3) copies of the Switchboard Inspection and Test Report to the Engineer.
- .3 Include a copy in the Maintenance Manuals.

# PART 2 PRODUCTS

#### 2.1 **POWER SUPPLY**

.1 Power Supply: 600Volt, 3 phase, 4 wire, 60 Hz.

#### 2.2 SERVICE ENTRANCE SWITCHBOARD

.1 General:

- .1 The service entrance switch board be standardized, CSA approved, and completely factory assembled. The design shall allow for bottom entry of service entrance cables. Factory supplied, suitably sized, NEMA two-hole crimp lugs shall be provided for all incoming conductor terminations on the bus bars. The switchboard manufacturer shall carry out a Secondary Distribution and Protection Coordination study prior to submission of shop drawings, and shall provide the results of this study with the shop drawings for review. All breakers shall be set by the manufacturer at the factory.
- .2 Bus Material and Rating:
  - .1 The service entrance board bus shall be rated @ 1200 Amps with a system voltage of 600 Volt, 3 phase, 4 wire, 60 Hz. All phase bussing shall be silver flashed copper, 100% Fully Rated to carry 1200 amps and braced to withstand a system fault of 80kA RMS symmetrical at 600VAC.
- .3 Enclosure:
  - .1 The switchboard shall be metal enclosed, fabricated from code gauge formed steel, finished with grey, polyester powder coat enamel and shall consist of the required number of vertical sections bolted together to form one rigid assembly. All sections are to be EEMAC-1 and equipped with sprinkler drip hoods. Insulated steel barriers are to be provided to isolate the main circuit breaker compartment and the utility metering compartment.
- .4 Utility Metering and Main Breaker Section:
  - .1 One section containing main breaker compartment and utility metering compartment. Minimum dimensions: section 54 inches (1372 mm) high x 30 inches (762 mm) wide x 24 inches (610mm) deep.
  - .2 Main Breaker Compartment:
    - .1 The main breaker compartment shall come complete with provisions for pad-locking the main breaker and sealing screws on the front cover. Grounding is supplied with a link to ground the neutral, the service conduit, and the system ground.
  - .3 Utility Metering Transformer Compartment:
    - .1 The utility transformer compartment shall be designed to meet local utility requirements. It shall be bussed and pre-drilled to accept standard bar type current transformers. The compartment shall have a concealed hinged door.
- .5 Distribution Section:
  - .1 The distribution section shall be a minimum of 21 x space and accommodate the circuit breakers as shown on the drawings. Minimum dimensions: 36 inches (915mm) high x 30 inches (762 mm) wide x 24 inches (610 mm) deep.
  - .2 The distribution section shall be designed to accept the installation of circuit breakers. Any space not occupied by a circuit breaker shall have a filler plate allowing no access to parts when energized.
  - .3 Each circuit breaker shall be provided with a padlockable handle hasp to allow the breaker to be locked in the on or off position, mounted on the circuit breaker cover within the trimline.

# .6 Customer Metering

- .1 The switchboard shall be supplied complete with a digital metering device to provide a direct read out of the following values:
  - .1 A/C amps on each phase.
  - .2 A/C voltage, phase to phase, phase to neutral.
  - .3 Watts, VARS, pf, frequency.
  - .4 Watt hours.
  - .5 Watt demand in 5, 10, 15, 30 minute windows.
  - .6 Power factor.
  - .7 Percent THD current.
  - .8 Percent THD voltage.
  - .9 K factor.
- .2 The digital meter shall be complete with a NO/NC dry contact which will close in the event of a phase failure condition detection. Wire contacts to a terminal block, for use by the BAS system contractor. Program digital meter accordingly. Phase loss relay must not activate on a total loss of all power to the switchboard.
- .3 The digital meter shall be complete with two (2) NO/NC dry contacts, one set will close in the event of an under-voltage condition and one set will close in the event of an over-voltage condition detection. Wire contacts to a terminal block, for use by the BAS system contractor. Program digital meter accordingly. These relays must not activate on a total loss of all power to the switchboard.
- .4 The digital meter shall be complete with a pulse output which will provide energy and demand input to the BAS. Wire contacts to a terminal block, for use by the BAS system contractor. Program digital meter accordingly.
- .5 Locate meter no more than 1.8 meters above finished floor so that display can be easily read.
- .6 The digital meter will be a minimum of of 170 mm (6.7 inches) wide by 260 (10.25 inches) tall and will include a large easy to read LCD display with LED backlight.
- .7 The meter shall be mounted at a height not exceeding 1800mm (72 inches).
- .7 Surge Protective Device (SPD)
  - .1 SPD unit mounted on wall near switchboard, complete with circuit breaker at switchboard.
  - .2 Surge current:
    - .1 Per Phase 250 Ka.
    - .2 Line to Neutral 125 Ka.
    - .3 Line to Ground 125 Ka.
    - .4 Neutral to Ground 125 Ka.
  - .3 Filter attenuation @ 100 KHz 55dB.
  - .4 Surge withstand capabilities @ 10 Ka > 3500.
  - .5 Complete with the following monitored items:

- .1 Overcurrent protection.
- .2 Infrared detection.
- .3 Thermal detection.
- .6 Complete with Premium Diagnostic Package.
  - .1 LED status indication on each phase.
  - .2 Transient surge counter.
  - .3 Audible alarm.

# 2.3 GROUNDING

.1 Copper ground bus to be silver flashed copper, with a bussed connection to the neutral bus, extending full width of cubicles and located at bottom.

# 2.4 FINISHES

- .1 Exterior and interior metal surfaces shall be finished with baked enamel over an iron phosphate pre-treatment.
- .2 Supply 2 spray cans touch-up enamel.

#### 2.5 PHYSICAL DIMENSIONS

.1 The switchboard will be comprised of three sections, vertically mounted, total size 90 inches (2286 mm) high x 30 inches (762 mm) wide x 24 inches (610mm) deep (Utility metering, main breaker section and Distribution section).

#### 2.6 MAIN OVERCURRENT DEVICE

- .1 Main Power Circuit Breaker
  - .1 Low voltage power circuit breaker.
  - .2 Fixed construction.
  - .3 100% rated.
  - .4 As shown on drawing
  - .5 Frame size -1200 A.
  - .6 Electronic Solid State Trip.
  - .7 System Voltage 208V/30/ .
  - .8 Frequency 60 Hz.
  - .9 Operation: Manual
  - .10 Continuous current rating 1200 amp.
  - .11 Interrupting rating 80 KA RMS min. symmetrical @ 600 VAC.
  - .12 Minimum 30 cycle short time withstand rating. 42 KA RMS min. symmetrical @ 600 VAC.
- .2 Digitrip 520M Trip Unit (LSIG):
  - .1 True RMS sensing electronic trip unit c/w.
  - .2 Adjustable long delay setting.

- .3 Adjustable long delay time.
- .4 Adjustable short delay pickup.
- .5 Adjustable short delay time.
- .6 Adjustable ground fault pick-up.
- .7 Adjustable ground fault delay.
- .8 Fault indicating LEDs.
- .9 Maintenance Mode Arc Flash Reduction Switch.
- .10 Four character LCD display.

# 2.7 FEEDER CIRCUIT BREAKERS

- .1 15A to 125A:
  - .1 Frame designation: F.
  - .2 225 amp frame/trip rating as indicated.
  - .3 Breaker Type FDC.
  - .4 RMS symmetrical interrupting rating at 600 VAC: Minimum of 35KA.
  - .5 Thermal magnetic trip unit.
  - .6 250V, poles as indicated.
  - .7 Padlockable handle hasp.
- .2 150A to 250A:
  - .1 Frame designation: J.
  - .2 250 amp frame/trip rating as indicated.
  - .3 Breaker type: JDB.
  - .4 RMS symmetrical interrupting rating at 600 VAC: Minimum of 35 KA.
  - .5 Thermal magnetic trip unit.
  - .6 250V, poles as indicated.
  - .7 Padlockable handle hasp.
  - .8 Extension handle for breakers rated at 225 amps and above.

# 2.8 STANDARD OF ACCEPTANCE

.1 The service entrance switchboard shall be type Canadian power-R-line CSswitchboard, as manufactured by Eaton., c/w main circuit breaker, c/w Digitrip Trip unit, SPD module, IQ6410 digital metering device and distribution sections with circuit breakers as indicated.

#### 2.9 ACCEPTABLE MANUFACTURERS, TO THE REQUIREMENTS ABOVE

- .1 Square D.
- .2 Siemens.

# PART 3 EXECUTION

## 3.1 INSTALLATION

- .1 This switchboard is designed for an indoor service application only. Switchboards supplied for indoor service which cannot be installed immediately must be stored in a clean, dry, heated and ventilated area.
- .2 Locate service entrance board in location as indicated.
- .3 Connect main secondary service conductors to busbars using factory supplied, NEMA two-hole crimp lugs.
- .4 Connect load side of distribution breakers to feeder conductors as indicated.
- .5 Check factory made connections for mechanical security and electrical continuity.
- .6 Run one grounding conductor, 4/0 AWG, copper, RW90, green insulated, in 35mm conduit from ground rods to water main, to neutral bar thru-lug, to switchboard ground bar thru-lug to ground bar on electrical room wall unbroken.
- .7 Field adjust all main breaker and feeder breaker trip units to match co-ordination values.
- .8 Provide an underslab conduit from the utility metering compartment to the meter base. Ensure this conduit does not pass through any other compartment or sections of the switchboard.
- .9 Provide two (2) underslabs 63 mm spare conduits from the distribution section of the service entrance switchboard to the nearest available clear wall space. Terminate conduits in a common 450mm high X 305mm wide X 150 mm deep Type 'E' box.
- .10 Program Owner's digital meter as follows:
  - .1 Pulse output to indicate energy and demand.
  - .2 Undervoltage:
    - .1 Measure phase to neutral voltage under normal conditions.
    - .2 Set trigger threshold at 190 volts.
    - .3 Set delay at 300 cycles (5 seconds).
  - .3 Overvoltage:
    - .1 Measure phase to neutral voltage under normal conditions.
    - .2 Set trigger threshold at 265 volts.
    - .3 Set delay at 300 cycles (5 seconds).

#### 3.2 SWITCHBOARD START-UP, VERIFICATION AND PERFORMANCE TESTING

- .1 Start-Up
  - .1 Perform start-up checks paying particular attention to:
    - .1 Name plate complete.
    - .2 Proper grounding.

- .3 Drip hood in place.
- .4 Clean equipment.
- .5 Condition of insulation and insulators.
- .6 No evidence of moisture damage.
- .7 Cable lugs torqued to manufacturer's recommendation.
- .8 Bus bolts torqued to manufacturer's recommendation.
- .9 Doors and covers in place.
- .10 Code required clearances around equipment.
- .11 Exterior and paint finish.
- .12 SPD installation.
- .13 Owner's metering installation.
- .14 Insulation Megger tests.
- .2 Verification
  - .1 Perform verification checks paying particular attention to:
    - .1 Owner's Metering
    - .2 Phase Rotation Test
    - .3 Main Breaker
    - .4 Feeder Breakers
- .3 Performance
  - .1 Carry out performance checks:
    - .1 Test Main Breaker and Solid State Trip Device
    - .2 Test Feeder Breakers and Trip Units.

# 3.3 SERVICE ENTRANCE SWITCHBOARD MANUFACTURER'S SITE VISIT AND ACCEPTANCE TESTING

- .1 Prior to energizing the service entrance, engage the services of the service entrance switchboard manufactures representative to visit the site and provide acceptance testing, including the following:
  - .1 Verify main circuit breaker solid state trip unit set points match coordination study values.
  - .2 Verify feeder circuit breakers trip unit set points match coordination study values.
  - .3 Verify proper operation of each over current device. Ensure proper operation of the main overcurrent device and that the switchboard connections are properly made, and torqued.
  - .4 Verify that digital Owner's meter is operating correctly.
  - .5 Verify that the Owner's meter will forward single phase failure signal to the BAS.
  - .6 Verify that the Owner's meter will forward undervoltage signal to the BAS.
  - .7 Verify that the Owner's meter will forward overvoltage signal to the BAS.
  - .8 Verify that the Owner's meter will forward energy and demands signal to the BAS.

- .2 The switchboard manufacturer's representative shall include and coordinate the following at the time of this field visit:
  - .1 Engage the Supply Utility to remove power from the line side of the switchboard.
  - .2 Have all switchboard compartments opened, including the utility metering compartment and inspect for the presence of foreign materials. Clean and vacuum out all areas of the switchboard. Engage the Supply Utility inspection department to review the incoming cable connections and general condition of the switchboard.
  - .3 Verify all bus bar connections are torqued to manufacturer's recommended values.
  - .4 Take several digital photographs of each switchboard compartment and include in field report.
  - .5 Engage the Supply Utility inspection department to reseal the utility metering compartment and restore power to the line side of the switchboard.
- .3 A written report shall be prepared summarizing the work itemized above and submitted to the Engineer. This report will include the following:
  - .1 Cover page indicating all items listed above have been carried out.
  - .2 A summary of the equipment inspected and the results of all acceptance tests.
  - .3 A copy of the Supply Utility electrical inspection report.
  - .4 Digital meter setup and confirmation of proper operation.
  - .5 Confirmation that the Owner's meter will forward single phase failure signal to the BAS.
  - .6 Confirmation that the Owner's meter will forward energy and demand signal to the BAS.
  - .7 Confirmation that the Owner's meter will forward under and over voltage signal to the BAS.
  - .8 Digital photographs of the interior of each switchboard compartment, suitably labelled.

# 3.4 COMMISSIONING

.1 Carry out the commissioning in conformance with Section 26 91 13 and Division 17.

# END OF SECTION

# PART 1 GENERAL

#### 1.1 SECTION INCLUDES

.1 Branch circuit panelboards.

## **1.2 RELATED SECTIONS**

.1 Section 26 05 53 – Electrical Identification.

#### **1.3 REFERENCES**

- .1 CSA C22.2 Canadian Electrical Code, Part I (2009, 21st Edition), Safety Standard for Electrical Installations
- .2 CSA C22.2 No.29 Panelboards and Enclosed Panelboards.
- .3 NEMA AB1 Moulded Case Circuit Breakers, Moulded Case Switches, and Circuit Breaker Enclosures.
- .4 NETA ATS Acceptance Testing Specifications for Electrical Power Distribution Equipment (published by the International Electrical Testing Association).

#### 1.4 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Procedures for submittals.
- .2 Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

#### 1.5 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Submittals for information.
- .2 Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

# 1.6 SUBMITTALS FOR CLOSE-OUT

- .1 Record actual locations of panelboards and record actual circuiting arrangements in project record documents.
- .2 Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

#### 1.7 QUALIFICATIONS

.1 Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

#### **1.8 REGULATORY REQUIREMENTS**

.1 Products: Listed and classified by CSA (Canadian Standards Association).

#### PART 2 PRODUCTS

#### 2.1 BRANCH CIRCUIT PANELBOARDS

- .1 Manufacturers:
  - .1 Siemens Model PIC42.
  - .2 Square 'D' Model NQOD.
  - .3 Cutler Hammer Model POW-R-LINE 2A
- .2 Description: CSA C22.2 No.29, circuit breaker type, lighting and appliance branch circuit panelboard.
- .3 Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard.
- .4 Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 240 volt panelboards.
- .5 Moulded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.
- .6 Enclosure: NEMA PB 1, Type 1.
- .7 Cabinet Box: 153 mm deep, 508 mm wide for 240 volt and less panelboards.
- .8 Cabinet Front: Flush cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.
- .9 Minimum of 20% space in the panel.

#### PART 3 EXECUTION

#### 3.1 INSTALLATION

- .1 Install panelboards to CSA C22.1.
- .2 Install panelboards plumb. Install recessed panelboards flush with wall finishes.

- .3 Height: 1800 mm to top of panelboard; install panelboards taller than 1800 mm with bottom no more than 100 mm above floor.
- .4 Provide filler plates for unused spaces in panelboards.
- .5 Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- .6 Provide engraved plastic nameplates.
- .7 Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Minimum spare conduits: 2 empty DN27. Identify each as SPARE.

# 3.2 FIELD QUALITY CONTROL

- .1 Section 01 43 00: Field inspection, testing, adjusting.
- .2 Perform inspections and tests listed in NETA ATS, Section 7.4 for switches, Section 7.5 for circuit breakers.

# 3.3 ADJUSTING

- .1 Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other.
- .2 Maintain proper phasing for multi-wire branch circuits.

# END OF SECTION

# PART 1 GENERAL

## 1.1 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Division 1.
- .2 Indicate:
  - .1 Outline dimensions
  - .2 Configuration of identified compartments.
  - .3 Cable entry and exit locations.
  - .4 Dimensioned position and size of busbars.
  - .5 Short circuit bracing and interrupting ratings of equipment.
- .3 Project Specific Wiring Diagrams:
  - .1 Submit with each starter a project specific wiring diagram indicating all interconnections.
  - .2 Each starter shop drawing will indicate the equipment being controlled (For example- Supply fan #1).

#### **1.2 OPERATION AND MAINTENANCE DATA**

- .1 Provide operation and maintenance data for motor control centre for incorporation into manual specified in Division 1.
- .2 Include data for each type and style of starter.

# PART 2 PRODUCTS

## 2.1 MATERIALS

.1 All individual motor starters and all motor control centre starters are to be of one manufacturer.

## 2.2 SUPPLY CHARACTERISTICS

.1 Phase and voltage, as indicated.

#### 2.3 GENERAL DESCRIPTION

- .1 Compartmentalized section with common power busbars.
- .2 Front Mounting.
- .3 Main lugs only.
- .4 EEMAC 1A Drip proof, c/w factory installed drip shield.
- .5 Accommodating circuit breakers and combination starters as indicated.

- .6 Floor mounting, free standing, enclosed dead front..
- .7 Control Wiring: Class 1B, #16 Red TEW, sleeve type tags at both ends.
- .8 Lug type: screw.
- .9 EEMAC 1.

#### 2.4 BUSBARS

- .1 Main horizontal and branch vertical, three phase high conductivity tin plated copper busbars, self-cooled, extending entire width and height of motor control centre, supported on insulators and rated:
  - .1 Main horizontal busbars: as per drawings.
  - .2 Branch vertical busbars: as per drawings.
- .2 No other cables, wires, equipment in main and branch busbar compartments.
- .3 Brace buswork to withstand effects of short circuit current of a minimum of 22 kA RMS symmetrical.
- .4 Bus supports: with high dielectric strength, low moisture absorption, high impact material and long creepage surface designed to discourage collection of dust.

# 2.5 GROUND BUS

.1 Copper ground bus extending entire width of motor control centre.

#### 2.6 NEUTRAL BUS

.1 Copper neutral bus sized to suit, extending entire width of motor control centre.

#### 2.7 MOTOR STARTERS AND DEVICES

- .1 Full Voltage Non-Reversing Units
  - .1 Combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
    - .1 Contactor solenoid operated, rapid action type.
    - .2 Motor solid state overload protective device in each phase ambient compensated, manually reset from outside enclosure, c/w
      - .1 One current sensor in each phase.
      - .2 Dial selectable overload protection.
      - .3 Phase loss protection.
    - .3 Power and control terminals.
    - .4 Project specific wiring and schematic diagram inside starter enclosure in visible location.

- .5 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
- .2 Combination type starters to include magnetic only circuit breaker, where indicated with operating lever on outside of enclosure to control circuit breaker, and provision for:
  - .1 Locking in "OFF" position with up to 3 padlocks.
  - .2 Locking in "ON" position.
  - .3 Independent locking of enclosure door.
  - .4 Provision for adjustable trip settings of 700 1300 % of motor FLA.
- .3 Accessories:
  - .1 Selector switches: labeled as indicated.
  - .2 Indicating lights: LED type and colour as indicated.
  - .3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.
  - .4 Manual overload reset button on enclosure exterior.
  - .5 Control transformer, minimum 150 VA.
- .4 Short Circuit Interrupting Rating:
  - .1 Standard rating of 25 KAIC RMS symmetrical.

## 2.8 STARTER UNIT COMPARTMENTS

- .1 Units EEMAC size 4 and smaller, circuit breaker units 225 A and smaller, plug-in type with self-disconnect. Guide rail supports for units to ensure that stabs make positive contact with vertical bus. Provision for units to be installed or removed, off load, while buses energized.
- .2 Unit mounting:
  - .1 Engaged position unit stabbed into vertical bus.
  - .2 Withdrawn position unit isolated from vertical bus but supported by structure.
  - .3 Provision for positive latching in either engaged or withdrawn position and padlocking in withdrawn position.
  - .4 Stab-on connectors free floating silver-plated clips, self-aligning, backed up with steel springs.
- .3 External operating handle of circuit switch interlocked with door to prevent door opening with switch in "on" position. Provision for 3 padlocks to lock operating handle in "off" position and lock door closed.
- .4 Hinge unit doors on same side.
- .5 Overload relays manually reset from front with door closed.
- .6 Pushbuttons and indicating lights mounted on door front.
- .7 Devices and components by one manufacturer to facilitate maintenance.

#### 2.9 VERTICAL SECTION CONSTRUCTION

- .1 Independent vertical sections fabricated from rolled flat steel sheets bolted together to form rigid, completely enclosed assembly, with cubicles sized as shown on the drawings.
- .2 Each vertical section divided into compartment units, minimum 305 mm high, as indicated.
- .3 Each unit to have complete top and bottom steel plate for isolation between units.
- .4 Horizontal wireways, equipped with cable supports, across top and bottom, extending full width of motor control centre, isolated from busbars by steel barriers.
- .5 Vertical wireways for load and control conductors extending full height of vertical sections, and equipped with cable tie supports. Installation wiring to units accessible with doors open and units in place.
- .6 Openings, with removable coverplates, in side of vertical sections for horizontal wiring between sections.
- .7 Incoming cables to enter as indicated.
- .8 Provision for outgoing cables to exit via top or bottom.
- .9 Removable lifting means.
- .10 Provision for future extension of both ends of motor control centre including busbars without need for further drilling, cutting or preparation in field.
- .11 Divide assembly for shipment to site, as indicated complete with hardware and instructions for re-assembly.

#### 2.10 MCC INCOMING BREAKER

- .1 Fully rated moulded case circuit breaker, listed for 100 percent continuous ampere rating, with thermal magnetic or electronic tripping devices and interchangeable rating plugs.
- .2 Breaker frame: as indicated on the drawings, 600 V, 60 Hz, 3-pole, minimum 42,000 A interrupting capacity (symmetrical).
- .3 Mounting: fixed mounted with either
  - .1 Visible window to confirm the circuit breaker main contact position (either opened or closed); or,
  - .2 Rack-out mounted breaker, while still maintaining enclosure depth (breaker can be racked out, to provide visual indication of breaker position, and MCC footprint does not exceed dimensions on drawings).
- .4 Enclosure: 21 inches (534 mm) deep full cell structure, flush mounted with the rest of the MCC.
- .5 Copper Lugs suitable for incoming cable copper conductors

.6 For main breakers that are Reverse Fed, that is incoming voltage is on the load side of the breaker, a clear warning note is required on the breaker cell door as follows "CAUTION, BREAKER IS REVERSE FED".

## 2.11 THERMAL-MAGNETIC BREAKERS (FEEDER/BRANCH BREAKERS)

- .1 Moulded case motor circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.
- .2 Breaker frame: 600 V, 60 Hz, 3-pole, interrupting capacity as per main breaker in the MCC (symmetrical). Approved series rated breakers with main MCC breaker is a suitable alternative.
- .3 Breaker trip unit: adjustable magnetic trip unit, properly rated for motor it is protecting.

# 2.12 MAGNETIC BREAKERS (MCP)

- .1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.
- .2 Breaker frame: 600 V, 60 Hz, 3-pole, 42 kA rms symmetrical interrupting capacity. Series rating is not acceptable.
- .3 Breaker trip unit: adjustable magnetic trip unit, properly rated for motor it is protecting.

#### 2.13 AUTOMATIC TRANSFER SWITCH

.1 Refer to Specification Section 26 36 23.

# 2.14 STARTER UNIT COMPARTMENTS

- .1 Units NEMA/EEMAC size 4 and smaller, circuit breaker units 225 A and smaller, plug in type with self-disconnect. Guide rail supports for units to ensure that stabs make positive contact with vertical bus. Provision for units to be installed or removed, off load, while buses energized.
- .2 All starter components to be mounted in the starter cell, accessible with starter in the connected position. No access to components shall be limited to requiring the starter to be disconnect. These components include, but not limited to:
  - .1 Control transformers
  - .2 Terminal blocks
  - .3 Relays and Timers
- .3 Unit mounting:
  - .1 Engaged position unit stabbed into vertical bus.
  - .2 Withdrawn position unit isolated from vertical bus but supported by structure.
  - .3 Provision for positive latching in either engaged or withdrawn position and padlocking in withdrawn position.

- .4 Stab on connectors free floating silver plated clips, self aligning.
- .4 External operating handle of circuit breaker interlocked with door to prevent door opening with switch in "on" position. Provision for 3 padlocks to lock operating handle in "off" position and lock door closed.
- .5 Hinge unit doors on same side.
- .6 Overload relays manually reset from front with door closed.
- .7 Pushbuttons, Elapsed Time Meters (ETMs) and indicating lights mounted on door front.
- .8 Devices and components by one manufacturer to facilitate maintenance.
- .9 The number of unassigned compartments (spaces) may be increased but not decreased.

# 2.15 MOTOR STARTERS

- .1 Motor starter units: Combination magnetic type, 3 pole, 600 V rated.
- .2 Overload relays: Solid state overload relays, manually resettable, one element per phase, reset pushbutton on starter door.
- .3 Control transformer: 120V AC, grounded secondary, c/w two primary and one secondary fuses. 200VA minimum. Sized for all components connected plus 100% capacity for future devices.
- .4 Starter contactor: Minimum four spare Form C contacts, in addition to all used in control circuit, wired to terminal blocks.
- .5 Motor Circuit Protector (MCP): Moulded case, 3 pole, 600 V, with adjustable instantaneous trip.
- .6 External circuit breaker operating handle: Interlocked with unit door, to be in OFF position before door can be opened. Allow padlocking of handle in ON or OFF position with three padlocks minimum.
- .7 Starter size: NEMA sizes as indicated. Minimum starter size NEMA size 1. Intermediate size starters will not be accepted.

# 2.16 SOLID STATE REDUCED VOLTAGE STARTERS (SOFT STARTER)

- .1 Provide modular solid state motor controller, consisting of microcomputer logic components and SCR power unit capable of providing soft start/soft stop with selectable kick start, current limit and full voltage. Starters to be Allen Bradley SMC PLUS<sup>™</sup>, Eaton S811 IT or Square 'D' Canada.
- .2 Complete, but not limited to the following features:
  - .1 Power circuit: Back-to-back SCR pairs, with failed SCR protection.

- .2 Power section thermal capacity rating: minimum 600% of unit rating for 10 seconds.
- .3 Contactors: Electrically energized and held. Isolating contactor on line side of solid state starter to disconnect starter when not required. Internal bypass contactor to remove load from solid state starter once motor up to speed and to switch power factor correcting capacitor.
- .4 Pump control option included: Close loop torque during starting and stopping, without use of external sensors or feedback devices, adjustable starting/ramp time of 0 to 60 seconds and stopping time of 0 to 120 seconds.
- .5 Other features to include:
  - .1 Hand-off-PLC selector switch
  - .2 Electric Overload
  - .3 Stall and Jam detection
  - .4 Phase unbalance detection
  - .5 Metering parameters such as three phase current, power in kW, power factor, three phase voltage, power usage in kWh, elapsed time meter.
  - .6 Indications: Red pilot light "pump off"
  - .7 Green pilot light "pump running"
  - .8 Amber pilot light "DRIVE FAULT"
  - .9 Starter coil: 120 volts
  - .10 Control transformer: 120V AC, two primary and one secondary fuses. Sized for all components connected plus 100% capacity for future devices.
- .6 Basic motor control algorithm shall be sensorless torque control. Provide the following operation via a real-time control method that dynamically determines motor efficiency in order to provide true torque control of the motor to control pressure overshoot, and deceleration to eliminate water hammer. Starters utilizing open loop voltage or closed loop current control algorithm is not acceptable. The torque control shall provide the following:
  - .1 Pressure surge & transient reduction
  - .2 Water hammer elimination
  - .3 "Soft" check valve opening & closing
- .7 Provide the following pump monitoring and protection, including all related sensing devices as described below. Listed pump protection functions shall be via the starters integral control package.
  - .1 Pump jam protection.
  - .2 User adjustable starting time of 0 to 300 seconds and adjustable stopping time of coast to 180 seconds, each utilizing a user adjustable linear, squared or "S" curve.
  - .3 Self-compensating for load and voltage (step voltage not acceptable).
  - .4 Low flow and run dry protection.
  - .5 Backspin detection.
  - .6 Shaft windup elimination on long shaft machines.
- .8 Provide the following Starter Diagnostic Functions:

- .1 Alpha/Numeric Fault Display
- .2 Revolving 99 Most Recent Events
- .3 Start/Stop Recorder
- .4 Date & Time Stamped Events
- .5 Motor Thermal % Capacity Display
- .6 Closed Loop Motor Stall Detection
- .7 Open Loop Motor Stall Detection Fault detection
- .8 Open Gate Detection
- .9 Starter Status Indication
- .10 Pre-Start: Pending Fault Indication
- .11 Pre-Start: Phase Rotation Indication
- .12 Control Board Built in Self Tests
- .13 Starter/System Level Built in Self Tests
- .14 Self-Check Parameter Set-Up
- .15 Full Screen Meter Mode
- .16 Zero Sequence and Residual ground
- .17 9 Event Fault Log (I1, I2, I3, V1, V2, V3, kW, Hz, runtime, fault #, description, Starter State).
- .9 Provide the following programmable Motor Protection Functions:
  - .1 Motor/Machine protection functions:
    - .1 Electronic Overload selectable from Class 1 through 40.
    - .2 Motor overload hot/cold ratio.
    - .3 Motor overload cooling time.
    - .4 Motor overload alarm level.
    - .5 Motor overload lockout level.
    - .6 Motor overload auto lockout level.
    - .7 Overload Reset.
    - .8 Overload Warning.
    - .9 Acceleration Timer.
    - .10 Mechanical Jam/Electronic Shear-pin (Selectable Trip or Warning).
    - .11 Motor Thermal Capacity Protection, protecting against hot starts.
    - .12 Undercurrent Alarm (Selectable Trip or Warning).
    - .13 Time Between Restarts.
    - .14 Trip Reset Protection.
    - .15 Machine Ground Fault Protection (Selectable Trip or Warning).
  - .2 Electrical System Faults:
    - .1 Undercurrent Protection
    - .2 Current Imbalance (10-40%)
    - .3 Under voltage Protection (10-40%)
    - .4 Over voltage Protection (10-40%)

- .5 Phase Reversal Protection
- .6 Under frequency Protection
- .7 Over frequency Protection
- .8 Overload Alarm
- .9 Generator Set Frequency Tracking
- .10 Restart After Non-critical Fault
- .11 Ground Fault Protection
- .3 Maintenance Mode
  - .1 Emergency Restart after Fault Lockout
  - .2 Selectable CT Ratios
  - .3 Current limited jog
  - .4 Built In Self-Test: Provide built-in self-testing (BIST) capability to perform the following functions to verify satisfactory starter operation:
    - .1 Sustained generation of SCR gate firing signals for 3 minutes to allow measurements to be made for the presence, amplitude and duration of the gating signals.
    - .2 Engage the Bypass and Inline contactors 1 time, utilizing aux. contact feedback to the microprocessor to verify correct operation of the contactors.
  - .5 Real Text Event Recorder
  - .6 Real text Fault Recorder
- .4 Starters furnished herein shall include a three (3) year manufacturer's warranty. The warranty shall be provided in writing from date of documented factory technicians start up.
- .5 A complete spare parts list shall be provided at time of bid. Spare parts shall include:
  - .1 One each of each type of Printed Circuit Board
  - .2 One of each type and size of control fuse
  - .3 Three of each type and size of power fuse
  - .4 One complete spare Power Cell of each type and size used

#### 2.17 UNIT AND DUCT HEATER CONTACTORS

- .1 Combination magnetic type, 3 pole, 600 V rated.
- .2 Thermal Magnetic breaker for each heater.
- .3 Control transformer: 120V AC, grounded secondary, c/w two primary and one secondary fuses. 200VA minimum. Sized for all components connected plus 100% capacity for future devices.
- .4 Circuit breakers: Moulded case, 3 pole, 600 V, thermal magnetic type, with adjustable instantaneous trips.

- .5 External circuit breaker operating handle: Interlocked with unit door, to be in OFF position before door can be opened. Allow padlocking of handle in ON or OFF position with three padlocks minimum.
- .6 Starter size: NEMA sizes as indicated. Minimum starter size NEMA size 1. Intermediate size starters will not be accepted.

# 2.18 INSTRUMENTATION AND METERING

- .1 Potential Transformers:
  - .1 Type: Moulded.
  - .2 Accuracy Classification: 0.3 at 150% burden imposed by meters and instruments.
  - .3 Primary Fuses: current limiting.
  - .4 Secondary Fuses: current limiting.
- .2 Current Transformer:
  - .1 Type: Moulded donut.
  - .2 Accuracy: 0.6 at burden imposed by meters and instruments.
  - .3 Shorting type terminal boards for current transformer leads.

## 2.19 WIRING AND TERMINAL BLOCKS

- .1 Provide internal power wiring from the line side of each starter to the bus stabs with a minimum of #10 AWG wire, stranded copper, XLPE, 1 kV rated. Size wiring to accommodate the largest horsepower that the line starter is capable of switching.
- .2 Control wiring: 600 V rated, XLPE insulated, minimum #14 AWG size stranded copper. Install wiring to panel doors utilizing extra flexible 49-strand conductors.
- .3 Identify all wiring by means of oil-resistant markers fixed to each conductor at both ends.
- .4 Wires colour code:
  - .1 Control circuits Red.
  - .2 Power circuits Black.
- .5 Terminal blocks: compression type, modular pull-apart construction, enabling unit wiring to be easily separated from field wiring. Identify all terminal blocks with numbers identical to the wire numbers.
- .6 No more than two wires per terminal screw (i.e. on terminal block).

#### 2.20 CONTROL DEVICES

- .1 Install operator's control devices for each starter or contactor unit on MCC units as indicated.
- .2 Install Control Circuit Transformers for each starter, Single phase, dry type, secondary: 120V or 24V AC, rating: as indicated plus 20% spare capacity, Secondary fuse kit

(terminal block type chips) and fuse, size as indicated, close voltage regulations as required by magnet coils and solenoid valves.

- .3 Pushbuttons: 30.5 mm, momentary contact type, type 4/13 watertight/oiltight heavy duty oil tight, operator flush type, colour as indicated, 1-NO and 1-NC contacts rated 5A at 120 V AC. Provide grey legend plate with wording to suit.
- .4 Selector switches: 30.5 mm, maintained contact type, 2 or 3 positions (as indicated), type 4/13 watertight/oiltight heavy duty oil tight, operator's standard knob, contact arrangement as indicated, rated 5A at 120 V AC. Provide grey legend plate with wording to suit.
- .5 Indicating and push to test lights: 30.5 mm, type 4/13 watertight/oiltight heavy duty oil tight, transformer type, lens colour as indicated, 120V AC supply voltage rating, 6 V lamp voltage rating. Provide grey legend plate with wording to suit.
- .6 Elapsed Time Meters: 8-digit, non-resettable, NEMA 12 rating.
- .7 General purpose relays: Heavy duty, industrial, enclosed, EEMAC rated, electrically held, 120 V coil, 60 Hz, 10 amp, 120 V AC convertible contacts, Provide Allen-Bradley 700-HA type, or Cutler Hammer, or Omron, equivalent.
- .8 Magnetic latching relays: Magnetically held, electrically released, 120 V AC coil, enclosed, with 10 A, 120 V AC convertible contacts, number and type as indicated, Type NM by Allen-Bradley Canada Ltd., Type XL by Square D Canada, or Type ARML by Cutler-Hammer.
- .9 Timing relays: General purpose plug-in type with DIN mountable tube base. ON delay, OFF delay or Interval type as indicated, enclosed, 120 V AC Form C contacts (quantity as indicated), knob adjustable timing range as indicated. Provide Allen Bradley 700-HT type, or Cutler Hammer, or Omron, equivalent.
- .10 Thermistor relays: Type 3UN2100 by Siemens Electric Ltd., compatible with respective motor thermistor type where indicated.
- .11 Ammeters and voltmeters: With suitable current and potential transformers. Voltmeters with 750 V scale, 2% accuracy. Ammeter with maximum demand indicator, scale 120% of full load current, 2% accuracy. Size CTs to suit the load.
- .12 Nameplates: Engraved to indicate relay function, device number, range and setting where applicable. Dymo labels not acceptable.
- .13 Motor control centre components: Factory installed by motor control centre manufacturer.
- .14 Power Meter: Power Meter on MCC to be a micro-processor based package, complete with LCD displaying volts, amps and selectable power functions.
  - .1 Voltage inputs: three PTs 600-120 V AC, 60 Hz, include a fuse for each line on primary and secondary side.
  - .2 Current inputs: three CTs (one per phase) at 5A.
  - .3 Accuracy Class: 1.

| .4 | Power supply: 120 V AC, 60 Hz, 1-phase. Provide 120 vac from the same source |
|----|------------------------------------------------------------------------------|
|    | as metering source.                                                          |

- .5 Test block connection on MCC panel door.
- .6 Master Module, complete with processor.
- .7 Display Module, for mounting on MCC panel.
- .8 Communication port: RS232 and RS485.
- .9 Four output relays, including one alarm relay.
- .10 Four input relays.
- .11 Relay contacts shall be Form 'C' (N.O. and N.C. contacts) rated 10 at 120 V AC or 24 V DC.
- .12 Alarm contacts to activate under the following protection features: Phase loss, Phase unbalance, Phase reversal.
- .13 Approved Model:
  - .1 GE MULTILIN PQM II
  - .2 PQM II complete with EnerVista GE Multilin's software tools for managing the entire lifecycle implementation of the PQM II. EnerVista contains all of the tools for setting up and configuring PQM II." Contractor shall provide programming of metering unit.

#### 2.21 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust-resistant primer inside and outside, and at least two coats of finish enamel.
- .2 Paint motor control centre exterior ASA #61 light grey and interiors white.
- .3 Provide a 100 mL container of finish enamel for touch-up of scratches during installation.

#### 2.22 SPARE PARTS AND SPECIAL TOOLS

- .1 Provide an itemized list of spare parts as recommended for start-up.
- .2 Provide an itemized list of all recommended spare parts required for routine and minor overhauls for two (2) years of normal operation. Each piece of equipment must have part number or designation.
- .3 Use identical equipment and components where practical to permit inter-changeability of parts, minimize spare parts inventory, and to simplify maintenance.
- .4 Where two or more items of equipment perform similar functions, use the same make and, where practical, the same model number and size.
- .5 Provide a complete list with price list of special tools required for commissioning and servicing of the equipment.
- .6 Provide spare fuses for each rating, indicating lights and three sets of spare overload heaters for each rating.

#### 2.23 WIRING IDENTIFICATION

.1 Provide wiring identification in accordance with Section 26 05 00.

#### 2.24 STANDARD OF ACCEPTANCE

.1 Eaton.

#### 2.25 ACCEPTABLE MANUFACTURERS

.1 Square D, Furnas, Allen Bradley, Siemens.

#### PART 3 EXECUTION

#### 3.1 INSTALLATION

- .1 This equipment is designed for indoor service applications only. Equipment supplied for indoor service which cannot be installed immediately must be stored in a clean, dry, heated and ventilated area.
- .2 Make field power and control connections as indicated.
- .3 Before energizing the motor control center (MCC), conduct a thorough inspection to make certain that all foreign materials such as tools, scraps of wire and other debris are removed from all units and the structure. Remove any accumulation of dust and dirt with a vacuum cleaner.
- .4 All circuit connections are tightened at time of assembly by power-driven tools with controlled torque. However, the vibrations experienced in transit may loosen some of these connections. Check all of the total connections for a tight connection. The connections to be checked include bus hardware, circuit breaker and switch terminals, contactor and relay terminals and terminal blocks. Check the incoming line connections. Tighten to the torque values shown in Manufacturer's literature.
- .5 Remove all blocks or other temporary holding means used for shipment from all component devices in the MCC interior.
- .6 Check the enclosure to see that it has not been damaged.
- .7 Compare all circuits for agreement with the wiring diagrams which accompany the MCC.
- .8 Be sure that each motor is connected to its intended starter.
- .9 Make certain that field wiring is clear of live busses and physically secured to withstand the effects of fault current.
- .10 Check to determine that all grounding connections are made properly.
- .11 Check all devices for damage. Make all necessary repairs or replacements prior to energizing.

- .12 Manually exercise all switches, circuit breakers and other operating mechanisms to make certain that they are properly aligned and operate freely.
- .13 Ensure that MCP adjustable current trip mechanisms match the full-load current shown on the nameplate of each motor.
- .14 Ensure that solid-state overload relays are installed and selected to match the full-load current shown on the nameplate of each motor.
- .15 Conduct an electrical insulation resistance test and make sure that the MCC and field wiring are free from short circuits and grounds. Do this test phase-to-phase, phase-to-ground, and phase-to-neutral with the switches or circuit breakers opened.
- .16 Install covers, close doors, and make certain that no wires are pinched and that all enclosure parts are properly aligned and tightened.

# 3.2 MOTOR CONTROL CENTRE START-UP, VERIFICATION AND PERFORMANCE TESTING

- .1 Start-Up
  - .1 Perform start-up checks paying particular attention to:
  - .2 Name plate complete.
  - .3 Proper grounding.
  - .4 Drip hood in place.
  - .5 Clean equipment.
  - .6 Condition of insulation and insulators.
  - .7 Evidence of moisture damage.
  - .8 Cable lugs torqued to manufacturer's recommendation.
  - .9 Bus bolts torqued to manufacturer's recommendation.
  - .10 Doors and covers in place.
  - .11 Code required clearances around equipment.
  - .12 Exterior and paint finish.
  - .13 Insulation Megger tests.
- .2 Verification:
  - .1 Perform verification checks paying particular attention to:
    - .1 Manufacturer
    - .2 Voltage
    - .3 Main Bus Rating
    - .4 Bus Bracing
    - .5 Copper Busing
    - .6 Copper Ground Bus
    - .7 Phase Rotation Test
    - .8 Breakers (MCP and Thermal/magnetic type).

#### .3 Performance:

- .1 Carry out performance checks:
  - .1 Test overcurrent devices.
  - .2 Test overload trip units.

#### 3.3 **MOTOR CONTROL CENTRE MANUFACTURER'S SITE VISIT**

- .1 Engage the services of the MCC manufacturer's representative to visit the site and commission the unit. Commissioning to include the following:
  - .1 Verify circuit breakers trip unit set points match motor nameplate values.
  - .2 Verify overload trip unit set points match motor nameplate values.
  - .3 Verify all connections are torqued to manufacturer's recommended values.
  - .4 Verify proper operation of each over device and that MCC connections are properly made and torqued.
- .2 A written report shall be prepared detailing this portion of the work, and submitted to the engineer.

#### 3.4 TESTS

- .1 Ensure moving and working parts are lubricated where required.
- .2 Operate starters in sequence to prove satisfactory performance of motor control centre during an 8 h period.
- .3 Adjust solid state overloads based on individual motor full load amps, as actually read on site.
- .4 Set individual MCP trip setpoints based on actual motor nameplate amperage.

#### 3.5 RECORDS

- .1 Obtain the following information for each motor and record.
  - .1 Motor horsepower
  - .2 Motor voltage
  - .3 Motor full load amps - (both nameplate and site measured values).
  - .4 Installed overload units.
  - .5 Installed over current protection. (Trip Unit)
  - .6 MCP adjustments. (In Amperes).
- .2 Submit chart to Engineer for approval and make changes where instructed.
- .3 Incorporate in maintenance manuals.

#### COMMISSIONING

Carry out the commissioning in conformance with Section 26 91 13 and Division 17. .1

3.6

# **END OF SECTION**
## 1.1 GOVERNING CONDITIONS

.1 Read this section in conjunction with Section 16010 which applies and governs the work of this section.

## **1.2 RELATED WORK**

- .1 Installation of anchor devices, channel base sills, setting templates: Section 03 30 00.
- .2 Concrete pad: Section 03 30 00.

## 1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00.

## PART 2 PRODUCTS

### 2.1 EQUIPMENT

- .1 Enclosure constructed with 2.7 mm thick minimum steel, with weather and corrosion resistant finish, size as indicated. Enclosure shall be 316 SS EEMAC 4X, sized to suite.
- .2 Entire enclosure capable of withstanding a maximum impact force of 86 MN/m 2 area without rupture of material.
- .3 Removable enclosure panels with formed edges, galvanized steel external fasteners removable only from inside enclosure.
- .4 Where required enclosure equipped with hot dipped galvanized mounting rails 1.3 m adjustable horizontally and vertically to enable mounting of equipment at any location within housing. Rails: 14 mm holes and 50 x 14 mm slots on 100 mm centres for horizontal adjustment. Holes in side panel flanges in 60 mm increments for vertical adjustment.
- .5 Tamperproof, bolt-on cover domed to shed water.
- .6 Door: minimum 1 m wide, hinged, 3 point latching, with padlocking means.
- .7 Ventilation panel constructed to allow air circulation yet preventing entry of foreign objects, wildlife, vermin.
- .8 Enclosure construction such as to allow any configuration of single or ganged enclosures.

## 2.2 MANUFACTURER

.1 Hammond or approved equivalent.

# PART 3 EXECUTION

# 3.1 INSTALLATION

- .1 Assemble enclosure in accordance with manufacturer's instructions and mount on concrete pad or structure as indicated.
- .2 Mount equipment in enclosure as indicated.

## **END OF SECTION**

## 1.1 SECTION INCLUDES

- .1 Wall switches.
- .2 Wall dimmers.
- .3 Receptacles.
- .4 Device plates and decorative box covers.

### **1.2 REFERENCES**

- .1 CSA C22.2-09 Canadian Electrical Code, Part I (2009, 21st Edition), Safety Standard for Electrical Installations
- .2 CSA-C22.2 No.42 General Use Receptacles, Attachment Plugs and Similar Devices.
- .3 CSA-C22.2 No.42.1 Cover Plates for Flush-Mounted Wiring Devices.
- .4 CSA-C22.2 No.55 Special Use Switches.
- .5 CSA-C22.2 No.111 General-Use Snap Switches.

## **1.3 SUBMITTALS FOR REVIEW**

- .1 Section 01 33 00 Submittal Procedures.
- .2 Product Data: Provide manufacturer's catalogue information showing dimensions, colours and configurations.

### 1.4 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00 Submittal Procedures.
- .2 Submit manufacturer's installation instructions.

### **1.5 REGULATORY REQUIREMENTS**

.1 Provide products listed and classified by CSA (Canadian Standards Association) ULC as suitable for the purpose specified and indicated.

## PART 2 PRODUCTS

## 2.1 WALL SWITCHES

- .1 Manufacturers:
  - .1 Leviton.

- .2 Hubbell.
- .3 Pass & Seymour.
- .2 Description: CSA-C22.2 No.111, Heavy-Duty specification grade.
- .3 Body and Handle: Ivory plastic with toggle handle.
- .4 Indicator Light: Not Required.
- .5 Ratings:
  - .1 Voltage: 120 volts, AC.
  - .2 Current: 20 amperes.

# 2.2 **RECEPTACLES**

- .1 Manufacturers:
  - .1 Leviton.
  - .2 Hubbell.
  - .3 Pass & Seymour.
- .2 Description: CSA-C22.2 No.42, Heavy-duty specification grade.
- .3 Device Body: Ivory plastic.
- .4 Configuration: Type as specified and indicated.
- .5 Convenience Receptacle: Type 5-15.

# 2.3 WALL PLATES

- .1 Decorative Cover Plate: Match existing (smooth stainless steel)
  - .1 Leviton.
  - .2 Hubbell.
  - .3 Pass & Seymour.
- .2 Jumbo Cover Plate: Match existing (smooth stainless steel)
  - .1 Leviton.
  - .2 Hubbell.
  - .3 Pass & Seymour.

# PART 3 EXECUTION

# 3.1 EXAMINATION

- .1 Verify existing conditions prior to beginning work.
- .2 Verify that outlet boxes are installed at proper height.

- .3 Verify that wall openings are neatly cut and will be completely covered by wall plates.
- .4 Verify that floor boxes are adjusted properly.
- .5 Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

## 3.2 PREPARATION

- .1 Provide extension rings to bring outlet boxes flush with finished surface.
- .2 Clean debris from outlet boxes.

## 3.3 INSTALLATION

- .1 Install to CSA C22.1.
- .2 Install devices plumb and level.
- .3 Install switches with OFF position down.
- .4 Install receptacles with grounding pole on bottom.
- .5 Connect wiring device grounding terminal to outlet box with bonding jumper branch circuit equipment grounding conductor.
- .6 Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- .7 Connect wiring devices by wrapping conductor around screw terminal.
- .8 Use jumbo size plates for outlets installed in masonry walls.
- .9 Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

## 3.4 INTERFACE WITH OTHER PRODUCTS

- .1 Coordinate locations of outlet boxes provided under Section 26 05 34 to obtain mounting heights specified and indicated on drawings.
- .2 Install wall switch to match existing.
- .3 Install convenience receptacle 600 mm 24 inches above finished floor.
- .4 Install convenience receptacle 150 mm 6 inches above backsplash of counter.

## 3.5 FIELD QUALITY CONTROL

- .1 Field inspection, testing, adjusting, and balancing to Section 01450 Quality Control.
- .2 Inspect each wiring device for defects.

- .3 Operate each wall switch with circuit energized and verify proper operation.
- .4 Verify that each receptacle device is energized.
- .5 Test each receptacle device for proper polarity.
- .6 Test each GFCI receptacle device for proper operation.

## 3.6 ADJUSTING

.1 Adjust devices and wall plates to be flush and level.

## 3.7 CLEANING

.1 Clean exposed surfaces to remove splatters and restore finish.

## **END OF SECTION**

## 1.1 RELATED WORK

- .1 Section 26 05 00 Common Work Results for Electrical
- .2 Section 26 28 13 Fuses Low Voltage

## 1.2 **REFERENCES**

- .1 CSA C22.2 No. 39 Fuseholder Assemblies.
- .2 CSA C22.2 No. 4 Enclosed switches.

## **1.3 SHOP DRAWINGS AND PRODUCT DATA**

.1 Submit shop drawings and product data in accordance with Division 1.

## 1.4 OPERATION AND MAINTENANCE DATA

.1 Not applicable.

# PART 2 PRODUCTS

# 2.1 DISCONNECT SWITCHES

- .1 Fusible and non-fusible disconnect switches in CSA enclosures as indicated.
- .2 Provision for padlocking in either on or off positions.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 ON-OFF switch position indication on switch enclosure cover.
- .5 Fuseholders: suitable without adaptors, for type and size of fuse as indicated.
- .6 Type "A", quick-make, quick-break action.

# 2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00.
- .2 Indicate name of load controlled on size 4 nameplate.

## 2.3 MANUFACTURERS

- .1 Standard of Acceptance: Cutler Hammer
- .2 Other approved manufacturers: Siemens, Square D

# PART 3 EXECUTION

# 3.1 INSTALLATION

- .1 Install disconnect switches as indicated.
- .2 Mount all disconnect switches in a secure manner, easily accessible, and at a height as specified in Section 26 05 00.
- .3 In finished areas mount disconnect switch on top of flush mounted junction box with conduit nipple on its coverplate into back of the switch.

# **END OF SECTION**

## 1.1 GOVERNING CONDITIONS

.1 Read this Section in conjunction with Section 26 05 01, which applies to and governs the work of this Section.AC 90 cable. Maximum length to be 1.5 meters run parallel to building lines.

## PART 2 PRODUCTS

## 2.1 CONTROL RELAYS

.1 Convertible contact type: contacts field convertible from NO to NC, electrically held. Coil rating: 120 V, 35 VA or 24 VAC (as required). Contact rating: 120 V, 20 A.

### 2.2 OPERATOR CONTROL STATIONS

.1 Enclosure: CSA Type 1 or 4, surface or flush mounting as indicated.

### 2.3 PUSHBUTTONS

.1 Heavy duty Oil tight. Operator recessed, flush or mushroom type, with 1-NO and 1-NC contacts rated at 10 A, ac, labels as indicated. Stop or close pushbuttons coloured red, provision for padlocking in depressed position labelled "stop". Red mushroom operator for emergency stop. Green for "start" or "open".

### 2.4 SELECTOR SWITCHES

.1 Maintained or position labelled as indicated heavy duty oiltight, operators standard, contact arrangement as indicated, rated 120 V, 10 A, AC.

### 2.5 INDICATING LIGHTS

.1 Heavy duty Oiltight, transformer or full voltage type, lens colour: as indicated, supply voltage: 120 V, lamp voltage: all same voltage, incandescent, 50,000 hr.

### 2.6 CONTROL CIRCUIT TRANSFORMERS

- .1 Single phase, dry type.
- .2 Primary: 600 V, 60 Hz ac. (not applicable to this project).
- .3 Secondary: 120 V, ac.
- .4 Rating: as required plus 20%.
- .5 Secondary fuse: 10 A or as indicated.

### 2.7 TIMING RELAYS

.1 Heavy duty type, solid state or pneumatic, electrically held, automatic reset after deenergizing, range and setting as shown. Coil rating: 120V 35Va. Contact rating: 120V 10A. Relays to be complete with timed and instantaneous contacts.

### 2.8 SMOKE DETECTORS IONIZATION

- .1 Supply and install where indicated on drawings.
- .2 Ceiling mount detectors shall be Edwards, Model 6250C or approved equivalent for 120 volt, 60 Hz power supply.

## 2.9 FIRE ALARM PULL STATION

.1 Edwards Cat. No. 270-SPO.

## 2.10 HIGH/LOW TEMPERATURE SWITCH (THERMOSTAT)

- .1 Adjustable isolated contacts to signal a low (or a high) temperature condition. Contacts rated 7.4A, 120VAC, 60 Hz (2.0 A @ 24 VAC), 1-SPDT.
- .2 Temperature range: 2°C to 38°C.
- .3 Finish: Grey
- .4 Wall mounted.
- .5 Manufacturer: Honeywell No. T631C1053.

### 2.11 **POWER SUPPLY**

- .1 Input 120 VAC
- .2 Output 24 VDC at 1.50 AMPDC
- .3 Regulation + 1%
- .4 Isolation D.C. Output Isolated from Case Ground
- .5 Line Protection Circuit Breaker or Fuse
- .6 Output Protection Output to be Short Circuit Protected
- .7 Connected Screw Terminals
- .8 Approvals C.S.A.
- .9 Manufacturer Hammond or Approved Equal

# 2.12 SECURITY SYSTEM (LEGAL/ILLEGAL ENTRY) KEY SWITCH AND FLASHING LIGHT

- .1 Supply and install key operated 2 position switch. Switch shall be installed on PLC enclosure door and identified as "Illegal Entry System" (Lamicoid).
- .2 Key switch positions shall be identified as "ENABLED" & "DISABLED". Key shall be "locked in" when switch in DISABLED position and only be removable when in ENABLED position. A DSC key pad system can be used instead of keys.
- .3 The electrical switch lock shall be Model 1W7B2 as manufactured by Best Lock Corporation or approved equivalent.
- .4 In lieu of a key switch, an approved key pad may be supplied.

# 2.13 DOOR SWITCHES

- .1 Supply and Install door switches as shown on the drawings. These switches shall have form C contacts rated at 120 VAC.
- .2 Supply and install all required equipment for mounting door switch above doors. Switches contacts to "open" when door opens and to remain "open" until door closes.
- .3 Door Switches shall be MICRO Switches as supplied by Honeywell Inc., Edwards 5600, or approved equivalent.

# PART 3 EXECUTION

## 3.1 INSTALLATION

.1 Install pushbutton stations, control devices as indicated and interconnect as indicated.

# 3.2 TESTS

- .1 Perform tests in accordance with Section 26 05 01.
- .2 Level controls shall be set and tested to operate pumps, valves and alarms as shown.

# END OF SECTION

## 1.1 RELATED REQUIREMENTS

.1 Section 26 05 00 – Common Work Results for Electrical.

## **1.2 REFERENCES**

- .1 International Electrotechnical Commission (IEC)
- .2 IEC 947-4-1-[2002], Part 4: Electromechanical contactors and motor-starters.
- .3 International Electrical and Electronic Engineers (IEEE) 519 Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.

## 1.3 ACTION AND INFORMATION SUBMITTALS

- .1 Provide submittals in accordance with Section
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Provide shop drawings for each type of starter to indicate:
    - .1 Mounting method and dimensions.
    - .2 Starter size and type.
    - .3 Layout and components.
    - .4 Enclosure types.
    - .5 Wiring diagram.
    - .6 Interconnection diagrams.

## 1.4 CLOSE-OUT SUBMITTALS

- .1 Provide maintenance materials
- .2 Submit operation and maintenance data for each type and style of motor starter for incorporation into maintenance manual.

## 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management.

## PART 2 PRODUCTS

## 2.1 **DESIGN REQUIREMENTS**

- .1 Continuous duty, solid state, modular, adjustable variable frequency drive (VFD) system suitable for operation on pumping station (utility) electrical power as well as diesel generator (emergency) electrical power systems, controlled locally or remotely.
- .2 Obtain motor data and coordinate characteristics of driven equipment with VFD system, regardless whether motor is supplied under this contract or by others.
- .3 Design drive system against:
  - .1 Premature breakdown of motor insulation,
  - .2 Higher than rated motor temperature rise as dictated by motor manufacturer, under intended operating speed and load range

## 2.2 **PERFORMANCE REQUIREMENTS**

- .1 Environmental conditions: Ambient operating temperature range 0 degrees Celsius to 40 degrees Celsius, humidity range 20 per cent to 90 per cent RH non-condensing, altitude 1,000 m maximum above sea level.
- .2 VFD system: Pulse width modulating (PWM) technology, 600V (+ten per cent, 10 per cent), three phase, 60Hz (±three per cent) input three phase, adjustable frequency and voltage output, suitable for controlling speed of standard Alternating Current (AC) squirrel cage induction motor.
- .3 Voltage/Frequency ratio (V/Hz): Vary output voltage proportionally with output frequency to maintain a constant V/Hz value over output range of 0.5 to 60Hz. Output voltage to remain constant above 60Hz.
- .4 VFD to be suitable for constant and variable torque applications. Horsepower of VFD to be based on constant torque setting.
- .5 Controller: Include power conversion components, power control logic devices and regulator circuitry. Incorporate into regulator, microprocessor technology for control of power semi-conductors.
- .6 Motor Speed Control: Stable throughout speed range, without cogging.
- .7 Rating: 100 per cent continuous motor current under ambient conditions indicated and 150 per cent rated motor current for one minute when applied to constant or high starting torque loads.
- .8 Displacement power factor: 0.93 minimum lagging over entire speed and load range.
- .9 Control circuitry ride-through capability: 16 milliseconds minimum on complete power loss.
- .10 Drive efficiency: 95 per cent minimum.

2.3

| .11 | Input current harmonics: 20 per cent maximum for any individual current harmonic and 30 per cent maximum total current harmonics at rectifier input, with balanced and unbalanced line voltage, under any load condition.                                                                                                             |  |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| .12 | Output: Output frequency regulation within $\pm$ one per cent and output current waveform close to sine wave such that motor rating, excluding service factor, is not reduced by more than five per cent.                                                                                                                             |  |
| .13 | Motor: Furnish VFD to match motor and driven equipment characteristics. For pre-<br>purchased equipment, coordinate requirements and sizing with the equipment supplier.                                                                                                                                                              |  |
| .14 | Internal components, including printed circuit boards: corrosion protected.                                                                                                                                                                                                                                                           |  |
| .15 | Design drive to withstand without damage, the following conditions:                                                                                                                                                                                                                                                                   |  |
|     | .1 Phase-to-phase output short circuit;                                                                                                                                                                                                                                                                                               |  |
|     | .2 Phase-to-ground output short circuit without utilizing an isolation transformer;                                                                                                                                                                                                                                                   |  |
|     | .3 Application of stationary, reverse or forward rotating motor while the drive is starting or while inadvertently running open circuit;                                                                                                                                                                                              |  |
|     | .4 Momentary loss of line voltage, whether partial or complete; and                                                                                                                                                                                                                                                                   |  |
|     | .5 Damage to direct current (dc) bus soft charging circuitry by internal short circuit.                                                                                                                                                                                                                                               |  |
| .16 | Motor feeder: Wire in Polyvinyl Chloride (PVC) jacketed rigid steel conduit and flexible cable by manufacturer.                                                                                                                                                                                                                       |  |
| .17 | Resetting after a fault: By reset input or by re issuing the Run command. Resetting by removing drive input power not acceptable.                                                                                                                                                                                                     |  |
| .18 | Restart after a power outage or low voltage condition: Automatic with ten second delay when power returns to normal, if run command is maintained.                                                                                                                                                                                    |  |
|     | HARMONIC DISTORTION AND NOISE                                                                                                                                                                                                                                                                                                         |  |
| .1  | Voltage Distortion Factor: As defined by IEEE 519, three per cent maximum at the input terminals where passive filter is used, or at the designated Point of Common Coupling where active filter is used as shown on the drawings. Harmonic analysis based on available symmetrical short current of 42,000A at 600V at input to VFD. |  |
| .2  | Input current harmonics: 20 per cent maximum for any individual current harmonic and 30 per cent maximum total current harmonics at rectifier input, with balanced and unbalanced line voltage, under any load condition.                                                                                                             |  |
| -   |                                                                                                                                                                                                                                                                                                                                       |  |

- .3 Furnish isolating transformers or series reactors, harmonic filters, or other devices and circuits to prevent one drive from adversely affecting operation of other drives supplied from the same transformer or same bus.
- .4 Ensure that means are provided to prevent Electromagnetic Interference (EMI) and Radio-Frequency Interference (RFI), if any, that are generated, do not reflect back into the power distribution system.

.5 Line notching: Notching area as defined by IEEE 519, 22,800V microseconds maximum with available short circuit of 35,000A at 600V. Notch depth, ten per cent maximum of normal peak line-to-neutral voltage.

# 2.4 SUBMITTALS

- .1 Comply with all submittals requirements as specified under Section 01 33 00 Submittals.
- .2 Submit shop drawings with the following:
  - .1 Detail specific electrical performance characteristics for each drive.
  - .2 Detail layout, enclosure, cooling requirements and similar items.
  - .3 Include values of notching and distortion factors at 600V input to drive. If additional filtering is required, state notching and distortion factors with and without filtering.
  - .4 Dimensional outline and equipment arrangement drawings including clearance requirements, foundation details and weights.
  - .5 Electrical schematics, wiring and interconnection drawings.
  - .6 Wiring diagrams and interface with SCADA
- .3 Submit operation and maintenance manuals with detailed records of start-up procedure, site calibration settings and adjustments in typewritten tabular form. Report voltage and current values at intermediate operating points.
- .4 Manufacturer to provide Overall Efficiency data at 50 per cent, 75 per cent and 100 per cent speed for all main components including the drive isolation transformer. For VFDs, producing output voltage harmonic distortions greater than two per cent, the Overall Efficiency to be decreased by 0.5 per cent at each point to account for the additional losses which will occur at the motor.
- .5 For VFDs over 100Hp, the Contractor to submit harmonic calculations to the 49th harmonic with the shop drawings for the VFD. The calculations to show total harmonic voltage and current distortion at the designated Point of Common Coupling.
- .6 For maximum removal of harmonic distortion, EMI and RFI from entering the power lines, provide a LC shunt filter (tuned to 5th harmonic) in combination with a 5% impedance harmonic compensated, epoxy impregnated, series reactor and connect to the line side of each VFD, to comply with the FCC requirements and to meet IEEE-519 specifications. The lineator (Advanced universal harmonic filter AUHF) shall filter voltage and current spike to comply to FCC requirement. The combined unit shall be as supplied by Mirus International Inc. or approved equivalent, rated for the 600/347 volt Wye, 3φ, 60 Hz power supply. Provide in same enclosure as VFD.
- .7 To attenuate load harmonics reflected waves, reduce motor operating temperature, reduce audible motor noise, to filter electrical noise (pulsed distortion and line notching) and to improve waveform to the motor, provide a 5% impedance, harmonic compensated, epoxy impregnated series (line) reactor connected to the load side of the VFDs rated 600 volts. Provide in the same enclosure as VFD, Rex Manufacturing Model 3PR, Cat. No. 3PR-0060C5H suitably sized motor for motor size, or approved equivalent.

### 2.5 QUALITY ASSURANCE

- .1 Inspect and test components and sub-assemblies for conformance to manufacturer's engineering and quality assurance specifications.
- .2 Test printed circuit boards for minimum 20 hours while heat cycled to maximum temperature of 55 degrees Celsius.
- .3 Operate power sections under worst case conditions minimum of 12 hours and operate with motors six hours minimum.
- .4 Test drive with motor before shipment to assure proper operation within the driven equipment speed range. Test and verify operating, alarm and interlock conditions.

## 2.6 MEASUREMENT AND PAYMENT

.1 Payment for the work outlined in this section is included in the lump sum tender price.

### 2.7 MANUFACTURERS

- .1 Acceptable manufacturer:
  - .1 Allen Bradley
  - .2 ABB ACS Series
  - .3 Vacon

### 2.8 MANUFACTURED UNITS

- .1 Enclosure
  - .1 Enclosure: VFD to be installed within standalone NEMA IA enclosure, and completely front accessible to internal components and wiring connections.
  - .2 Access doors: Hinged with automotive type door handles and three point latches, key operated with two sets of keys. Interlock door opening mechanism with main disconnecting device operating handle.
  - .3 Ventilation openings: Size to dissipate heat at full VFD capacity, vermin proof screens, sprinkler proof louvres and drip shields.
  - .4 Cooling fans: Minimum additional 25 per cent extra capacity.
  - .5 Steel channel base: Continuous under entire assembly.
  - .6 Location of expendable parts, (fuses and similar items): Close to front for ease of replacement.
  - .7 Conduit/cable entry points: Top and bottom.
  - .8 Cable support: cable support clips.
  - .9 Ground bus: Tin plated copper.
  - .10 Finish: Exterior, primed and two coats ASA number 61 grey factory standard epoxy enamel or powder coat; interior, matte white.
- .2 Primary Filters and Surge Protection

- .1 Filter circuits and surge suppressors: to protect inverter from Alternating Current (AC) line disturbances including 5,000V, 120J, maximum voltage spikes. Filters to prevent VFD from causing line voltage disturbances on pumping station distribution system.
- .2 Furnish input and output line reactors.
- .3 Furnish line filters to protect motor from damaging switching spikes.
- .3 Radio Frequency Suppression
  - .1 Suppress generation of radio frequencies.
- .4 Primary Disconnect Device
  - .1 Main power disconnecting device: Rated for full load current of drive.
  - .2 Primary Disconnect handle: Operable from outside without opening cubicle doors, mechanically interlocked to prevent door from being opened with primary disconnect in ON position.
  - .3 Moulded Case Breaker, Fuses and similar protection devices, rated for full load current of drive: As recommended by VFD manufacturer.
  - .4 Shunt trip: as indicated or as required for safety shutdown.
  - .5 Breaker handle: Operable from outside without opening cubicle doors, mechanically interlocked to prevent door from being opened with circuit breaker in ON position
- .5 Control Transformer
  - .1 Control transformer: Dry type, fused primary and secondary windings, sized for 125 per cent of maximum system control circuit requirements, including external circuits.
  - .2 Secondary voltage: 120V, 60Hz.
- .6 Operator Controls and Interlocks
  - .1 VFD controller to provide full motor selectable overcurrent protection (matching motor characteristics and overload heaters).
    - .1 Electronic motor overload, with selectable Class 5, 10, 15, 20, 25, and 30.
    - .2 Protection to be adjustable for various motor sizes between 50 per cent to 100 per cent VFD rating. Where this protection does not match motor rating, provide separate overload relays.
  - .2 Provide an isolated input (SPEED CONTROL) to accept a remote 4 20mA Direct Current (DC) control signal when speed control is in AUTO (Programmable Logic Control (PLC)) mode.
  - .3 Remote 4-20mA input signal to control motor speed when the VFD panel selector switch is in "Remote" only. When the selector switch is in "Local" the VFD Keypad is to provide the adjustable speed reference control.
  - .4 Provide an isolated input (START) to accept a remote dry contact 120VAC, 2Amps rated, that start the VFD when AUTO (PLC) mode is selected.
  - .5 Provide an isolated input (STOP) to accept a remote dry contact (external stop, fault contact or E-STOP) 120VAC, 2Amps rated, that shut down the VFD when AUTO (PLC) mode is selected.

- .6 Surge suppressor: On relay coils.
- .7 General-purpose relays: Heavy duty, industrial, Electrical Equipment Manufacturers Association of Canada (EEMAC) rated, electrically held, 120V, 60Hz, 10A, 120V AC convertible contacts, Type P by Allen-Bradley Canada Ltd.
- .8 Timing relays: 120V AC coil, 10A, 120V AC, convertible contacts, knob adjustable timing range as indicated, Type PT or NT by Allen-Bradley Canada Ltd.
- .9 Thermistor relay: To trip and lock out the motor. Refer to motor specifications for protective sensor description. Where a Remote RTD (RRTD) is shown on control schematics, provide an RRTD as described in clause 2.9 of this specification section.
- .10 Remote indication of VFD Fault status: Isolated, separate contact (one SPDT contact 240VAC, 2Amps rated).
- .11 Remote indication of Motor Running status: Isolated, separate contacts (two SPDT contacts 240VAC, 2Amps rated).
- .12 Remote indication of output speed: Isolated 4-20mA signal.
- .13 Remote indication of Ready status: Isolated, separate contacts (one SPDT contact 240VAC, 2Amps rated).
- .14 Remote indication of High Temperature and Seal Leakage status: Isolated, separate contact (one SPDT contact 240VAC, 2Amps rated).
- .15 Remote indication while AUTO is selected at MANUAL/OFF/AUTO switch: Isolated, separate contact (1 NO).
- .16 Solid state programming and diagnostic unit: Door mounted.
- .17 Door mounted Human Interface Module (HIM) with discrete selectors, and indicators, incorporating controls and indicators, heavy duty, oil tight design:
  - .1 MANUAL/OFF/AUTO (PLC) selection: discrete selector switch
  - .2 STOP/START pushbuttons: active when MANUAL / OFF / AUTO switch in MANUAL
  - .3 MANUAL/AUTO speed control selection,
  - .4 Manual speed control (through HIM), 0 100 per cent scale,
  - .5 Speed indication, 0 100 per cent scale,
  - .6 Elapsed run time indication (hourly), (separate elapsed time meter)
  - .7 Output current indication, 0-125 per cent scale.
- .18 Door mounted indicator lights: Push-to-test type with Light-Emitting Display (LED) lamps, indicating Power On (white), VFD Operation (red), Fault (amber).
- .19 Door mounted High Temperature and Seal Leakage status indication.
- .20 Internal adjustment features:
  - .1 Preset frequency adjustment, 50 to 100 per cent range; while external preset speed contact is closed, during REMOTE or AUTO control mode, the VFD starts and goes to a preset speed and ignores the external AUTO speed reference signal and ignores the external auto run signal.
  - .2 VFD shall automatically attempt to restart after a trip condition resulting from overcurrent, overvoltage, undervoltage, or overtemperature. For safety, the drive shall shut down and require manual reset and restart if the

automatic reset/restart function is not successful within a maximum of three attempts within a customer programmable time period. Auto-Restart shall be programmable to allow for individual fault selection.

- .3 Active current limit adjustment, 50 100 per cent range.
- .4 Maximum frequency adjustment, 50 100 per cent range.
- .5 Minimum frequency adjustment, 0 100 per cent range.
- .6 Acceleration ramp rate adjustment, 3 200 seconds.
- .7 Deceleration ramp rate adjustment, 3 200 seconds.
- .8 Slip compensation, minimum range five per cent of maximum frequency, no load to full load.
- .9 IR compensation or boost, minimum range 30VAC.
- .21 Isolated output signals, 4 20mA, for remote readouts of output frequency and total power.
- .22 Main logic Printed Circuit Board (PCB): Adjustment and test points at ground potential.
- .7 Alarms and Safety Interlocks
  - .1 Shut down without damage under the following conditions: (unless otherwise indicated, precise limits to be specified and documented by VFD manufacturer)
    - .1 Low AC input voltage. Indirect sensing of line voltage via DC bus not acceptable,
    - .2 Loss of input phase,
    - .3 High DC bus voltage,
    - .4 Low DC bus voltage,
    - .5 High peak DC bus or output current,
    - .6 Drive over-temperature,
    - .7 External fault contact operation,
    - .8 Motor over-temperature and seal leakage relay operation.
    - .9 Motor ground fault.
  - .2 Annunciators: LED type, visible on or through window in front door with the following real time annunciators:
    - .1 Incoming power,
    - .2 External interlock,
    - .3 DC bus charged,
    - .4 Drive over-temperature fault,
    - .5 Motor ground fault.
  - .3 Fault memory retention circuit: with manual reset, annunciating the following system conditions:
    - .1 Line voltage fault,
    - .2 Over current fault,
    - .3 DC bus voltage fault,
    - .4 Logic fault.

- .4 Current limit: Control logic, accurate over entire speed range, to automatically reduce output frequency when load current exceeds adjusted current limit level.
- .5 Motor regeneration: Override circuit to limit regenerated energy.

## .8 Wiring

- .1 Internal wiring: Copper conductor, stranded, 600V rated.
- .2 Wire identification: To correspond to wire numbers on schematic and control diagrams, Type Z wire marker by Wieland Electric Inc. on both ends. Colour coding is not acceptable.
- .3 Terminal blocks: Modular, for external wiring connections, 600V, 25A rating, DIN rail mounted. Label each terminal with same designation as connecting wire.
- .4 Group terminal blocks according to voltage or signal level and function. Allow 150mm space between rows of terminals blocks. Install two conductors per block maximum.
- .5 Barriers: Covering exposed terminals and terminal blocks against inadvertent contact.
- .6 Warning labels: Lamacoid with 3mm white letters on red background, on front of compartments where multiple power sources are present.
- .7 Lay-in duct: For wire groupings of six conductors or more. Acceptable Manufacturer: Panduit Canada. For smaller runs, use plastic tie wrap and clips.
- .9 Identification
  - .1 Equipment identification:- Electrical General Requirements.
  - .2 Nameplates: For face-mounted components.
  - .3 Identify interior sub-assemblies compartments with lamacoid labels.
  - .4 Warning nameplates: Lamacoid, 5mm white lettering on red background, indicating presence of live circuit when VFD is in normal or bypass mode. Mount on access doors and internal compartment doors or barriers.
- .10 Spare Parts and Special Tools
  - .1 Refer to Section 01 75 00 Spare Parts and Maintenance Material.
  - .2 Provide spare parts including one HMI (keypad), sixteen indicating lights, twelve control fuses and six semiconductor fuses.Pushbutton: heavy duty, oil tight as required.
  - .3 Selector switches: heavy duty, oil tight as required.
  - .4 Indicating lights: heavy duty, oil tight, type and colour as indicated.

# PART 3 EXECUTION

# 3.1 INSTALLATION

- .1 Install starters and accessories, connect power and control as per shop and working drawings.
- .2 Ensure correct settings on overload devices.

- .3 Provide auxiliary relays where required by high contactor coil currents and PLC interface.
- .4 Supply and install a VFD's for pumps. Submit detailed installation shop drawings for both locations.
- .5 Install equipment in locations indicated.
- .6 Verify required floor openings are provided.
- .7 Connect external power, control and instrumentation wiring.
- .8 Conduct VFD manufacturer's recommended tests and start up procedures.
- .9 Train Owner's staff in aspects of VFD operation, maintenance and start up procedures.

## 3.2 COORDINATION

.1 Coordinate characteristics and integration of variable frequency drive units with manufacturer of motors and driven equipment supplied under this contract or other contracts.

### **3.3 FIELD QUALITY ASSURANCE**

- .1 Carry out tests recommended by the manufacturer.
- .2 Verify voltage and current distortion and line notching factors do not exceed limits specified.
- .3 Submit report by testing organization, sealed by a Professional Engineer, verifying measured voltage distortion and line notching factors comply with specified requirements.

### 3.4 ON-SITE START-UP AND COMMISSIONING

- .1 Include services of manufacturer's technical representative to assist in setting up the VFD control systems on job site.
- .2 Follow the VFD manufacturer's recommended test and start-up procedures and refer to Division 1.
- .3 Include necessary visits by manufacturer's representative to start up and ensure trouble free operation of the systems. Allow for a minimum of two-person-days total for the VFD systems. The number of visits and person-days per visit to be coordinated with the Contractor in accordance with the Construction, Start-up and Commissioning Schedules.

## 3.5 ACCESSORIES

- .1 Pushbutton: heavy duty, oil tight as required.
- .2 Selector switches: heavy duty, oil tight as required.
- .3 Indicating lights: heavy duty, oil tight, type and colour as indicated.

# **END OF SECTION**

## 1.1 **RELATED DOCUMENTS**

.1 Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

.1 This Section includes packaged engine-generator sets suitable for use in applications with the features as specified and indicated where the engine generators will be used as the Standby power source for the system.

## 1.3 **DEFINITIONS**

- .1 Emergency Standby Power (ESP): Per ISO 8528: The maximum power available during a variable electrical power sequence, under the stated operating conditions, for which a generating set is capable of delivering in the event of a utility power outage or under test conditions for up to 200 hours of operation per year with the maintenance intervals and procedures being carried out as prescribed by the manufacturers. The permissible average power output (Ppp) over 24 hours of operation shall not exceed 70 percent of the ESP unless otherwise agreed by the RIC engine manufacturer.
- .2 Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

## 1.4 ACTION SUBMITTALS

- .1 Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
  - .1 Thermal damage curve for generator.
  - .2 Time-current characteristic curves for generator protective device.
  - .3 Sound test data, based on a free field requirement.
- .2 Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, and location and size of each field connection.
  - .1 Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
  - .2 Wiring Diagrams: Control interconnection, Customer connections.
- .3 Certifications:
  - .1 Submit statement of compliance which states the proposed product(s) is certified to the emissions standards required by the location for EPA, stationary emergency application.

### 1.5 INFORMATIONAL SUBMITTALS

- .1 Source quality-control test reports.
  - .1 Certified summary of prototype-unit test report. See requirements in Part 2 "Source Quality Control" Article Part A. Include statement indicating torsional compatibility of components.
  - .2 Certified Test Report: Provide certified test report documenting factory test per the requirements of this specification, as well as certified factory test of generator set sensors per NFPA110 level 1.
  - .3 List of factory tests to be performed on units to be shipped for this Project.
- .2 Warranty:
  - .1 Submit manufacturer's warranty statement to be provided for this Project.

## 1.6 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100km of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
- .2 Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.
- .3 Comply with CSA C282
- .4 Comply with NFPA 70 (National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702).
- .5 Comply with NFPA 110 (Emergency and Standby Power Systems) requirements for Level 1 emergency power supply system.
- .6 Comply with CSA 22.2.

## **1.7 PROJECT CONDITIONS**

- .1 Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
- .2 Ambient Temperature: -30.0 deg C (-22.0 deg F) to 40.0 deg C (104.0 deg F).
  - .1 Relative Humidity: 0 to 95 percent.
  - .2 Altitude: Sea level to 1000.0 feet (304.8 m).

### 1.8 WARRANTY

.1 Base Warranty: Manufacturer shall provide base warranty coverage on the material and workmanship of the generator set for a minimum of twenty-four (24) months for Standby product from registered commissioning and start-up.

## PART 2 PRODUCTS

## 2.1 MANUFACTURERS

.1 Manufacturers: Kohler, Cummins or approved equal.

## 2.2 ENGINE-GENERATOR SET

.1 Factory-assembled and -tested, engine-generator set. It shall provide 750 kVA and 600 kW when operating at 600VAC volts, 3 phase, 4 wire,60 Hz,,0.80 power factor. The generator set shall be capable of a 130°C Standby rating while operating in an ambient condition of less than or equal to 77 °F and a maximum elevation of 500 ft above sea level. The standby rating shall be available for the duration of the outage.

## 2.3 ENGINE

- .1 The engine rated speed of 1800 rpm, and shall be equipped with the following:
  - .1 Electronic isochronous governor capable of 0.25% steady-state frequency regulation
  - .2 12-volt positive-engagement solenoid shift-starting motor
  - .3 70-ampere automatic battery charging alternator with a solid-state voltage regulation
  - .4 Positive displacement, full-pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain
  - .5 Dry-type replaceable air cleaner elements for normal applications
  - .6 Engine-driven or electric fuel-transfer pump including fuel filter and electric solenoid fuel shutoff valve capable of lifting fuel
  - .7 The turbocharged engine shall be fueled by diesel
  - .8 The engine shall have a minimum of 4 cylinders and be liquid-cooled
- .2 The engine shall be CSA certified from the factory
- .3 The generator must accept rated load in one-step.

## 2.4 COOLING SYSTEM

- .1 The engine shall be liquid-cooled by a closed loop, unit mounted radiator rated to operate the generator set at full load at an ambient temperature of 50 degrees C (122 degrees F). The radiator fan and other rotating engine parts shall be guarded against accidental contact.
- .2 Standard Air Cleaner
  - .1 The air cleaner shall provide engine air filtration which meets the engine manufacturer's specifications under typical operating conditions.
- .3 Battery
  - .1 Each genset requires a maintenance free BCI group 24 battery which must meet the engine manufactures' specifications for the ambient conditions specified in

Part 1 Project Conditions and shall comply with the NFPA requirements for engine cranking cycles. This battery shall be rated according to SAE Standards J-537 with a minimum cold cranking amp of 650 amps and a minimum reserve capacity of 120 Minutes at 80F. The battery plates shall be constructed of a Calcium-Lead alloy to provide long waterless operation and extended battery life. The battery must contain a handle to aid in lifting and the case must be constructed of polypropylene to resist breakage and extend service life.

- .2 Battery rack and battery cables capable of holding the manufacturer's recommended batteries shall be supplied.
- .4 Housing
  - .1 Level 1 Sound Attenuated Enclosure
    - .1 The generator set shall be supplied with a Sound Attenuated Enclosure, providing a sound pressure of 75 dB(A) at 7 meters (23 feet) – free field – using acoustic insulation and acoustic-lined inlet hoods, constructed from high strength, low alloy 14 gauge galvanized steel. The acoustic insulation used shall meet ULC 94 HF1 flammability classification. The enclosure shall be manufactured from bolted panels to facilitate service, future modifications, or field replacement. The enclosure shall use external vertical air inlet and outlet hoods with 90 degree angles to discharge air up and reduce noise. The enclosure shall have an integral rodent guard and skid end caps and shall have bracing to meet 241 kph (150 mph) wind loading.
    - .2 The enclosure components and skid shall be cleaned with a two-stage alkaline cleaning process to remove grease, grit, and grime from parts. Components shall then be subjected to a Zirconium-based conversion coating process to prepare the metal for electrocoat (e-coat) adhesion. All enclosure parts shall receive an 100% epoxy primer electrocoat (e-coat) with high-edge protection. Following the e-coat process, the parts shall be finish coated with powder baked paint for superior finish, durability, and appearance with a Power ArmorTM industrial finish that provides heavy duty durability in harsh conditions, and is fade-, scratch- and corrosion-resistant.
    - .3 The enclosure must surpass a 3,000 hour salt spray corrosion test per ASTM B-1117.
    - .4 Enclosures will be finished in the manufacturer's standard color.
    - .5 The enclosures shall allow the generator set to operate at full load in an ambient temperature of 50°C with no additional derating of the electrical output of the generator set.
    - .6 Enclosures shall be equipped with sufficient side and end doors to allow access for operation, inspection, and service of the unit and all options. Minimum requirements are two doors per side. When the generator set controller faces the rear of the generator set, an additional rear facing door is required. Access to the controller and main line circuit breaker shall meet the requirements of the Canadian Electric Code.
    - .7 Doors shall be fitted with hinges, hardware, and the doors shall be removable.

- .8 Doors shall be equipped with lockable latches. Locks shall be keyed alike. Door locks shall be recessed to minimize potential of damage to door/enclosure.
- .9 A duct between the radiator and air outlet shall be provided to prevent recirculation of hot air.
- .10 The complete exhaust system shall be internal to the enclosure.
- .11 The critical silencer shall be fitted with a tailpipe and rain cap.
- .5 Fuel oil storage
  - .1 Double Wall Secondary Containment Sub-base Fuel Tank.
    - .1 The generator set shall be supplied with a sub-base fuel tank of sufficient capacity to hold diesel fuel for 48 hours capacity at full load. The state tank shall have 5 Gal fuel lockable spill containment and a above grade vent extensions .
    - .2 The sub-base fuel system shall be listed under ULC 142, subsection entitled Special Purpose Tanks EFVT category, and will bear their mark of ULC Approval according to their particular classification.
    - .3 The above ground steel secondary containment rectangular tank for use as a sub base for diesel generators is manufactured and intended to be installed in accordance with the Flammable and Combustible Liquids Code—NFPA 30, the Standard for Installation and Use of Stationary Combustible Engine and Gas Turbines—NFPA 37, and Emergency and Standby Power Systems—NFPA 110.
    - .4 The primary tank shall be rectangular in shape and constructed in clam shell fashion to ensure maximum structural integrity and allow the use of a full throat fillet weld.
    - .5 Steel Channel Support System. Reinforced steel box channel for generator support, with a load rating of 5,000 lbs. per generator mounting hole location. Full height gussets at either end of channel and at generator mounting holes shall be utilized.
    - .6 Exterior Finish. The sub-base tank exterior finish shall be Power Armor PlusTM, a polyurea-textured rubberized coating.
    - .7 Normal venting shall be sized in accordance with the American Petroleum Institute Standard No 2000, Venting Atmospheric and Low Pressure Storage Tanks not less than 1-1/4" (3 cm.) nominal inside diameter.
    - .8 The emergency vent opening shall be sized to accommodate the total capacity of both normal and emergency venting and shall be not less than that derived from NFPA 30, table 2-8, and based on the wetted surface area of the tank. The wetted area of the tank shall be calculated on the basis of 100 percent of the primary tank. The vent is to be spring-pressure operated: opening pressure is 0.5/psig and full opening pressure is 2.5 psig. The emergency relief vent is to be sized to accommodate the total venting capacity of both normal and emergency vents.
    - .9 There shall be a 2" NPT opening within the primary tank and lockable manual fill cap.

| 10 | A direct reading, ULC listed, magnetic fuel level gauge with a          |
|----|-------------------------------------------------------------------------|
|    | hermetically sealed, vacuum tested dial, to eliminate fogging, shall be |
|    | provided.                                                               |

- .11 A float switch for remote or local annunciation of a (50% standard) low fuel level condition shall be supplied.
- .12 Inner Tank Leak Alarm Kit Includes one light, one horn remote annunciator panel, leak alarm switch and wiring. This kit is intended when the inner tank has leaked into the outer tank, thus indicating a need for a replacement tank.

## .6 Controller

- .1 Decision-Maker® 3000 Generator Set Controller
  - .1 The generator set controller shall be a microprocessor based control system that will provide automatic starting, system monitoring, and protection. The controller system shall also provide local monitoring and remote monitoring. The control system shall be capable of PC based updating of all necessary parameters, firmware, and software.
  - .2 The controller shall be mounted on the generator set and shall have integral vibration isolation. The controller shall be prototype and reliability tested to ensure operation in the conditions encountered.
- .2 Codes and Standards
  - .1 The generator set controller shall meet NFPA 110 Level 1 requirements and shall include an integral alarm horn as required by NFPA.
  - .2 The controller shall meet NFPA 99 and NEC requirements.
  - .3 The controller shall be CSA listed.
- .3 Applicability
  - .1 The controller shall be a standard offering in the manufacturer's controller product line.
  - .2 The controller shall support 12-volt and 24volt starting systems.
  - .3 The controller's environmental specification shall be: -40°C to 70°C operating temperature range and 5-95% humidity, non-condensing.
  - .4 The controller shall mount on the generator or remotely within 40 feet with viewable access.
- .4 Controller Buttons, Display and Components
  - .1 The generator set controller shall include the following features and functions:
    - .1 Push button Master Control buttons. The buttons shall be tactilefeel membrane with an indicator light to initiate the following functions:
      - .1 Run Mode: When in the run mode the generator set shall start as directed by the operator.
      - .2 Off/Reset Mode: When in the Off/Reset mode the generator set shall stop, the reset shall reset all faults, allowing for the restarting of the generator set after a shutdown.

- .3 Auto Mode: When in Auto the mode the generator set shall be ready to accept a signal from a remote device.
- .2 Emergency Stop Switch. The remote stop switch shall be red in color with a "mushroom" type head. Depressing the stop button will immediately stop the generator set and lockout the generator set for any automatic remote starting.
- .3 Push Button/Rotary Selector dial. This dial shall be used for selection of all Menus and sub-menus. Rotating the dial moves you through the menus, pushing the dial selects the menu and function/features in that menu. Pushing the button selects the feature/function and sub-menus.
- .4 Digital Display. The digital display shall be alphanumeric, with 2 lines of data and approximately 24 charters. The display shall have back lighting for ease of operator use in high and low light conditions. The display shall display status of all faults and warnings. The display shall also display any engine faults. While the generator set is running, the display shall scroll all-important information across the screen for ease of operator use. The scroll can be stopped by pushing the rotary dial. The display shall fall asleep when the generator set is not running and will wake-up when the generator set starts or the rotary dial is depressed.
- .5 Fault Light. The controller shall have an annunciator fault light that glows red for faults and yellow for warnings. These faults and warnings shall be displayed in the digital display. The fault light will also glow yellow when not in AUTO.
- .6 Alarm Horn. The controller shall provide an alarm horn that sounds when any faults or warnings are present. The horn shall also sound when the controller is not in the AUTO mode.
- .7 Alarm Silence/Lamp Test Button. When this button is depressed, it shall test all controller lamps. This button will also silence the alarm horn when the unit is not AUTO.
- .8 USB Connection. The controller shall have a USB connection on the face of the controller. This connection shall allow for updating of all software and firmware. This port shall also allow for all servicing of generator set parameters, fault diagnostics and viewing of all controller information via use a laptop computer.
- .9 Dedicated user inputs. The controller shall have dedicated inputs for remote emergency stop switch, remote 2-wire star for transfer switch and auxiliary shutdown.
- .10 The controller shall have auto resettable circuit protection integral on the circuit board.
- .5 System Controller Monitoring and Status Features and Functions
  - .1 The generator controller shall display and monitor the following engine and alternator functions and allow adjustments of certain parameters at the controller:
    - .1 Overview menu
      - .1 Active shutdowns and warnings shall be displayed if present and without the need of operator interface

- .2 Engine runtime with total hours
- .3 Average line to line voltage
- .4 Coolant temperature
- .5 Fuel level or pressure
- .6 Oil pressure
- .7 Battery voltage
- .8 Software version
- .9 Frequency
- .10 Average current
- .2 Engine metering menu.
  - .1 Engine speed
  - .2 Oil pressure
  - .3 Coolant temperature
  - .4 Battery voltage
- .3 Generator metering menu.
  - .1 Total power in VA
  - .2 Total power in W
  - .3 Rated power % used
  - .4 Voltage L-L and L-N for all phases
  - .5 Current in line
  - .6 Frequency
- .4 Generator set information.
  - .1 Generator set model number
  - .2 Generator set serial number
  - .3 Controller set number
- .5 Generator set run time.
  - .1 Engine run time total hours
  - .2 Engine loaded total hours
  - .3 Number of engine starts
  - .4 Total energy in kW
- .6 Generator set system
  - .1 System voltage
  - .2 System frequency 50/60Hz
  - .3 System phase, single/three phase
  - .4 Power rating kW
  - .5 Amperage rating
  - .6 Power type standby/prime
  - .7 Measurement units, metric/English units adjustable
  - .8 Alarm silence, always or auto only

| .7 | Generator set calibration, the following are adjustable at the |
|----|----------------------------------------------------------------|
|    | controller.                                                    |

- .1 Voltage L-L and L-N all phases
- .2 Current in Line
- .3 Reset all calibrations
- .8 Voltage regulation, +/-0.5% regulation, the following is adjustable at the controller.
  - .1 Voltage Adjustable +/- 10%
- .9 Digital and Analog Inputs and outputs
  - .1 Displays settings and status
- .10 Event Log
  - .1 Stores event history, up to 1000 events
- .6 Controller Engine control features and functions
  - .1 Automatic restart the controller has automatic restart feature that initiates the start routine and re-crank after a failed start attempt.
  - .2 Cyclic cranking the controller shall have programmable cyclic cranking
  - .3 Engine starting aid the controller shall have the capability of providing control for an optional engine starting aid.
  - .4 The control system shall include time delays for engine start and cool down.
  - .5 The control system shall interface with the engine ECM and display engine fault codes and warnings. The ECM shall also include sender failure monitoring to help distinguish between failed senders and actual failure conditions.
  - .6 The controller shall monitor and display engine governor functions with include steady state and transient frequency monitoring
- .7 Controller Alternator control features and functions
  - .1 Integrated hybrid voltage regulator. The system shall have integral microprocessor based voltage regulator system that provides +/- 5% voltage regulation, no-load to full load with three phase sensing. The system is prototype tested and control variation of voltage to frequency. The voltage regulator shall be adjustable at the controller with maximum +/- 10% adjustable of nominal voltage.
  - .2 AC output voltage regulator adjustment. The system shall allow for adjustment of the integral voltage regulator with maximum of +/- 10% adjustment of the system voltage.
  - .3 Alternator thermal overload protection. The system shall have integral alternator overload and short circuit protection matched to each alternator for the particular voltage and phase configuration.
  - .4 Power metering. The controller digitally displays power metering of kW and kVA.
- .8 Other control features and functions

- .1 Event logging. The controller keeps a record of up to 1000 events, for warning and shutdown faults. This fault information becomes a stored record of systems events and can be reset.
- .2 Historical data logging. The controller total number of generator set successful start shall be recorded and displayed.
- .3 Programmable access. The control system shall include a USB port that gives service technicians the ability to provide software and firmware upgrades. The system shall also be capable of allowing setting of all critical parameters using the service software and a laptop computer. All parameters and setting should be capable to being stored on a laptop for future upgrades of printing for analysis.
- .9 Generator Set Warning, Shutdown Alarm and Status
  - .1 The generator set shall have alarms and status indication lamps that show non-automatic status and warning and shutdown conditions. The controller shall indicate with a warning lamp and or alarm and on the digital display screen any shutdown, warning or engine fault condition that exists in the generator set system. The following alarms and shutdowns shall exist as a minimum:
    - .1 Engine functions
      - .1 Critical high fuel level (alarm)
      - .2 ECM communication loss (shutdown)
      - .3 ECM diagnostics (alarm & shutdown)
      - .4 Engine overspeed (shutdown)
      - .5 Engine start aid active
      - .6 Engine under speed (shutdown)
      - .7 Fuel tank leak (alarm & shutdown)
      - .8 High DC battery voltage (alarm)
      - .9 High coolant temperature (alarm & shutdown)
      - .10 High fuel level (alarm)
      - .11 Low DC battery voltage (alarm)
      - .12 Low coolant level (shutdown)
      - .13 Low coolant temperature (alarm)
      - .14 Low cranking voltage (alarm)
      - .15 Low engine oil level (alarm & shutdown)
      - .16 Low fuel level (alarm & shutdown)
      - .17 Low fuel pressure (alarm)
      - .18 Low oil pressure (alarm & shutdown)
      - .19 No coolant temperature signal (shutdown)
      - .20 No oil pressure signal (shutdown)
      - .21 Overcrank (shutdown)
      - .22 Speed sensor fault (alarm)
    - .2 Generator functions

- .1 AC sensing loss over & under current (alarm & shutdown)
- .2 Alternator protection (shutdown)
- .3 Ground fault input (alarm)
- .4 kW overload (shutdown)
- .5 Locked rotor (shutdown)
- .6 Over-frequency (shutdown)
- .7 Over AC voltage (shutdown)
- .8 Under-frequency (shutdown)
- .9 Under AC voltage (shutdown)
- .10 Emergency stop (shutdown)
- .3 Other General functions
  - .1 Battery charger fault (alarm)
  - .2 Common fault (shutdown)
  - .3 Common warning (alarm)
  - .4 Master switch not in auto (alarm)
  - .5 Generator running
  - .6 Input/Output fault (alarm)
- .4 The generator set controller shall also be capable of meeting all necessary NFPA 110 level 1 requirements that include several of the above along with; EPS supplying load, Master switch "not in auto", and contacts for local and remote common alarm.

## .10 Communications

- .1 If the generator set engine is equipped with an ECM (engine control module), the controller shall communicate with the ECM for control, monitoring, diagnosis, and meet SAE J1939 standards
- .2 Communication bus shall be available.
- .3 A Communication bus shall be able to monitor and alter parameters, and start or stop a generator.
- .4 The controller shall have the capability to communicate to a personal computer (IBM or compatible) and appropriate application software
- .5 A variety of connections shall be available based on requirements:
- .6 A single control connection to a PC via USB
- .7 Internet connection via Ethernet
- .8 Generator and transfer switch controls shall be equipped with communications modules capable of connecting to the same communication network.
- .7 Generator Overcurrent and Fault Protection
  - .1 The generator shall be provided with a factory installed, 100% rated line circuit breaker rated at 250.00 amperes that is ULC489 listed. Line circuit breakers shall be sized for the rated ampacity of the loads served by the breaker per the NEC.

Additional breaker to be provided for load bank test point connection as part of maintenance test.

- .2 The circuit breaker(s) shall incorporate an electronic trip device with the following characteristics:
- .3 Adjustable long time delay
- .4 Instantaneous
- .5 Load side lugs shall be provided from the factory. The line circuit breaker shall include auxiliary contacts, shunt trip, undervoltage trip, alarm switch, and overcurrent switch functionality. Load side breaker connections made at the factory shall be separated from field connections.
- .6 The shunt trip device shall be connected to trip the generator breaker when the generator-set is shut down by other protective devices.
- .7 When GFI is required per the NEC, additional neutrals shall be factory installed, and the alarm indication shall be integrated with the generator-set alarms.
- .8 Barriers to provide segregation of wiring from an emergency source to emergency loads from all other wiring and equipment, if required by the NEC, shall be provided.
- .8 Alternator
  - .1 The alternator shall be salient-pole, brushless, 2/3-pitch, with 4 bus bar provision for external connections, self-ventilated, with drip-proof construction and amortisseur rotor windings, and skewed for smooth voltage waveform. The ratings shall meet the NEMA standard (MG1-32.40) temperature rise limits. The insulation shall be class H per ULC1446 and the varnish shall be a vacuum pressure impregnated, fungus resistant epoxy. Temperature rise of the rotor and stator shall be limited to 130°C Standby. The PMG based excitation system shall be of brushless construction controlled by a digital, three phase sensing, solidstate, voltage regulator capable of maintaining voltage within  $\pm 0.25\%$  at any constant load from 0% to 100% of rating with <0.5% drift due to temperature variation. The AVR shall be capable of proper operation under severe nonlinear loads and provide individual adjustments for voltage range, stability and volts-perhertz operations. The AVR shall be protected from the environment by conformal coating. The waveform harmonic distortion shall not exceed 5% total RMS measured line-to-line at full rated load. The TIF factor shall not exceed 50.
  - .2 The alternator shall have dual maintenance-free bearings, designed for 40,000 hour B10 life. The alternator shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.
  - .3 The generator shall be inherently capable of sustaining at least 300% of rated current for at least 10 seconds under a 3-phase symmetrical short circuit without the addition of separate current-support devices.
  - .4 Motor starting performance and voltage dip determinations shall be based on the complete generator set. The generator set shall be capable of supplying 502.00 LRKVA for starting motor loads with a maximum instantaneous voltage dip of 35%, as measured by a digital RMS transient recorder in accordance with IEEE Standard 115. Motor starting performance and voltage dip determination that does not account for all components affecting total voltage dip, i.e., engine, alternator, voltage regulator, and governor will not be acceptable. As such, the

generator set shall be prototype tested to optimize and determine performance as a generator set system.

- .9 Vibration Isolation
  - .1 Vibration isolators shall be provided between the engine-alternator and heavyduty steel base.

## 2.5 ACCESSORIES

- .1 The generator shall be supplied with a thermostatically controlled strip heater to prevent the accumulation of moisture and dampness and to maintain the stator windings above the dew point. The heater shall be wired to be "on" at all times that the generator set is not operating.
- .2 The generator set shall be supplied with a 6-ampere automatic float/equalize battery charger capable of charging both lead-acid and gel-cell type batteries, with the following features:
  - .1 Automatic 3-stage float to equalization charge
  - .2 1% steady-state voltage regulation from no load to full load over 10% AC input line voltage variation
  - .3 Indicator LED lamps for charge state indication (bulk charge/absorption/float)
  - .4 Ambient temperature operating range: -40°C to 70°C
  - .5 Potting for durability and waterproofing
  - .6 Short-circuit and reverse polarity protection
  - .7 UL 1236 listed
  - .8 UL 2200 compliant
  - .9 CSA certified
  - .10 Ring terminals for battery connection.
- .3 The generator set shall be furnished with rodent guards to prevent rodent intrusion and protect internal components.
- .4 Fuel pressure gauge A pressure gauge is mounted into the fuel line to display the pressure of the incoming fuel.
- .5 Battery rack and battery cables capable of holding the manufacturer's recommended batteries shall be supplied.
- .6 Block Heater The block heater shall be thermostatically controlled, 1,800 watt, 110-120 VAC single phase, to maintain manufacturers recommended engine coolant temperature to meet the start-up requirements of NFPA 99 and NFPA 110, Level 1.
- .7 Supply flexible fuel lines to provide a flexible connection between the engine fuel fittings and the fuel supply tank piping and for the fuel return lines from the injector pump per engine manufacturer's recommendations. Flex line shall have a protective steel wire braid to protect the hose from abrasion.

- .8 The generator set shall be supplied with a common failure relay to provide means of signaling fault and/or shutdown conditions.
  - .1 The common failure relay shall remotely signal auxiliary faults, emergency stop, high engine temperature, low oil pressure, overcrank, and over speed via one single-pole, double-throw relay with 10 amps at 120 VAC contacts.
  - .2 The relay contacts shall be gold flashed to allow use of low current draw devices (100ma @ 28VDC min.).
  - .3 Once energized the relay shall remain latched until the system is reset by the main controller switch.
- .9 The generator set shall be provided with a run relay which shall provide a three-pole, double-throw relay with 10-amp/ 250 VAC contacts to indicate that the generator is running. The run relay dry contacts can be used for energizing or de-energizing customer devices while the generator is running (e.g. louvers, indicator lamps, etc.)

## 2.6 SOURCE QUALITY CONTROL

- .1 Non-Conforming Work
  - .1 To ensure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and/or local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.
    - .1 Design Prototype Tests. Components of the emergency system, such as the engine/generator set, transfer switch, and accessories, shall not be subjected to prototype tests because the tests are potentially damaging. Rather, similar design prototypes and preproduction models shall be subject to the following tests:
      - .1 Maximum power (kW)
      - .2 Maximum motor starting (kVA) at 35% instantaneous voltage dip.
      - .3 Alternator temperature rise by embedded thermocouple and/or by resistance method per NEMA MG1-32.6.
      - .4 Governor speed regulation under steady-state and transient conditions.
      - .5 Voltage regulation and generator transient response.
      - .6 Harmonic analysis, voltage waveform deviation, and telephone influence factor.
      - .7 Three-phase short circuit tests.
      - .8 Alternator cooling air flow.
      - .9 Torsional analysis to verify that the generator set is free of harmful torsional stresses.
      - .10 Endurance testing.
    - .2 Final Production Tests. Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:
      - .1 Single-step load pickup
- .2 Safety shutdown device testing
- .3 Rated Power @ 0.8 PF
- .4 Maximum power
- .5 Upon request, a witness test, or a certified test record sent prior to shipment.
- .3 Site Tests. The manufacturer's distribution representative shall perform an installation check, startup, and building load test. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:
  - .1 Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.
  - .2 Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery chargers, alternator strip heaters, remote annunciators, etc.
  - .3 Generator set startup under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during operation, normal and emergency line-to-line voltage and frequency, and phase rotation.
  - .4 Automatic start by means of a simulated power outage to test remote-automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge level along with generator set voltage, amperes, and frequency shall be monitored throughout the test.

#### 2.7 SPARES

- .1 Spares to be maintained at site
  - .1 2 fuel filters
  - .2 2 oil filters
  - .3 2 air filters

#### PART 3 EXECUTION

### 3.1 INSTALLATION

- .1 Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions.
- .2 Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall

also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.

- .3 Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer's instructions and seismic requirements of the site.
- .4 Equipment shall be initially started and operated by representatives of the manufacturer. All protective settings shall be adjusted as instructed by the consulting engineer.
- .5 All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to initial operation and final testing of the system.
- .6 The fuel tank as it is over 2000L shall be inspected and certified by a licensed inspector as per Code B139.
- .7 On completion of the installation by the electrical contractor, the generator set supplier shall conduct a site evaluation to verify that the equipment is installed per manufacturer's recommended practice.

## 3.2 ON-SITE ACCEPTANCE TEST

- .1 The complete installation shall be tested to verify compliance with the performance requirements of this specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests. The generator set manufacturer shall provide a site test specification covering the entire system. Tests shall include:
- .2 Prior to start of active testing, all field connections for wiring, power conductors, and bus bar connections shall be checked for proper tightening torque.
- .3 Installation acceptance tests to be conducted on site shall include a "cold start" test, a two hour full load (resistive) test, and a one-step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test, if necessary.
- .4 Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service, and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel. The test shall be dome after hours or on weekend when the building is vacant.

### 3.3 TRAINING

.1 The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to 5 persons. Training date shall be coordinated with the facility owner.

### 3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

### 3.5 SERVICE AND SUPPORT

- .1 The generator set supplier shall maintain service parts inventory for the entire power system at a central location which is accessible to the service location 24 hours per day, 365 days per year. The inventory shall have a commercial value of \$3 million or more. The manufacturer of the generator set shall maintain a central parts inventory to support the supplier, covering all the major components of the power system, including engines, alternators, control systems, paralleling electronics, and power transfer equipment.
- .2 The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. There shall be monthly, semi-annual and annual testing done based on C282. Report and logs shall be maintained on site. The supplier shall maintain an inventory of critical power system replacement parts in the local service location. Service vehicles shall be stocked with critical replacement parts.
- .3 The service organization shall be on call 24 hours per day, 365 days per year. The service organization shall be physically located within 100km of the site.
- .4 The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.

## **END OF SECTION**

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

.1 Materials and installation for automatic load transfer equipment which can monitor voltage on all phases of normal power supply, initiate cranking of standby generator unit, transfer loads and shut down standby unit.

#### **1.2 RELATED SECTIONS**

.1 Section 26 05 00 - Common Work Results - Electrical.

### 1.3 **REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CAN3 C13 M83(R1998), Instrument Transformers.
  - .2 CSA C22.2No.5 02, Moulded Case Circuit Breakers, Molded Case Switches and Circuit Breaker Enclosures (Tri national standard with UL 489, tenth edition, and the second edition of NMX J 266 ANCE).
  - .3 CSA C22.2No.178 1978(R2001), Automatic Transfer Switches.
- .2 American National Standards Institute (ANSI)/National Electrical Manufacturers Association (NEMA)
  - .1 ANSI/NEMA ICS 2 2000, Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.

### 1.4 SYSTEM DESCRIPTION

- .1 Automatic load transfer equipment to:
  - .1 Monitor voltage on phases of normal power supply.
  - .2 Initiate cranking of standby generator unit on normal power failure or abnormal voltage on any one phase below preset adjustable limits for adjustable period of time.
  - .3 Transfer load from normal supply to standby unit when standby unit reaches rated frequency and voltage pre set adjustable limits.
  - .4 Transfer load from standby unit to normal power supply when normal power restored, confirmed by sensing of voltage on phases above adjustable pre set limit for adjustable time period.
  - .5 Shut down standby unit after running unloaded to cool down using adjustable time delay relay.

## 1.5 SHOP DRAWINGS

- .1 Submit shop drawings.
- .2 Include:
  - .1 Make, model and type.

- .2 Single line diagram showing controls and relays.
- .3 Description of equipment operation including:
  - .1 Automatic starting and transfer to standby unit and back to normal power.
  - .2 Test control.
  - .3 Manual control.
  - .4 Automatic shutdown.

#### 1.6 CLOSE-OUT SUBMITTALS

- .1 Technical data:
  - .1 Schematic diagram of components, controls and relays.
  - .2 Illustrated parts lists with parts catalogue numbers.
  - .3 Certified copy of factory test results.

### 1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal and wiring materials from landfill to metal recycling facility.

## PART 2 PRODUCTS

#### 2.1 MATERIALS

- .1 Instrument transformers: to CAN3 C13.
- .2 Contactors: to ANSI/NEMA ICS2.

### 2.2 CONTACTOR TYPE TRANSFER EQUIPMENT

- .1 Contact Type Transfer Equipment: to CSA C22.2No.178.
- .2 Double throw power transfer arrangement, mechanically and electrically interlocked with microprocessor control with CSA enclosure.
- .3 Rated: 600 VAC, 60Hz, 1000A,3 phase, 3pole/4wire, solid neutral.
- .4 Main contacts: silver surfaced, protected by arc disruption means.
- .5 Switch and relay contacts, coils, spring and control elements accessible for inspection and maintenance from front of panel without removal of switch panel or disconnection of drive linkages and power conductors.

- .6 Auxiliary contact to initiate emergency generator start up on failure of normal power.
- .7 Fault withstand rating: 42 kA
- .8 Lever to operate switch manually when switch is isolated.
- .9 Solid neutral bar, rated: 1000 A.

#### 2.3 CIRCUIT BREAKER TYPE TRANSFER EQUIPMENT

- .1 Circuit Breaker Type Transfer Equipment: to CSA C22.2No.5.
- .2 Rated: 600 VAC, 60Hz, 1000A,3 phase, 3pole/4wire, solid neutral.
  - .1 Fault withstand rating: 42kA.
  - .2 Molded case circuit breaker with thermal magnetic, mounted on common base, motor operated, mechanically held and interlocked.
  - .3 One emergency three phase molded case circuit breaker with thermal magnetic, mounted on common base, motor operated, mechanically held and interlocked.
  - .4 Circuit breakers:
  - .5 Trip free in closed position.
  - .6 Dead front construction with access to relays and controls for inspection and maintenance, and manual operating lever for transfer switch.
  - .7 Auxiliary contact: to initiate emergency generator start up on failure of normal power.

### 2.4 CONTROLS

- .1 Selector switch four position "Test", "Auto", "Manual", "Engine start".
  - .1 Test position Normal power failure simulated. Engine starts and transfer takes place. Return switch to "Auto" to stop engine.
  - .2 Auto position Normal operation of transfer switch on failure of normal power; retransfers on return of normal voltage and shuts down engine.
  - .3 Engine start position Engine starts but unit will not transfer unless normal power supply fails. Switch must be returned to "Auto" to stop engine.
- .2 Control transformers: dry type with 120V secondary to isolate control circuits from:
  - .1 Normal power supply.
  - .2 Emergency power supply.
- .3 Relays: continuous duty, industrial control type, with wiping action contacts rated 10 A minimum:
  - .1 Voltage sensing: one per phase, solid state type, adjustable drop out and pick up, close differential, 2V minimum under-voltage and over-voltage protection.
  - .2 Time delay: normal power to standby, adjustable solid state,
  - .3 Time delay on engine starting to override momentary power outages or dips, adjustable delay.

- .4 Time delay on retransfer from standby to normal power, adjustable
- .5 Time delay for engine cool off to permit standby set to run unloaded after retransfer to normal power, adjustable.

### 2.5 ACCESSORIES

- .1 Pilot lights to indicate power availability normal and standby, switch position, green for normal, red for standby.
- .2 Auxiliary relay to provide N.O. and N.C. contacts for remote alarms.
- .3 Manual bypass.

### 2.6 OPERATION

- .1 Operators
- .2 Controls
  - .1 A four line, 20 character LCD display and dynamic 4 button keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and control through the communications interface port or USB. The following parameters shall only be adjustable via a password protected programming on the controller:
  - .2 Nominal line voltage and frequency
  - .3 Single or three phase sensing
  - .4 Operating parameter protection
  - .5 Transfer operating mode configuration (Standard transition, Programmed transition, or Closed transition)
- .3 Voltage and Frequency
  - .1 Voltage (all phases) and frequency on both the normal and emergency sources shall be continuously monitored. Voltage on both normal and emergency sources and frequency on the emergency sources shall be adjustable with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal unless otherwise specified):

| .1 | Parameter         | Dropout/Trip | Pickup/Reset       |
|----|-------------------|--------------|--------------------|
| .2 | Under voltage     | 75 to 98%    | 85 to 100%         |
| .3 | Over voltage      | 06 to 135%   | 95 to 100% of trip |
| .4 | Under frequency   | 95 to 99%    | 80 to 95%          |
| .5 | Over frequency    | 01 to 115%   | 105 to 120%        |
| .6 | Voltage unbalance | 5 to 20%     | 3 to 18%           |

- .2 Repetitive accuracy of all settings shall be within  $\pm 0.5\%$  over an operating temperature range of  $-20^{\circ}$ C to  $70^{\circ}$ C.
- .3 An adjustable dropout time for transient voltage and frequency excursions shall be provided. The time delays shall be 0.1 to 9.9 seconds for voltage and .1 to 15 seconds for frequency.

- .4 Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad, remotely via the communications interface port or USB.
- .5 The controller shall be capable of sensing the phase rotation of both the normal and emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or BAC). Unacceptable phase rotation shall be indicated on the LCD; the service required LED and the annunciation through the communication protocol and dry contacts. In addition, the phase rotation sensing shall be capable of being disabled, if required.
- .6 The controller shall be capable of detecting a single phasing condition of a source, even though a voltage may be regenerated by the load. This condition is a loss of phase and shall be considered a failed source.
- .7 Source status screens shall be provided for both normal & emergency to provide digital readout of voltage on all 3 phases (phase to phase and phase to neutral), frequency, and phase rotation.
- .4 Time Delays
  - .1 An adjustable time delay of 0 to 6 seconds shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Capability shall be provided to extend this time delay to 60 minutes by providing an external 12 or 24 VDC power supply.
  - .2 A time delay shall be provided on transfer to the emergency source, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.
  - .3 A time delay shall be provided on re-transfer to normal. The time delays shall be adjustable from 0 to 60 minutes. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.
  - .4 A time delay shall be provided on shut down of engine generator for cool down, adjustable from 0 to 60 minutes.
  - .5 A time delay activated output signal shall also be provided to drive external relay(s) for selective load disconnect and reconnect control. The controller shall be capable of controlling a maximum of 9 individual output time delays to step loads on after a transfer occurs. Each output may be individually programmed for their own time delay of up to 60 minutes. Each sequence shall be independently programmed for transferring from normal to emergency and transferring from emergency to normal.
  - .6 All time delays shall be adjustable in 1 second increments.
  - .7 All time delays shall be adjustable by using the display and keypad, with a remote device connected to the communications interface port or USB.
  - .8 Each time delay shall be identified and a dynamic countdown shall be shown on the display. Active time delays can be viewed with a remote device connected to the communications interface port or USB.
- .5 Additional Features
  - .1 The controller shall have 3 levels of security. Level 1 shall allow monitoring of settings and parameters only. The Level 1 shall be capable of restricted with the use of a lockable cover. Level 2 shall allow test functions to be performed and Level 3 shall allow setting of all parameters.

- .2 The display shall provide for the test functions, allowed through password security. The test function shall be load, no load or auto test. The auto test function shall request an elapsed time for test. At the completion of this time delay the test shall be automatically ended and a retransfer sequence shall commence. All loaded tests shall be immediately ended and retransfer shall occur if the emergency source fails and the normal source is acceptable. .3 A contact closure shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred. .4 Auxiliary contacts shall be provided consisting of a minimum of two contacts, closed when the ATS is connected to the normal source and two contacts closed, when the ATS is connected to the emergency source. LED indicating lights shall be provided; one to indicate when the ATS is .5 connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red). LED indicating lights shall be provided and energized by controller outputs. The .6 lights shall provide true source availability of the normal (green) and emergency sources (red), as determined by the voltage, frequency and phase rotation sensing trip and reset settings for each source. .7 A membrane switch shall be provided on the membrane panel to test all indicating lights and display when pressed. .8 Provide the ability to select "commit/no commit to transfer" to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load. Terminals shall be provided for a remote contact which opens to signal the ATS to .9 transfer to emergency and for remote contacts which closes to inhibit transfer to emergency and/or retransfer to normal. Both of these inhibit signals can be activated through the keypad, communications interface port or USB. A "not-inauto" LED shall indicate anytime the controller is inhibiting transfer from occurring. .10 An in-phase monitor shall be a standard feature in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The inphase monitor shall be specifically designed for and be the product of the ATS manufacturer. The in-phase monitor shall be capable of being enabled or disabled from the user interface, communications interface port or USB. .11 A time based load control feature shall be available to allow the prioritized addition and removal of loads based during transfer. This feature may be enabled for either or both sources. The user shall be able to control up to nine loads with
- .12 The controller shall provide 2 inputs for external controls that can be programmed from the following values:

of transfer.

.1 Common fault, Remote test, Inhibit transfer, Low battery voltage, Peak shave, Time delay bypass, Load shed forced to OFF position (Programmed transition only)

independent timing sequences for pre and post transfer delays in either direction

- .13 The controller shall provide two form "C" contact outputs rated for up to 12A @ 240VAC or 2A @ 480VAC that can be programmed from the following values:
  - .1 Aux switch open, Transfer switch aux contact fault, Alarm silenced, Alarm active, I/O communication loss, Contactor position, Exercise active, Test mode active, Fail to transfer, Fail to acquire standby source, Source available, Phase rotation error, Not in automatic mode, Common alarm, In phase monitor sync, Load bank control active, Load control active, Maintenance mode active, Non-emergency transfer, Fail to open/close, Loss of phase, Over/under voltage, Over/under frequency, Voltage unbalance, Start signal, Peak shave active, Preferred source supplying load, Standby source supplying load
- .14 The controller shall be capable of expanding the number of inputs and outputs with additional modules.
- .15 Optional input/output modules shall be furnished which mount on the inside of the enclosure to facilitate ease of connections.
- .16 Engine Exerciser The controller shall provide an internal engine exerciser. The engine exerciser shall allow the user to program up to 21 different exercise routines based on a calendar mode. For each routine, the user shall be able to:
  - .1 Enable or disable the routine
  - .2 Enable or disable transfer of the load during routine.
  - .3 Set the start time, time of day, day of week, week of month (1st, 2nd, 3rd, 4th, alternate or every)
  - .4 Set the duration of the run.
  - .5 At the end of the specified loaded exercise duration the switch shall transfer the load back to normal and run the generator for the specified cool down period. All loaded exercises shall be immediately ended and retransfer shall occur if the standby source fails. The next exercise period shall be displayed on the main screen with the type of exercise, time and date. The type of exercise and the time remaining shall be display when the exercise is active. It shall be possible of ending the exercise event with a single button push.
- .17 Date and time The date shall automatically adjust for leap year and the time shall have the capability of automatically adjusting for daylight saving and standard times.
- .18 System Status The controller shall have a default display the following on:
  - .1 System status
  - .2 Date, time and type of the next exercise event
  - .3 Average voltage of the preferred and standby sources
  - .4 Scrolling through the displays shall indicate the following:
    - .1 Line to line and line to neutral voltages for both sources
    - .2 Frequency of each source
    - .3 Load current for each phase
    - .4 Single or three phase operation
    - .5 Type of transition
    - .6 Preferred source

- .7 Commit or no commit modes of operation
- .8 Source/source mode
- .9 In phase monitor enable/disable
- .10 Phase rotation
- .11 Date and time
- .19 Controllers that require multiple screens to determine system status or display "coded" system status messages, which must be explained by references in the operator's manual, are not permissible.
- .20 Self-Diagnostics The controller shall contain a diagnostic screen for the purpose of detecting system errors. This screen shall provide information on the status input signals to the controller which may be preventing load transfer commands from being completed.
- .21 Communications Interface The controller shall be capable of interfacing, through a standard communications with a network of transfer switches and generators. It shall be able to be connected via an RS-485 serial communication (up to 4000 ft. direct connect or multi-drop configuration). This module shall allow for seamless integration of existing or new communication transfer devices and generators.
- .22 The transfer switch shall also be able to interface to 3rd party applications using Modbus RTU open standard protocols utilizing Modbus register maps. Proprietary protocols shall not be acceptable.
- .23 The controller shall contain a USB port for use with a software diagnostic application available to factory authorized personnel for downloading the controller's parameters and settings; exercise event schedules; maintenance records and event history. The application can also adjust parameters on the controller.
- .24 Data Logging The controller shall have the ability to log data and to maintain the last 2000 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non-volatile memory. The controller shall be able to display up to the last 99 events. The remaining events shall be accessible via the communications interface port or USB.
  - .1 Event Logging
    - .1 Data, date and time indication of any event
  - .2 Statistical Data
    - .1 Total number of transfers\*
    - .2 Total number of fail to transfers\*
    - .3 Total number of transfers due to preferred source failure\*
    - .4 Total number of minutes of operation\*
    - .5 Total number of minutes in the standby source\*
    - .6 Total number of minutes not in the preferred source\*
    - .7 Normal to emergency transfer time
    - .8 Emergency to normal transfer time
    - .9 System start date
    - .10 Last maintenance date

- .11 \* The statistical data shall be held in two registers. One register shall contain data since start up and the second register shall contain data from the last maintenance reset.
- .25 External DC Power Supply An optional provision shall be available to connect up to two external 12/24 VDC power supply to allow the LCD and the door mounted control indicators to remain functional when both power sources are dead for extended periods of time. This module shall contain reverse battery connection indication and circuit protection.

## 2.7 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section [26 05 00 - Common Work Results – Electrical.

### 2.8 MANUFACTURERS

.1 ASCO ,Kohler or approved equal

### 2.9 SOURCE QUALITY CONTROL

- .1 Complete equipment, including transfer mechanism, controls, relays and accessories factory assembled and tested.
- .2 Notify Consultant days in advance of date of factory test.
- .3 Tests:
  - .1 Operate equipment both mechanically and electrically to ensure proper performance.
  - .2 Check selector switch, in modes of operation [Test, Auto, Manual, Engine Start] and record results.
  - .3 Check voltage sensing and time delay relay settings.
  - .4 Check:
    - .1 Automatic starting and transfer of load on failure of normal power.
    - .2 Retransfer of load when normal power supply resumed.
    - .3 Automatic shutdown.
    - .4 In phase monitor operation

#### PART 3 EXECUTION

#### 3.1 INSTALLATION

- .1 Locate, install and connect transfer equipment.
- .2 Check relays and adjust as required.
- .3 Install and connect batter and remote alarms.

#### **3.2 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 Common Work Results Electrical.
- .2 Energize transfer equipment from normal power supply.
- .3 Set selector switch in "Test" position to ensure proper standby start, running, transfer, retransfer. Return selector switch to "Auto" position to ensure standby shuts down.
- .4 Set selector switch in "Manual" position and check to ensure proper performance.
- .5 Set selector switch in "Engine start" position and check to ensure proper performance. Return switch to "Auto" to stop engine.
- .6 Set selector switch in "Auto" position and open normal power supply disconnect. Standby should start, come up to rated voltage and frequency, and then load should transfer to standby. Allow to operate for 10 min, then close main power supply disconnect. Load should transfer back to normal power supply and standby should shutdown.
- .7 Repeat, at 1h intervals, 3 times, complete test with selector switch in each position, for each test.

#### **END OF SECTION**

### PART 1 GENERAL

### 1.1 SUMMARY

.1 The specifications in this section describe the electrical and mechanical requirements for a protection system provided by high-energy transient voltage surge suppressors. The specified system shall provide effective, high-energy surge current diversion and be suitable for application in ANSI/IEEE C62.41 Category A, B and C environments (as tested by ANSI/IEEE C62).

### 1.2 STANDARDS

- .1 The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:
- .2 Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.11, C62.41, C62.45)
- .3 American National Standards Institute
- .4 Federal Information Processing Standards Publication 94 (FIPS PUB 94)
- .5 National Electrical Manufacturer Association (prior to repeal NEMA LS-1 1992 Peak Current Testing)
- .6 National Fire Protection Association (NFPA 70, 75 and 780)
- .7 MIL Standard 220A Method of Insertion Loss Measurement
- .8 National Electric Code
- .9 Underwriters Laboratories UL 1283 and UL 1449 (most recent edition)
- .10 Canadian Standards (cUL or cETL)

#### **1.3 ENVIRONMENTAL REQUIREMENTS**

- .1 The operating temperature range shall be  $-40^{\circ}$  to  $70^{\circ}$  C ( $-40^{\circ}$  to  $160^{\circ}$  F).
- .2 The unit shall be capable of operation up to 13,000 feet above sea level.
- .3 No appreciable magnetic fields shall be generated.

#### 1.4 SUBMITTALS

- .1 Product Data: Provide catalog sheets showing voltage, physical size, IEEE let through voltage for each waveform listed, UL1449 latest revision, latest edition, suppressed voltage ratings, dimensions showing construction, lifting and support points, enclosure details, per mode and per phase peak surge current, modes of discrete suppression circuitry, warranty period and replacement terms, conductor size, conductor type and lead length.
- .2 Submit product data for all components and accessories.
- .3 Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product. Indicate maximum size of circuit breaker or fuse to be connected for each unit.

- .4 List and detail all protection systems such as fuses, disconnecting means and protective features.
- .5 Provide verification that the TVSS device complies with the required UL1449 latest edition, latest revision, and CSA approvals.

## 1.5 QUALITY ASSURANCE AND WARRANTY

- .1 The panel mounted SPD and supporting components shall be guaranteed by the manufacturer to be free of defects in material and workmanship for a period of thirty (30) years from the date of substantial completion of service and activation of the system to which the suppressor is attached. Additionally, the warranty shall state that during the applicable warranty period any SPD which fails due to any transient surge activity, including lightning, shall be repaired or replaced by the manufacturer without charge. Special or optional warranties in excess of the unit's standard warranty for purposes of this bid are not acceptable.
- .2 Since "Acts of Nature" or similar statements typically include the threat of lightning to which the SPDs shall be exposed, any such clause limiting warranty responsibility in the general conditions of this specification shall not apply to this particular section. That is, the warranty must specifically provide for unlimited free replacements of the SPD in the event of failure caused by the effects of lightning and all other electrical anomalies. The warranty shall cover the entire device, not just various components, such as modules only.
- .3 Provide electrically operated equipment specified in this Section that is listed and labeled. As defined in the National Electrical Code, Article 100, Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- .4 Comply with NFPA 70 and Nema LS1.

## PART 2 PRODUCTS

#### 2.1 PERFORMANCE

- .1 The SPD shall be listed by ETL, UL, or other nationally recognized test laboratory to UL's 1283 and UL's 1449 standards (latest edition, latest revision), and not merely the components or modules. All SPD's shall be Type 1 for use in Type 1 and Type 2 locations.
- .2 The TVSS shall protect all modes L-G, L-N, L-L, and N-G, have discrete suppression circuitry in L-G, L-N and N-G, and have bidirectional, positive and negative impulse protection. Line-to-neutral-to-ground protection is not acceptable where line-to-ground is specified, and accordingly reduced mode units with suppression circuitry built into only 4

modes are not acceptable. In delta systems, line-to-ground-to-line protection is not acceptable where line-to-line is specified.

- .3 Obtain all surge suppression devices through one source from a single manufacturer.
- .4 The maximum continuous operating voltage (MCOV) of all components shall not be less than 125% for a 120V system and 120% for 220 and 240V systems, and 115% for 277 and 600V systems.
- .5 All SPD's shall be equipped with a comprehensive monitoring system which shall include a visual LCD panel display providing information on unit status and phase loss/protection loss.
- .6 All SPD's shall be Total Protection Solutions. No unit will be accepted as an "approved equal" unless it meets the warranty, strength, safety features, IEEE let-through levels, modes of discrete suppression circuitry, fusing, independent third party per mode surge testing, and all other requirements of this specification.
- .7 If a disconnect switch is specified, the disconnect switch and the SPD as a system shall be capable of interrupting up to a 200kA symmetrical fault current with 600 VAC applied.

## PART 3 EXECUTION

## 3.1 INSTALLATION

- .1 Install the SPD's with the conductors as short and straight as practically possible.
- .2 Follow the SPD manufacturer's recommended installation practice as outlined in the equipment installation manual. The electrical contractor shall ensure that all neutral conductors are bonded to the system ground at the service entrance or the serving isolation transformer prior to installation of the associated SPD.
- .3 Main service entrance units shall be installed on a 60 amp breaker, or, where indicated, shall be installed on a non-fused disconnect switch provided by Total Protection Solutions, or other manufacturer, that meets or exceeds the fault current rating of the switchgear.
- .4 Distribution, branch panel, and motor control center units shall be installed on 30-60 amp dedicated circuit breakers.
- .5 When SPD cable lead lengths exceed four (4) feet, Low Impedance Cable must be used. Please follow the SPD manufacturer's recommended installation practice as outlined in the equipment installation manual.
- .6 The Dry Contact Relay (DRC) for the alarm must be wired to a signaling device specified by the engineer.
- .7 The installing contractor shall comply with all applicable codes.
- .8 For installation questions, technical support and ordering information call John Shamess 905-775-7474, email: john@tpscanada.ca

## 3.2 ADJUSTING

.1 Adjust devices and wall plates to be flush and level.

## 3.3 CLEANING

.1 Clean exposed surfaces to remove splatters and restore finish.

## **END OF SECTION**

### PART 1 GENERAL

#### 1.1 SCOPE OF WORK

.1 Testing and commissioning are called for throughout the individual specifications. This does not relieve this trade from providing all testing and commissioning necessary to ensure that systems and equipment operate as required and that they interface with other systems and equipment as required.

#### **1.2 SECTION INCLUDES**

- .1 Commissioning of all building electrical systems and component including:
- .2 Testing and adjustment.
- .3 Demonstrations and Training.
- .4 Instructions of all procedures for Owner's personnel.
- .5 Updating as-built data.
- .6 Co-ordination of Operation and Maintenance material.

#### **1.3 RELATED SECTIONS**

- .1 Section 01 77 00 Closeout Procedures.
- .2 Section 01 91 13 General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 Common Work Results Electrical.

#### 1.4 **REFERENCES**

- .1 CSA (Canadian Standards Association).
- .2 Underwriters Laboratories of Canada.

#### 1.5 QUALITY ASSURANCE

- .1 Provide qualified trades persons, certified testing agencies, factory trained and approved by the Commissioning Team Leader.
- .2 Submit the names of all personnel to be used during the Commissioning activities for Owner Approval.

#### 1.6 COMMISSIONING

.1 The purpose of the commissioning process is to fully test all building systems including architectural, mechanical and electrical components and operating procedures by challenging these systems to realistic operation conditions.

- .2 The Commissioning activities shall be coordinated by the General Contractor.
- .3 Commissioning activities for the electrical systems must have available up to date as-built drawing information and accurate Operations and Maintenance Manuals. These documents shall be a major part of this activity.
- .4 Contractor shall be responsible to update all documentation with information and any changes duly noted during the Commissioning exercise.
- .5 Contractor shall arrange for all outside suppliers, equipment manufacturers, test agencies and others as identified in the commissioning sections of this specification. The cost associated with this requirement shall be included as part of the tender price.

### 1.7 SUBMITTALS

- .1 A commissioning document shall be prepared by the Owner's Representative prior to conducting these activities for use by the Commissioning Team.
- .2 The electrical sub-contractor shall be responsible for ensuring all activities are properly documented in this manual and coordinated through the General Contractor.
- .3 As-built drawings and data books must be available two weeks prior to commissioning for review and use by the consultant and Commissioning Team prior to the start of the commissioning activities.

#### **1.8 PREPARATION**

- .1 Provide test instruments required for all activities as defined in the commissioning documents.
- .2 Verify all systems are in compliance with the requirements of the commissioning documents prior to the pre-commissioning check out operation.
- .3 Confirm all scheduled activities have identified personnel available.
- .4 Where systems or equipment do not operate as required, make the necessary corrections or modifications, re-test and re-commission.

## **1.9 SYSTEM DESCRIPTION**

- .1 Perform all start-up operations, control adjustment, trouble shooting, servicing and maintenance of each item of equipment as defined in the commissioning documentation.
- .2 Owner will provide list of personnel to receive instructions and will co-ordinate their attendance at agreed upon times.
- .3 Prepare and insert additional data in the operations and maintenance manuals and update as-built drawings when need for additional data becomes apparent during the commissioning exercise.

- .4 Where instruction is specified in the commissioning manual, instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.
- .5 Conduct presentation on Owner's premises. Owner will provide space.

### 1.10 FINAL REPORT

- .1 This trade shall assemble all testing data and commissioning reports and submit them to the Owner.
- .2 Each form shall bear signature of recorder, and that of supervisor of reporting organizer.

### **1.11 SCHEDULE OF ACTIVITIES**

- .1 Commissioning activities shall be conducted based on pre-established schedule with all members of the commissioning team, refer to Section 01 91 13 General Commissioning (Cx) Requirements.
- .2 In addition, there will be two meetings held through the contract duration to introduce the parties of the commissioning team, establish the schedules and deadlines for the various activities and review the Commissioning Manual.
- .3 Adhering to the established schedule is very important as the co-ordination and scheduling of the participants will be difficult to alter once this is established. Close co-ordination of this schedule is important.
- .4 In the event project cannot be commissioned in the allotted time slot, the contractor shall pay for all costs associated with assembling the Commissioning Team at a later date. If the contractor has not performed his duties to reach commissioning stage as outlined earlier, he will incur all expenses of other trades and the Commissioning Team due to his non-compliance.

#### PART 2 PRODUCTS

- 2.1 NOT USED
- PART 3 EXECUTION
- 3.1 NOT USED

## **END OF SECTION**

# 1 General

## 1.1 Related Sections

- .1 Section 09 90 00 Painting and Coatings.
- .2 Section 40 05 06 Couplings, Adapters, and Specials for Process Piping.
- .3 Section 40 05 51 Process Valves.

## 1.2 References

- .1 Comply with the latest edition of the following statutes, codes, and standards, and all amendments thereto.
  - .1 American Society of Mechanical Engineers (ASME):
    - .1 B16.1, Cast Iron Pipe Flanges and Flanged Fittings.
    - .2 B16.5, Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24.
  - .2 American Water Works Association (AWWA):
    - .1 C153/A21.53, Ductile-Iron Compact Fittings, 3 in. (76 mm) through 64 in. (1,600 mm), for Water Service.
    - .2 C226-13, Stainless Steel Fittings for Waterworks Service, Sizes 1/2 in. (13 mm) through 72 in. (1,800 mm)
    - .3 C210, Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
    - .4 C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
    - .5 C219, Bolted, Sleeve-Type Couplings for Plain-End Pipe.
    - .6 Manual M11, Steel Water Pipe—A Guide for Design and Installation.
  - .3 ASTM International (ASTM):
    - .1 A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
    - .2 A276, Standard Specification for Stainless Steel Bars and Shapes.
  - .4 National Fire Protection Association (NFPA): 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
  - .5 National Fire Protection Association (NFPA): 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities.

# 1.3 Submittals

- .1 Action Submittals: Manufacturer's data on materials, construction, end connections, ratings, overall lengths, and live lengths (as applicable).
- .2 Informational Submittals:
  - .1 Submit shop drawings and Product data in accordance with Section 01 33 00 Submittal Procedures.
  - .2 Details, ratings, calculations and test reports for thrust restraints relying on welded bars or rings.
  - .3 Weld procedure qualifications.
  - .4 Load proof-testing report of prototype restraint for any size coupling.
- .3 Data as specified in Section 01 78 23 Equipment Operation and Maintenance Data.

## 1.4 Measurement and Payment

.1 The Work outlined in this Section shall be included in the lump sum price as indicated in the Form of Tender.

## 2 Products

## 2.1 General

- .1 Provide required piping specialty items, whether shown or not shown on the Contract Drawings, as required by the referenced codes identified under subsection 1.2.
- .2 Rubber ring joints, mechanical joints, flexible couplings, and proprietary restrained stainless steel pipe joints are considered flexible joints; welded, screwed, and flanged pipe joints are not considered flexible.

## 2.2 Couplings

- .1 General:
  - .1 Coupling linings for use in sewage systems shall be compatible with the liquids and related exposure conditions.
  - .2 Couplings shall be rated for working pressures indicated in Piping Schedule in Section 40 05 00 – Common Work Results for Process Interconnections, or 1035 kPa, whichever is greater.

- .3 Unless thrust restraint is provided by other means, couplings shall be harnessed in accordance with requirements of AWWA Manual M11, and restrained with retainer bar or ring welded to pipe end, or as shown on Drawings.
- .4 Sleeve type couplings shall conform to AWWA C219 and shall be hydraulically expanded beyond minimum yield for accurate sizing and proofing of tensile strength.
- .2 Flexible Sleeve Type Coupling:
  - .1 Bolted Split Sleeve Type Coupling: Victaulic Co., Depend-O-Lok couplings.
- .3 Transition Coupling for Steel Pipe:
  - .1 Manufacturers and Products in accordance with the supplier's recommendations.
- .4 Flanged Coupling Adapter:
  - .1 Manufacturers and Products: in accordance with the supplier's recommendations.
- .5 Restrained Flange Adapter:
  - .1 Pressure Rating:
    - .1 Minimum Working Pressure Rating: A minimum of 1035 kPa.
    - .2 Safety Factor: A minimum of two times working pressure and shall be supported by manufacturer's proof testing.
  - .2 Thrust Restraint:
    - .1 Provide hardened steel wedges that bear against and engage outer pipe surface, and allow articulation of pipe joint after assembly while wedges remain in their original setting position on pipe surface.
    - .2 Products employing set screws that bear directly on pipe will not be acceptable.
    - .3 Manufacturers and Products in accordance with the supplier's recommendations.
- .6 Dismantling Joints:
  - .1 Pressure Rating: A minimum of 1035 kPa.
  - .2 Minimum working pressure rating shall be a minimum of the rating of the connecting flange.

- .1 Proof testing shall conform to the requirements of AWWA C219 for bolted couplings.
- .3 Manufacturers and Products: in accordance with the supplier's recommendations.

# 2.3 Service Saddles

- .1 Double-Strap Iron:
  - .1 Pressure Rating: Capable of withstanding 1035 kPa internal pressure without leakage or over stressing.
  - .2 Run Diameter: Compatible with outside diameter of pipe on which saddle is installed.
  - .3 Taps: Iron pipe threads.
  - .4 Materials:
    - .1 Body: Malleable or ductile iron
    - .2 Straps: Galvanized steel.
    - .3 Hex Nuts and Washers: Steel.
    - .4 Seal: Rubber.
  - .5 Manufacturers/Products: in accordance with the supplier's recommendations.
- .2 Nylon-Coated Iron:
  - .1 Pressure Rating: Capable of withstanding 1035 kPa internal pressure without leakage or over stressing.
  - .2 Run Diameter: Compatible with outside diameter of pipe on which saddle is installed.
  - .3 Materials:
    - .1 Body: Nylon-coated iron.
    - .2 Seal: Buna N.
    - .3 Clamps and Nuts: Stainless steel.
  - .4 Manufacturers/Products: in accordance with the supplier's recommendation.

## 2.4 Pipe Sleeves

- .1 Steel Pipe Sleeve:
  - .1 Minimum Thickness: 4.7mm.

- .2 Seep Ring:
  - .1 Center steel flange for water stoppage on sleeves in exterior or water-bearing walls, 4.7mm minimum thickness.
  - .2 Outside Diameter: Unless shown otherwise on the Drawings, 80mm greater than the outside diameter of the pipe sleeve.
  - .3 Continuously fillet weld on each side all around.
- .3 Factory Finish:
  - .1 Galvanizing:
  - .1 Hot-dip applied, meeting requirements of ASTM A153/A153M.
  - .2 Electroplated zinc or cadmium plating is unacceptable.
- .4 Shop Lining and Coating: Factory prepare, prime, and finish coat in accordance with 09 90 0 Painting and Coatings.
- .2 Molded Polyethylene Pipe Sleeve:
  - .1 Molded HDPE with integral water stop ring a minimum of 80mm larger than sleeve.
  - .2 Provided with end caps for support during concrete placement.
  - .3 Manufacturers/Products: in accordance with the supplier's recommendations.
- .3 Insulated and Encased Pipe Sleeve:
  - .1 Manufacturers/Products: in accordance with the supplier's recommendations.
- .4 Modular Mechanical Seal:
  - .1 Type: Interconnected synthetic rubber links shaped and sized to continuously fill annular space between pipe and wall sleeve opening.
  - .2 Fabrication:
    - .1 Assemble interconnected rubber links with ASTM A276, Type 316 stainless steel bolts and nuts.
    - .2 Pressure plates shall be reinforced nylon polymer.
  - .3 Size: According to manufacturer's instructions for size of pipes shown on the Drawings to provide a watertight seal between pipe and wall sleeve opening and to withstand the design hydrostatic head.

.4 Manufacturer/Product: in accordance with the supplier's recommendations.

# 2.5 Slab, Floor, Wall and Roof Penetrations

- .1 Stainless Steel Pipe:
  - .1 Diameter and Ends: Same as connecting pipe.
  - .2 Thickness: Equal to or greater than remainder of pipe in line.
  - .3 Fittings: In accordance with applicable Pipe Data Sheet.
  - .4 Thrust Collars:
    - .1 Rated for thrust load developed at 1725 kPa.
    - .2 Safety Factor: 2, minimum.
    - .3 Material and Construction: Stainless steel, cast integral with wall pipe wherever possible, or thrust rated, welded attachment to wall pipe.
  - .5 Manufacturers/Products: in accordance with the supplier's recommendations.
- .2 Steel or Stainless Steel Wall Pipe:
  - .1 Same material and thickness as for connecting pipe, except that it must have a minimum thickness of 6.3mm.
  - .2 Lining: Same as for connecting pipe.
  - .3 Thrust Collar:
    - .1 Outside Diameter: Unless otherwise shown on the Drawings, 80mm greater than outside diameter of wall pipe.
    - .2 Continuously fillet welded on each side all around.

## 2.6 Miscellaneous Specialties

- .1 Strainers, Water Service, 50mm and Smaller:
  - .1 Type: Bronze body, Y pattern, 1380 kPa nonshock rated, with screwed gasketed bronze cap.
  - .2 Screen: Heavy-gauge Type 304 stainless steel or monel, 20 mesh.
  - .3 Manufacturers/Products: in accordance with the supplier's recommendations.
- .2 Strainers, Plastic Piping Systems, 100 mm and Smaller:

- .1 Type: Y pattern PVC body, 1035 kPa nonshock rated, with screwed PVC cap and Viton seals
- .2 End Connections: Screwed or solvent weld, 50 mm and smaller. Class 150 ANSI flanged, 65 mm and larger.
- .3 Screen: Heavy-gauge PVC, 0.8mm mesh, minimum 2 to 1 screen area to pipe size ratio.
- .4 Manufacturer/Products: in accordance with the supplier's recommendations.
- .3 Water Hose:
  - .1 Furnish five (5) 15 m lengths of 25 mm rubber hose. EPDM black cover and EPDM tube, reinforced with two textile braids. Provide each length with brass male and female NST hose thread couplings to fit hose nozzle and hose valve.
  - .2 Rated minimum working pressure of 1380 kPa.
- .4 Hose Nozzles:
  - .1 Furnish five (5) 25mm cast brass, satin finish, nozzles with adjustable fog, straight-stream, and shut-off feature and rubber bumper. Provide nozzles with a female NST hose thread.

## 3 Execution

## 3.1 General

.1 Provide accessibility to all piping specialties for control and maintenance.

## 3.2 Piping Flexibility Provisions

- .1 General:
  - .1 Thrust restraint shall be provided as specified in Section 40 05 06 Couplings, Adapters, and Specials for Process Piping
  - .2 Install flexible couplings to facilitate piping installation, in accordance with approved shop drawings.
- .2 Flexible Joints at Concrete Backfill or Encasement: Install within 450mm or one-half pipe diameter, whichever is less, from the termination of any concrete backfill or concrete encasement.
- .3 Flexible Joints at Concrete Structures:

- .1 Install 450mm or less from face of structures; joint may be flush with face.
- .2 Install a second flexible joint, whether or not shown.
- .3 Pipe Diameter 450mm and Smaller: Within 450mm of first joint.
  - .1 Pipe Diameter Larger than 450mm: Within one pipe diameter of first joint.
- .4 Flexible expansion joints shall be provided to compensate for earth settlement at buried piping connections to structure wall pipes. Wrap complete joint assembly in a double layer of polyethylene encasement, as specified in Sections 40 05 23 Stainless Steel Pipe and Tubing, 40 05 06 Coupling, Adapters, and Specialties for Process Piping.

# 3.3 **Piping Transition**

- .1 Applications:
  - .1 Provide complete closure assembly where pipes meet other pipes or structures.
  - .2 Pressure Pipeline Closures: Plain end pieces with double flexible couplings, unless shown otherwise on the Drawings.
  - .3 Restrained Joint Pipe Closures: Install with thrust tie-rod assemblies as shown on the Drawings or in accordance with NFPA 24.
  - .4 Gravity Pipe Closures: As specified for pressure pipelines, or concrete closures.
  - .5 Concrete Closures: Use to make connections between dissimilar pipe where standard rubber gasketed joints or flexible couplings are impractical.
  - .6 Elastomer sleeves bonded to pipe ends are not acceptable.
- .2 Installation:
  - .1 Flexible Transition Couplings: Install in accordance with coupling manufacturer's instructions to connect dissimilar pipe and pipes with a small difference in outside diameter.
  - .2 Concrete Closures:
    - .1 Locate away from structures so there are a minimum of two flexible joints between closure and pipe entering structure.
    - .2 Clean pipe surface before placing closure collars.
    - .3 Wet non-metallic pipe thoroughly prior to pouring collars.

- .4 Prevent concrete from entering pipe.
- .5 Extend collar a minimum of 300mm on each side of joint with minimum thickness of 150mm around outside diameter of pipe.
- .6 Make entire collar in one placement.
- .7 After concrete has reached initial set, cure by covering with well-moistened earth.

## 3.4 Service Saddles

- .1 Ferrous Metal Piping (except stainless steel): Double-strap iron.
- .2 Plastic Piping: Nylon-coated iron.

# 3.5 Couplings

- .1 General:
  - .1 Install in accordance with manufacturer's written instructions.
- .2 Before coupling, clean pipe holdback area of oil, scale, rust, and dirt.
- .3 Remove pipe coating if necessary to present a smooth surface. Do not remove pipe coating. If damaged, repair before joint is made.
- .4 Application:
  - .1 Metallic Piping Systems: Flexible couplings, transition couplings, and flanged coupling adapters.
  - .2 Concrete Encased Couplings: Flexible coupling.

## 3.6 Pipe Sleeves

- .1 Application:
  - .1 As specified in Section 40 05 06 Couplings, Adapters, and Specials for Process Piping.
- .2 Above Grade in Non-submerged Areas: Hot-dip galvanized after fabrication.
  - .1 Below Grade or in Submerged or Damp Environments: Shop-lined and coated.
  - .2 Alternatively, Molded Polyethylene Pipe Sleeve may be applied, as specified in the Contract Documents.
- .3 Installation:

- .1 Support non-insulating type securely in formwork to prevent contact with reinforcing steel and tie-wires.
- .2 Caulk joint with specified sealant in non-submerged applications and seal below grade and submerged applications with wall penetration seal.

# 3.7 Slab, Floor, Wall and Roof Penetrations

- .1 Applications:
  - .1 Watertight and Below Ground Penetrations:
    - .1 Wall pipes with thrust collars.
    - .2 Provide taps for stud bolts in flanges to be set flush with wall face.
  - .2 Non-watertight Penetrations: Pipe sleeves with seep ring.
  - .3 Existing Walls: Rotary drilled holes.
  - .4 Fire-Rated or Smoke-Rated Walls, Floors or Ceilings: Insulated and encased pipe sleeves.
- .2 Wall Pipe Installation:
  - .1 Isolate embedded metallic piping from concrete reinforcement using coated pipe penetrations as specified in Section 09 90 00 – Painting and Coatings.
  - .2 Support wall pipes securely by formwork to prevent contact with reinforcing steel and tie-wires.

# END OF SECTION

# 1 General

# 1.1 Related Sections

- .1 Section 01 41 00 Regulatory Requirements
- .2 Section 01 33 00 Submittal Procedures
- .3 Section 09 90 00 Painting and Coatings
- .4 Division 22 Plumbing
- .5 Division 23 Heating, Ventilating and Air Conditioning
- .6 Division 40 Process Interconnections

# 1.2 References

- .1 Comply with the latest edition of the following statutes, codes, and standards, and all amendments thereto.
  - .1 ASTM International (ASTM):
    - .1 A123/A123M, Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
    - .2 A653/A653M, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvanealed) by the Hot Dip Process.
  - .2 Building Officials and Code Administrators (BOCA): Basic Building Code.
  - .3 International Conference of Building Officials (ICBO): Uniform Building Code.
  - .4 National Building Code of Canada (NBC)
  - .5 Manufacturers' Standardization Society of the Valves and Fittings Industry (MSS):
    - .1 SP 58, Pipe Hangers and Supports Materials, Design and Manufacture.
    - .2 SP 69, Pipe Hangers and Supports Selection and Application.
    - .3 SP 89, Pipe Hangers and Supports Fabrication and Installation Practices.

## 1.3 Definitions

.1 Wetted or Submerged: Submerged, less than 0.3m above liquid surface, below top of inlet channel walls, under cover or slab of wet well, or in other damp locations.

## 1.4 Submittals

- .1 Shop Drawings:
  - .1 Drawings of piping support system, locating each support, brace, hanger, guide, component, and anchor. Identify support, hanger, guide, and anchor type by catalogue number and Shop Drawing detail number.
  - .2 Revisions to support systems resulting from changes in related piping system layout or addition of flexible joints.
- .2 Information Submittals: Maintenance information on piping support system.

## 1.5 Qualifications

.1 Piping support systems shall be designed and Shop Drawings prepared and sealed by a registered professional engineer licensed to practice in the province of Ontario.

## **1.6 Design Requirements**

- .1 General:
  - .1 Seismic Load: Seismic performance category forces with seismic loads in accordance with the Ontario Building Code, latest edition.
  - .2 Design, size, and locate piping support systems throughout the facility, whether shown on the Contract Drawings or not.
  - .3 Piping Smaller than 750 mm: Supports are shown on the Contract Drawings only where specific types and locations are required; additional pipe supports may be required.
  - .4 Piping 750 mm in diameter and Larger: Support systems have been designed for piping shown on the Contract Drawings.
  - .5 Meet requirements of MSS SP 58, MSS SP 69, and MSS SP 89, or as modified by this section.
- .2 Pipe Support Systems:
  - .1 Load: Dead loads imposed by weight of pipes filled with water, except air and gas pipes, plus insulation.

- .2 Maximum Support Spacing and Minimum Rod Size:
  - .1 Mild Steel or Ductile Iron Piping (Note that this spacing may require the use of higher load pipe clamps and more than a single point anchor point in concrete):

| Pipe Size Diameter         | Maximum<br>Support/      | Minimum Rod<br>Size Single Rod |
|----------------------------|--------------------------|--------------------------------|
|                            | Hanger Spacing           | Hangers                        |
| 25 mm and smaller          | 1.8 m                    | 6.25 mm                        |
| 32.5 mm through<br>62.5 mm | 2.4 m                    | 6.25 mm                        |
| 75 mm and<br>100 mm        | 3.0 m                    | 9.5 mm                         |
| 150 mm                     | 3.6 m                    | 9.5 mm                         |
| 200 mm                     | 3.6 m                    | 12.5 mm                        |
| 250 mm and<br>300mm        | 4.3 m                    | 15.9 mm                        |
| 350 mm                     | 4.8 m                    | 19.1 mm                        |
| 400 mm and<br>450 mm       | 4.8 m                    | 22.2 mm                        |
| 500 mm                     | 5.4 m                    | 25.4 mm                        |
| 600 mm                     | 5.4 m                    | 31.7 mm                        |
| 762 mm and larger          | As shown on the Drawings | As shown on theDrawings        |

- .2 Copper Piping: Maximum Support Spacing: 0.61 m less per size than listed for steel pipe, with 25 mm and smaller pipe supported every 1.5 m.
- Minimum Hanger Rod Sizing: Same as listed for steel pipe.
  .3 Plastic and Fiberglass Piping: Maximum support spacing: As recommended by manufacturer for flow temperature in pipe. Minimum Hanger Rod Sizing: Same as listed for steel pipe.
- .4 Stainless Steel Piping:

| SST Pipe   | Maximum        | Minimum Rod |
|------------|----------------|-------------|
| Size       | Support/       | Size        |
| Diameter   | Hanger Spacing | Single Rod  |
|            |                | Hangers     |
| 25 mm      | 2.4 m          | 6.25 mm     |
| through    |                |             |
| 100 mm     |                |             |
| 150 mm     | 2.4 m          | 9.5 mm      |
| 200 mm and | 3.0 m          | 12.5 mm     |
| 250 mm     |                |             |
| 300 mm     | 3.0 m          | 12.5 mm     |
| 350 mm and | 3.6 m          | 15.9 mm     |
| 400 mm     |                |             |
| 450 mm and | 4.3 m          | 19.1 mm     |
| 500 mm     |                |             |
| 600 mm     | 4.3 m          | 22.2 mm     |

- .3 Framing Support System:
  - .1 Beams: Size such that beam stress does not exceed 172,000 kPa and maximum deflection does not exceed 1/240 of span.
  - .2 Column Members: Size in accordance with manufacturer's recommended method.
  - .3 Support Loads: Calculate using weight of pipes filled with Maximum Spans:
    - .1 Steel and Ductile Iron Pipe, 75 mm in Diameter and Larger: 3 m centers, unless shown otherwise on the Drawings.
    - .2 Other Pipelines and Special Situations: May require supplementary hangers and supports.
  - .4 Electrical Conduit Support: Include in design of framing support system.
- .4 Anchoring Devices: Design, size, and space support anchoring devices, including anchor bolts, inserts, and other devices used to anchor support, to withstand shear and pullout loads imposed by loading and spacing on each particular support.
- .5 Vertical Sway Bracing: 3 m maximum centers, or as shown on the Contract Drawings.

## 1.7 Measurement and Payment

.1 The Work outlined in this Section shall be included in the lump sum price for "Hangers and Supports for Process Piping" as indicated in the Form of Tender.

## 2 Products

## 2.1 General

- .1 The Contract Drawings show pipe support systems with general intent but should not be construed as showing all supports as required for installation of piping.
- .2 When items specified in the Contract Documents are not available, fabricate pipe supports of correct material and to the general configuration recommended by the manufacturer.
- .3 Special support and hanger details may be shown on the Drawings for cases where standard catalogue supports are inapplicable.
- .4 Materials: In accordance with Tables 1 and 2, included as supplements to this section and as otherwise indicated in the Contract Drawings.

## 2.2 Hangers

- .1 Clevis Type: MSS SP 58 and SP 69, Type 1 or 6.
  - .1 Anvil International Inc.; Figure 104 or 260.
  - .2 Cooper B Line Inc.; Figure B3198 or B3100.
- .2 Hinged Split Ring Pipe Clamp: MSS SP 58 and SP 69, Type 6 or 12.
  - .1 Anvil International Inc.; Figure 104.
  - .2 Cooper B Line Inc.; Figure B3198H.
- .3 Hanger Rods, Clevises, Nuts, Sockets, and Turnbuckles: In accordance with MSS SP 58.
- .4 Attachments:
  - .1 I Beam Clamp: Concentric loading type, MSS SP 58 and SP 69, Type 21, 28, 29, or 30, which engage both sides of flange.
  - .2 Concrete Insert: MSS SP 58 and SP 69, Type 18, continuous channel insert with load rating of a minimum of the hanger rod that it supports.

# 2.3 Saddle Supports

- .1 Pedestal Type: Schedule 40 pipe stanchion, saddle, and anchoring flange.
  - .1 Nonadjustable Saddle: MSS SP 58 and SP 69, Type 37 with U bolt.
    - .1 Anvil International Inc.; Figure 259.
    - .2 Cooper B Line Inc.; Figure B3090.
  - .2 Adjustable Saddle: MSS SP 58 and SP 69, Type 38 without clamp.
    - .1 Anvil International Inc.; Figure 264.
    - .2 Cooper B Line Inc.; Figure B3093.

# 2.4 Wall Brackets

- .1 Welded Steel Bracket: MSS SP 58 and SP 69, Type 33 (heavy-duty).
  - .1 Anvil International Inc.; Figure 199.
  - .2 Cooper B Line Inc.; Figure B3067.
- .2 One Hole Clamp: Anvil; Model to suit pipe size and type
- .3 Channel Type:
  - .1 Atkore International: Unistrut.
  - .2 Anvil International; Power Strut.
  - .3 Cooper B Line Inc.; Strut System.
.4 Atkore Internation: Aickinstrut (FRP).

### 2.5 Pipe Clamps

- .1 Riser Clamp: MSS SP 58 and SP 69, Type 8.
  - .1 Anvil International Inc.; Figure 261.
  - .2 Cooper B Line Inc.; Figure B3373.

# 2.6 Channel Type Support Systems

- .1 Channel Size: 12 gauge, 1 5/8 inch wide minimum steel, 1 1/2 inch wide, minimum FRP.
- .2 Members and Connections: Design for all loads with safety factor of 5.

# 2.7 Accessories

- .1 Insulation Shields:
  - .1 Type: Galvanized steel or stainless steel, MSS SP 58 and SP 69, Type 40.
- .2 Welding Insulation Saddles:
  - .1 Type: MSS SP 58 and SP 69, Type 39.
- .3 Vibration Isolation Pads:
  - .1 Type: Neoprene Waffle.
- .4 Flush Type Insert Channels: Refer to Section 05 50 00 Metal Fabrications.

### 2.8 Intermediate Pipe Guides

- .1 Piping 150 mm in diameter and smaller:
  - .1 Type: Pipe clamp with oversized pipe sleeve to provide a minimum of 3.2 mm of clearance.
- .2 Piping 200 mm in diameter and larger:
  - .1 Type: Specially formed U bolts with double nuts to provide a minimum clearance of 6.4 mm around pipe.
  - .2 U Bolt Stock Size:
    - .1 200 mm Pipe: 15.9 mm.
    - .2 250 mm Pipe: 19.1 mm.
    - .3 300 mm Through 400 mm Pipe: 22.2 mm.
    - .4 450 mm Through 762 mm Pipe: 25.4 mm.

### 2.9 Pipe Alignment Guides

- .1 Type:
  - .1 Piping 200 mm in diameter and Smaller: Spider or sleeve type.
  - .2 Piping 250 mm in diameter and Larger: Roller type.

#### 2.10 Pipe Anchors

.1 Type: Anchor chair with U bolt strap.

#### 2.11 Anchoring Systems

.1 Size: Sized by equipment manufacturer, and as specified in Section 05 50 00 - Metal Fabrications.

#### 3 Execution

#### 3.1 Installation

- .1 General:
  - .1 Install support systems in accordance with MSS SP 69 and MSS SP 89, unless shown otherwise on the Contract Drawings.
  - .2 Support piping connections to equipment by pipe support and not by equipment.
  - .3 Support large or heavy valves, fittings, and appurtenances independently of connected piping.
  - .4 Do not support pipe from the pipe above it.
  - .5 Support pipe at changes in direction or in elevation, adjacent to flexible joints and couplings, and where shown on the Contract Drawings.
  - .6 Do not install pipe supports and hangers in equipment access areas or bridge crane runs.
  - .7 Brace hanging pipes against horizontal movement by both longitudinal and lateral sway bracing and to reduce movement after startup.
  - .8 Install lateral supports for seismic loads at all changes in direction.
  - .9 Install pipe anchors where required to withstand expansion thrust loads and to direct and control thermal expansion.
  - .10 Repair mounting surfaces to their original pre-construction condition after attachments are made.

- .2 Standard Pipe Supports:
  - .1 Horizontal Suspended Piping:
    - .1 Single Pipes: Adjustable swivel ring, split ring, or clevis hangers.
    - .2 Grouped Pipes: Trapeze hanger systems.
    - .3 Furnish galvanized steel protection shield and oversized hangers for insulated pipe.
    - .4 Furnish precut sections of rigid insulation with vapour barrier at hangers for insulated pipe.
  - .2 Horizontal Piping Supported From Walls:
    - .1 Single Pipes: Wall brackets or wall clips attached to wall with anchors. Clips attached to wall mounted framing are also acceptable.
    - .2 Stacked Piping:
      1) Wall mounted framing system and clips acceptable for piping smaller than 75 mm in diameter.
      2) Piping clamps that resist axial movement of pipe through support not acceptable.
    - .3 Wall mounted piping clips not acceptable for insulated piping.
  - .3 Horizontal Piping Supported From Floors:
    - .1 Stanchion Type:

1) Pedestal type; adjustable with stanchion, saddle, and anchoring flange.

2) Use yoked saddles for piping whose centerline elevation is 450 mm or greater above floor and for exterior installations.

3) Provide neoprene waffle isolation pad under anchoring flanges, adjacent to equipment or where otherwise required to provide vibration isolation.

- .4 Floor Mounted Channel Supports:
  - .1 Use for piping smaller than 75 mm nominal diameter running along floors and in trenches at piping elevations which are lower than those which can be accommodated using pedestal pipe supports.
  - .2 Attach channel framing to floors with anchor bolts.
  - .3 Attach pipe to channel with clips or pipe clamps.
- .5 Concrete Cradles: Use for piping larger than 75 mm along floor and in trenches at piping elevations which are lower than those which can be accommodated using stanchion type.

- .6 Vertical Pipe: Support with wall brackets and base elbow or riser clamps on floor penetrations.
- .7 Standard Attachments:
  - .1 To Concrete Ceilings: Concrete inserts.
  - .2 To Steel Beams: I beam clamp or welded attachments.
  - .3 To Wooden Beams: Lag screws and angle clips to members shall be a minimum of 62.5 mm thick.
  - .4 To Concrete Walls: Concrete inserts or brackets or clip angles with anchor bolts.
- .8 Existing Walls and Ceilings: Install as specified for new construction, unless shown otherwise on the Contract Drawings.
- .3 Intermediate and Pipe Alignment Guides:
  - .1 Provide pipe alignment guides (or pipe supports that provide same function) at expansion joints and loops.
  - .2 Guide piping on each side of expansion joint or loop at 4 pipe diameters on one side and 14 pipe diameters on the other side of each joint or loop.
  - .3 Install intermediate guides on metal framing support systems not carrying pipe anchor or alignment guide.
- .4 Accessories:
  - .1 Insulation Shield: Install on insulated non-steel piping. Oversize rollers and supports.
  - .2 Welding Insulation Saddle: Install on insulated steel pipe. Oversize rollers and supports.
  - .3 Vibration Isolation Pad: Install under base flange of pedestal type pipe supports adjacent to equipment, and where required to isolate vibration.
  - .4 Dielectric Barrier:
    - .1 Install between carbon steel members and copper or stainless steel pipe.
    - .2 Install between stainless steel supports and non-stainless steel ferrous metal piping.
  - .5 Electrical Isolation: Install 6.4 mm by 75 mm neoprene rubber wrap between submerged metal pipe and oversized clamps.

# 3.2 Field Finishing

.1 Paint atmospheric exposed surfaces with hot dip galvanized steel components as specified in Section 09 90 00 – Painting and Coatings.

#### 3.3 Supplements

- .1 The supplements listed below form part of this Specification:
  - .1 Table 1: Nonchemical Areas.

# **END OF SECTION**

| Table 1<br>Nonchemical Areas                    |                                     |
|-------------------------------------------------|-------------------------------------|
| Exposure Conditions                             | Hanger Material                     |
| General Non-classified areas                    | Galvanized steel or precoated steel |
| Pipe Galleries                                  | Galvanized steel or precoated steel |
| Wet Well/Emergency Storage Tanks/MH<br>Chambers | Stainless steel or FRP              |

Notes:

Pre-coated steel to be fusion bonded epoxy or vinyl copolymer (Plastisol).

Stainless steel to be Type 316.

Galvanized steel to be per ASTM A653, Class G90, or hot-dip galvanized after fabrication in accordance with ASTM A123.

Do not use galvanized steel or aluminum where lime dust can accumulate on these surfaces.

### 1. General

# 1.1 Codes and References

- .1 Perform work and material to be in accordance with the following:
  - .1 MSS-SP-58, Pipe Hangers and Supports Materials, Design and Manufacturer.
  - .2 MSS-SP-69, Pipe Hangers and Supports Erection and Application.

# **1.2** Shop Drawings and Product Data

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 Submittal Procedures.
- .2 Submit shop drawings and product data for following items:
  - .1 Upper attachment.
  - .2 Middle attachment.
  - .3 Pipe attachment.
  - .4 Riser clamps.
  - .5 Shields and saddles.

# **1.3 Design Requirements**

- .1 Construct pipe hanger and support to manufacturer's recommendations utilizing equipment manufacturer's regular production components, parts and assemblies.
- .2 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
- .3 Provide for vertical adjustments after erection and during commissioning.
- .4 Ensure that supports, guides, anchors do not transmit excessive quantities of stress or heat to building structure.
- .5 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS-SP-58.

### 1.4 Scope

- .1 This specification covers the design, selection, application, fabrication and installation procedures for field engineered pipe supports for pipe sizes 50mm in diameter and smaller, unless noted otherwise.
- .2 Refer to contract drawings.

#### 2. Products

#### 2.1 General

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS-SP-58.
- .2 Support from structural members, where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members. Do not suspend from metal deck.
- .3 All supplementary structural members and supports shall be hot dipped galvanized after fabrication. All steel hangers and rods shall be hot dipped galvanized. All supports beneath liquid levels in tanks shall be type 316L stainless steel.
- .4 Provide seismic bracing of piping.
- .5 Provide 1.5mm thick bondable teflon isolation material to isolate stainless steel piping from galvanized steel supports where not insulated overlap at least 10mm, either side of support.
- .6 Provide rubber hose over threaded rod on all pipe clamps.

#### 2.2 Upper Attachments

- .1 Concrete:
  - .1 Hollow core block concrete: Adhesive material applied with screen tube.
    - .1 Acceptable material: Hilti Hit Adhesive Anchors, HY-20.
    - .2 Coordinate minimum embedment of adhesive anchors with anchor manufacturer.
  - .2 Solid cast in place concrete or hollow core slabs: Adhesive material fastened into solid base.

- .1 Acceptable material: Hilti Hit Adhesive Anchors, HY150.
- .2 Coordinate anchor locations with precast slab supplier so that anchor locations provide adequate concrete thickness.
- .3 Coordinate spacing of hangers with precast slab supplier so that support loads do not exceed slab capacities. Provide supplementary steel as required so that supports can be placed where required if adequate bearing does not exist.
- .4 Coordinate minimum embedment of adhesive anchors with anchor manufacturer.
- .5 Submit anchor manufacturer's embedment and precast slab suppliers recommendations for anchoring to structural engineer prior to drilling for supports.
- .2 Steel beam (bottom flange):
  - .1 Cold piping NPS 2 and under: malleable iron C clamp to MSS-SP-58, type 19. ULC listed. Complete with restraining clip.
    - .1 Standard of Acceptance: Anvil fig.61.
- .3 Steel beam (top):
  - .1 Cold piping NPS 2 and under: malleable iron "top of beam" C clamp to MSS-SP-58, type 19. ULC listed. Complete with restraining clip.
    - .1 Standard of Acceptance: Anvilfig.61.
- .4 Steel joist:
  - .1 Cold piping NPS 2 and under: steel washer plate with double locking nuts.
    - .1 Standard of Acceptance: Anvil fig.60.
- .5 Steel channel or angle (bottom):
  - .1 Cold piping NPS 2 and under; malleable iron C clamp to MSS-SP-58, type 23. ULC listed. Complete with restraining clip.
    - .1 Standard of Acceptance: Anvil fig.86.
- .6 Steel channel or angle (top):
  - .1 Cold piping NPS 2 and under; malleable iron "top of beam" C clamp to MSS-SP-58, type 19. ULC listed. Complete with restraining clip.

.7 Standard of Acceptance: Anvil fig.61.

### 2.3 Middle Attachment (Rod)

- .1 Carbon steel threaded rod electro-galvanized.
  - .1 Standard of Acceptance: Anvil fig.146.
- .2 Ensure that hanger rods are subject to tensile loading only.
- .3 Provide linkages where lateral or axial movement of pipework is anticipated.

### 2.4 Pipe Attachment

- .1 Cold piping, steel or cast iron: hot piping steel, with less than 1 inch horizontal movement; adjustable clevis to MSS-SP-58, type 1. ULC listed. Galvanized finish.
  - .1 Standard of Acceptance: Anvil fig.260.
- .2 Uninsulated cold copper piping; uninsulated hot copper piping with less than 1 inch. Horizontal movement; adjustable clevis to MSS-SP-58, type 1. Copper plated.
  - .1 Standard of Acceptance: Anvil fig.CT-65.
- .3 Suspended hot piping, steel and copper, with horizontal movement in excess of 1 inch; pipe roller to MSS-SP-58, type 43. Galvanized finish.
  - .1 Standard of Acceptance: Anvil fig.174 and fig.171.
- .4 Bottom supported hot piping, steel and copper: pipe roller stand to MSS-SP-58, type 45.
  - .1 Standard of Acceptance: Anvil fig.271.
- .5 Pipe hangers and supports on all cold pipework and hot pipework above NPS 1 must be oversized to accommodate thermal insulation and to avoid penetrating the vapour barrier.

### 2.5 Riser Clamps

- .1 Steel or cast iron pipe: galvanized carbon steel to MSS-SP-58, type 42. ULC listed.
  - .1 Standard of Acceptance: Anvil fig.261.

- .2 Copper pipe: carbon steel copper finished to MSS-SP-58, type 42.
  - .1 Standard of Acceptance: Anvil fig.CT-121.

### 2.6 Saddles And Shields

- .1 Cold piping NPS 1-1/4 and over: protection shield with 25 mm maximum thickness of polyisocyanurate insulation under shield with uninterrupted vapor barrier.
  - .1 Standard of Acceptance: Anvil fig.167.
- .2 Hot piping NPS 1-1/4 and over: protective saddle with insulation under saddle.
  - .1 Standard of Acceptance: Anvil fig.160 to 166.
  - .2 Tack weld protective saddle to pipe.

#### 2.7 Finish

- .1 Fabricated support material shall be hot dipped galvanized. Support material submerged and/or in tanks shall be type 316L stainless steel.
- .2 Bolt threads in assembled components shall be painted. Stainless steel or other corrosion-resistant material need not be painted.
- .3 Supplementary and structural steel shall be hot dipped galvanized. Supplementary and structural steel materials submerged and/or in tanks shall be type 316L stainless steel.

#### 3. Execution

#### 3.1 Installation

- .1 Install in accordance with:
  - .1 Manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
  - .1 Install on piping systems at pumps, boilers, chillers, cooling towers, elsewhere as indicated.
- .3 Clamps on riser piping:

- .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
- .2 Bolt-tightening torques to be to industry standards.
- .3 Steel pipes: Install below coupling or shear lugs welded to pipe.
- .4 Cast iron pipes: Install below joint.
- .4 Clevis plates:
  - .1 Attach to concrete with four (4) minimum concrete inserts, one at each corner.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .6 Use approved constant support type hangers where:
  - .1 Vertical movement of pipework is 13 mm or more, transfer of load to adjacent hangers or connected equipment is not permitted.
- .7 Use variable support spring hangers where:
  - .1 Transfer of load to adjacent piping or to connected equipment is not critical.
  - .2 Variation in supporting effect does not exceed 25% of total load.
- .8 Support plastic piping as per manufacturer recommendations.

### 3.2 Hanger Spacing

- .1 Spacing and middle attachment (rod) diameter as specified in paragraphs below or as in table below, whichever is more stringent.
- .2 Copper piping: up to NPS 1/2: every 5 ft.
- .3 Within 300 mm of each horizontal elbow.
- .4 Non-metallic piping per manufacturer's instructions.

| Maximum Pipe Size | Maximum Rod<br>Spacing NPS<br>Diameter | Spacing Steel<br>Cooper |
|-------------------|----------------------------------------|-------------------------|
| up to 1¼          | 10 mm                                  | 2.1 m 1.8 m             |
| 11/2              | 10 mm                                  | 2.7 m 2.4 m             |
| 2                 | 10 mm                                  | 3.0 m 2.7 m             |

#### 3.3 Hanger Installation

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.
- .4 Do not suspend from metal deck.
- .5 Anchoring of piping shall be as per manufacturer's recommendations. Submit anchorage system for review before installation.
- .6 The use of perforated band, wire chain, or solid ring type hangers will not be accepted.
- .7 Prior to connecting pumping units or other equipment to pipe sections, support complete piping assembly and anchor in perfect alignment with pumping units and sleeves to prevent movement of piping assembly and strain on pumping units or equipment.
- .8 Support all valves and risers so that weight of valve or valve assembly is not carried by adjacent horizontal pipe sections.

#### 3.4 Horizontal Movement

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4° from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

#### 3.5 Final Adjustment

- .1 Adjust hangers and supports.
  - .1 Ensure that rod is vertical under operating conditions.
  - .2 Equalize loads.
- .2 Adjustable clevis.
  - .1 Tighten hanger load nut securely to ensure proper hanger performance.
  - .2 Tighten upper nut after adjustment.

- .3 C-clamps.
  - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam. Provide restraining clip.
- .4 Beam clamps:
  - .1 Hammer jaw firmly against underside of beam.

# **END OF SECTION**

# 1. General

### 1.1 Scope

- .1 This standard covers the fabrication, and installation procedures for engineered pipe supports. This generally applies to piping 65 mm diameter and larger, unless noted otherwise.
- .2 Refer to contract drawings for lines which require engineered pipe supports.

# 1.2 Codes

- .1 Standards and Specification Sheets: The codes, standards, and specification/data sheets listed shall be the latest edition.
  - .1 CAN3-S16.1 Steel Structures for Buildings
  - .2 MSS-SP-58 Pipe Hanger and Support Materials, Design and Manufacture
  - .3 MSS-SP-69 Pipe Hangers and Supports Selection and Application
  - .4 MSS-SP-89 Pipe Hangers and Supports Fabrication and Installation Practices
  - .5 ANSI B18.2.1 Square and Hex Bolts and Screws
  - .6 ANSI B18.2.2 Square and Hex Nuts
  - .7 ANSI B1.1 Unified Screw Threads (UN and UNR Thread Forms)
  - .8 ANSI/ASME Pipe Threads, General Purpose B1.20.1
  - .9 CSA W47.1 Certification of Companies for Fusion Welding of Steel Structures
  - .10 ASME B31.3 Process Piping

### 1.3 Pipe Support Design

- .1 Contractor shall engineer and design pipe support systems for piping of 65 mm diameter and larger in accordance with ASME B31.3 for Normal Fluid Service. Pipe supports shall be engineered and certified by a Professional Engineer licensed to practice in Ontario.
- .2 Contractor shall submit to Consultant for review all support details.

- .3 Operating and installation loads, direction and amount of movement shall be shown on the detail drawings.
- .4 Supplementary steel required for attachment to roof, wall or floor structure shall be engineered and supplied by the Contractor. Supplementary steel for rod hangers shall be engineered and supplied by the Contractor. All supports and supplementary steel shall be hot dipped galvanized after fabrication. All supports and supplementary steel submerged in tanks shall be type 316L stainless steel.
- .5 All field welds and shop welds of non-catalog items will be indicated on the detail drawing using American Welding Society standard welding symbols.
- .6 The location of a particular support assembly shall be shown on the drawings issued to Consultant for review.
- .7 Support loads shall not exceed building elements design loadings.
   Contractor shall review with Consultant building loads and shall space or design supports so that building elements design loads are not exceeded.
- .8 Provide bracing of piping.
- .9 Construct pipe hanger and support to manufacturer's recommendations utilizing equipment manufacturer's regular production components, parts and assemblies.
- .10 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
- .11 Provide for vertical adjustments after erection and during commissioning.
- .12 Ensure that supports, guides, anchors do not transmit excessive quantities of stress or heat to building structure.
- .13 Maximum rod length to be 1.5 m. Pipes requiring supports with rod lengths greater than 1.5 m shall have supplementary steel attached to structure to reduce rod length to less than 1.5 m.
- .14 Pump suction/discharge headers shall be supported from below utilizing supplementary steel support racks which have base plates secured to floor.

- .15 All supports to be arranged to provide maximum access to valves and other equipment requiring access.
- .16 Do not weld directly to stainless steel pipes with steel supports. Provide clamps with bondable Teflon sheet between clamp and stainless steel pipe.

### 1.4 Dimensional Tolerances

- .1 This section covers maximum tolerances in fabricated pipe supports except for cast or forged products.
- .2 Tolerances for raw materials such as strip, sheet, bar, plate, pipe, tubing, structural and bar size shapes shall be in accordance with recognized standards and specifications. Tolerances for casting and forgings shall be in the individual manufacturer's standards.
- .3 Manufacturing Tolerances:
  - .1 Cut Lengths Linear
    - .1 Hanger rods ±12 mm.
    - .2 Structural shapes, pipe, tubing ±3 mm.
    - .3 Plates and bars ±3 mm.
  - .2 Threads:
    - .1 Screw threads to ANSI B1.1, Class 1A, 2A, and 2B.
    - .2 Pipe threads to ANSI/ASME B1.20.1.
  - .3 Weld Sizes All welds plus only, no minus.
  - .4 Angularity all manufacturing methods to ±4 degrees.
  - .5 Holes Drilled or Punched Only
    - .1 Location center to edge, or center to center, ±1.6 mm.
    - .2 Diameter plus .2 times metal thickness or minus 0.8 mm.

### 1.5 Shop Drawings

.1 Submit shop drawings in accordance with the Section 01 33 00 – Submittal Procedures.

### **1.6 Qualification of Workmanship**

.1 Use organizations approved under the Canadian Welding Bureau to the requirements of CSA W47.1, Division 2, to undertake welding operations using welders qualified to perform the type of welds required.

#### 2. Products

#### 2.1 General

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS-SP-58.
- .2 Support from structural members, where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members. Do not suspend from metal deck. Anchoring of piping and equipment shall be to manufacturers recommendations. Submit anchorage system, arrangement and type of hanger's supports with calculations for review. Supplemental steel to be galvanized after fabrication.
- .3 Finishes:
  - .1 Hangers and supports: galvanized after manufacturer.
  - .2 Use electro-plating galvanizing process.
  - .3 Ensure steel hangers in contact with copper piping are epoxy coated.
- .4 Provide seismic bracing of piping.
- .5 Use components for intended design purpose only. Do not use for rigging or erection purposes.
- .6 Steel sections (except tube sections) and plates: to CSA G40.21, type 300W.
- .7 Welding Materials: to CSA W59.1.

### 2.2 Upper Attachments

- .1 Concrete:
  - .1 Hollow core block concrete: Adhesive material applied with screen tube.
    - .1 Acceptable material: Hilti Hit Adhesive Anchors, HY-20.
    - .2 Coordinate minimum embedment of adhesive anchors with anchor manufacturer.
    - .3 Submit anchor manufacturer's recommendations for anchoring to Consultant prior to drilling for supports.
  - .2 Solid cast in place concrete or hollow core slabs: Adhesive material fastened into solid base.
    - .1 Acceptable material: Hilti Hit Adhesive Anchors, HY150.
    - .2 Coordinate anchor locations with precast slab supplier so that anchor locations provide adequate concrete thickness.
    - .3 Coordinate spacing of hangers with precast slab supplier so that support loads do not exceed slab capacities. Provide supplementary steel as required so that supports can be placed where required if adequate bearing does not exist.
    - .4 Coordinate minimum embedment of adhesive anchors with anchor manufacturer.
    - .5 Submit anchor manufacturer's embedment and precast slab suppliers recommendations for anchoring to Consultant prior to drilling for supports.
- .2 Steel beam (bottom flange):
  - .1 Cold piping NPS 2 and under: malleable iron C clamp to MSS-SP-58, type 19. ULC listed.
    - .1 Standard of Acceptance: Anvil fig.61.
  - .2 Cold piping NPS 2½ and larger and all hot piping: malleable iron beam clamp to MSS-SP-58, type 28 or 29. ULC listed.
    - .1 Standard of Acceptance: Anvil fig.229.

- .3 Steel beam (top):
  - .1 Cold piping NPS 2 and under: malleable iron "top of beam" C clamp to MSS-SP-58, type 19. ULC listed.
    - .1 Standard of acceptance; Anvil fig.61.
  - .2 Cold piping NPS 2<sup>1</sup>/<sub>2</sub> and larger and all hot piping: steel jaw, hook rod with nut, spring washer and plain washer, to MSS-SP-58, type 25. ULC listed.
    - .1 Standard of Acceptance: Anvil fig.227.
- .4 Steel joist:
  - .1 Cold piping NPS 2 and under: steel washer plate with double locking nuts.
    - .1 Standard of Acceptance: Anvil fig.60.
  - .2 Cold piping NPS 2<sup>1</sup>/<sub>2</sub> and larger and all hot piping: steel washer plates with double locking nut, carbon steel clevis and malleable iron socket.
    - .1 Standard of Acceptance: Anvil: washer plate fig.60; clevis, fig.66; eye nut, fig.290.
- .5 Steel channel or angle (bottom):
  - .1 Cold piping NPS 2 and under; malleable iron C clamp to MSS-SP-58, type 23. ULC listed.
    - .1 Standard of Acceptance: Anvil fig.86.
  - .2 Cold piping NPS 2<sup>1</sup>/<sub>2</sub> and larger and all hot piping; universal channel clamp. ULC listed.
    - .1 Standard of Acceptance: Anvil fig.226.
- .6 Steel channel or angle (top):
  - .1 Cold piping NPS 2 and under; malleable iron "top of beam" C clamp to MSS-SP-58, type 19. ULC listed.
    - .1 Standard of Acceptance: Anvil fig.61.
  - .2 Cold piping NPS 2<sup>1</sup>/<sub>2</sub> and larger and all hot piping: steel jaw, hook rod with nut, spring washer and plain washer, to MSS-SP-58, type 25. ULC listed.
    - .1 Standard of Acceptance: Anvil fig.227.

### 2.3 Middle Attachment (Rod)

- .1 Carbon steel threaded rod electro-galvanized finish.
  - .1 Standard of Acceptance: Anvil fig.146.
- .2 Ensure that hanger rods are subject to tensile loading only.
- .3 Provide linkages where lateral or axial movement of pipework is anticipated.

### 2.4 Pipe Attachment

- .1 Cold piping, steel or cast iron: hot piping steel, with less than 25 mm horizontal movement; adjustable clevis to MSS-SP-58, type 1. ULC listed. Galvanized finish.
  - .1 Standard of Acceptance: Anvil fig.260.
- .2 Uninsulated Cold copper piping; uninsulated hot copper piping with less than 25 mm horizontal movement; adjustable clevis to MSS-SP-58, type 1. Copper plated.
  - .1 Standard of Acceptance: Anvil fig.CT-65.
- .3 Suspended hot piping, steel and copper, with horizontal movement in excess of 25 mm; pipe roller to MSS-SP-58, type 43. Galvanized finish.
  - .1 Standard of Acceptance: Anvil fig.174 and fig.171.
- .4 Bottom supported hot piping, steel and copper: pipe roller stand to MSS-SP-58, type 45.
  - .1 Standard of Acceptance: Anvil fig.271.
- .5 Pipe hangers and supports on all cold pipework and hot pipework above NPS 1 must be oversized to accommodate thermal insulation and to avoid penetrating the vapour barrier.
- .6 Do not weld supports directly to stainless steel pipes. Provide clamps welded to support plates. Provide bondable Teflon sheet between clamps and stainless steel pipes.

### 2.5 Riser Clamps

.1 Steel or cast iron pipe: galvanized carbon steel to MSS-SP-58, type 42. ULC listed.

- .1 Standard of Acceptance: Anvil fig.261.
- .2 Copper pipe: carbon steel copper finished to MSS-SP-58, type 42.
  - .1 Standard of Acceptance: Anvil fig.CT-121.
- .3 Provide bondable 1.5 mm thick Teflon sheet between clamps and stainless steel pipes. Overlap min. 10 mm either side of support.

### 2.6 Saddles and Shields

- .1 Cold and hot piping NPS 1<sup>1</sup>/<sub>4</sub> and over: protection shield with high density insulation (25.4 mm thick polyisocyanurate) under shield with uninterrupted vapour barrier.
  - .1 Standard of Acceptance: Anvil fig.167.
- .2 Hot piping NPS 1¼ and over: protective saddle with insulation under saddle.
  - .1 Standard of Acceptance: Anvil fig.160 to 166.
  - .2 Tack weld protective saddle to carbon steel pipe.

#### 3. Execution

#### 3.1 Fabrication

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1, B31.3 and MSS-SP-58.
- .2 This section covers fabrication of pipe support components and assemblies.
  - .1 Material of construction shall be CSA G40.21, type 300W unless otherwise noted. Plates, rods, bars, etc. which are used for the fabrication of support assemblies may be cut to shape or size by shearing, sawing, machining, grinding or thermal cutting.
  - .2 Thermal cutting processes shall be suitable for the material to which it is applied. After thermal cutting, slag shall be removed prior to further fabrication or use. Discolouration remaining on the flame cut surface is not considered to be detrimental oxidation.
  - .3 Drilling and punching shall be performed as required by drawings and specifications.

- .4 Screw threads shall be in conformance with ANSI B1.1 Class 1A, 2A and 2B for coarse thread series and Class 2A & 2B for the eight thread series.
- .5 Pipe threads shall be in accordance with ANSI/ASME B1.20.1 either straight or tapered as required.
- .6 All threaded rod shall be hot-dip galvanized
- .7 Welding shall be performed where indicated on the detail drawings in accordance with the welded joint requirements specified in the CAN3-S16.1. When welding any attachment to a pressure pipe, such welding shall to the specific applicable welding procedures which have been qualified in accordance with Section IX of the ASME Boiler & Pressure Vessel Code and T.S.S.A. Pressure Vessels branch requirements. A copy of the fabricator's procedures and weld qualification record shall be submitted for owner review and record.
- .8 Fabricate supports in accordance with ASME B31.1, Power Piping.

### 3.2 Finishing (Painting and Galvanizing)

- .1 Fabricated support material shall be hot dipped galvanized. Support material submerged in tanks shall be type 316L stainless steel.
- .2 Bolt threads in assembled components shall be painted. Stainless steel or other corrosion-resistant material need not be painted.
- .3 Supplementary and structural steel shall be hot dipped galvanized.
   Supplementary and structural steel materials submerged in tanks shall be type 316L stainless steel.

### 3.3 Inspection

.1 There will be an inspection program to ensure that all aspects of work performed comply fully with specified requirements. The owner may elect to conduct inspection during fabrication.

### 3.4 Marking

.1 When pipe supports are to be shop fabricated, each pipe support shall have its identifying mark number painted on with water-proof paint in letters at least 20 mm high.

### 3.5 Pipe Support and Installation

- .1 Engineered pipe supports shall be located in strict accordance with the pipe support location drawing supplied by the Contractor and certified. Relocation and reorientation of any pipe support from the specified location shall not be permitted without written permission of the Contractor's design engineer.
- .2 Installed pipe supports shall be used only for their intended purpose. They shall not be used for rigging or erection purposes.
- .3 The contractor is responsible for developing an installation sequence giving priority to major components and groups of piping closest to the supporting structure.
- .4 Prior to connecting pumping units or other equipment to pipe sections, support complete piping assembly and anchor in perfect alignment with pumping units and sleeves to prevent movement of piping assembly and strain on pumping units or equipment.
- .5 Support all valves and risers so that weight of valve or valve assembly is not carried by adjacent horizontal pipe sections.
- .6 Provide heavy rubber material between pipe and galvanized supports.
- .7 Provide plastic hose material over all threaded rods used as part of pipe clamps.
- .8 All material in contact with the supported pipe shall be of the same material unless separated by suitable means.
- .9 All material welded to the supported pipe shall be of the same material as the pipe.
- .10 Clamps on riser piping:
  - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
  - .2 Bolt-tightening torques to be to industry standards.
  - .3 Steel pipes: Install below coupling or shear lugs welded to pipe.
  - .4 Cast iron pipes: Install below joint.
  - .5 Provide bondable Teflon sheet between clamps and stainless steel pipes.

- .11 Use approved constant support type hangers where:
  - .1 Vertical movement of pipework is 13 mm or more, transfer of load to adjacent hangers or connected equipment is not permitted.
- .12 Use variable support spring hangers where:
  - .1 Transfer of load to adjacent piping or to connected equipment is not critical.
  - .2 Variation in supporting effect does not exceed 25% of total load.
- .13 Provide support within 300 mm (12 in.) of each horizontal elbow.
- .14 Space supports for non-metallic pipe as per manufacturer's instructions.

### 3.6 Hanger Installation

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Do not suspend from metal deck.

#### 3.7 Horizontal Movement

- .1 Angularity of rod hanger resulting from horizontal movement of pipework form cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm ( $\frac{1}{2}$  inch) offset pipe hanger and support so that rod hanger is vertical in the hot position.

### 3.8 Final Adjustment

- .1 Adjust hangers and supports.
  - .1 Ensure that rod is vertical under operating conditions.
  - .2 Equalize loads.
- .2 Adjustable clevis:
  - .1 Tighten hanger load nut securely to ensure proper hanger performance.
  - .2 Tighten upper nut after adjustment.
- .3 C-clamps:

- .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
  - .1 Hammer jaw firmly against underside of beam.

# END OF SECTION

#### 1 General

#### 1.1 Work of This Section

- .1 The Work of this Section covers the general clauses for the supply and installation of all process equipment and other Works as specified herein and/or indicated on the Drawings.
- .2 Provide all labour and materials, obtain all necessary permits and pay all fees as may be required.
- .3 Fully coordinate the Work of all related Specification Sections. Use equipment Specifications together with all Site Work, concrete, building, electrical and controls Specifications as necessary in order to produce a fully coordinated Product meeting all necessary Specifications.

#### 1.2 Related Sections

- .1 Division 23 Heating, Ventilating and Air Conditioning
- .2 Division 26 Electrical
- .3 Division 40 Process Interconnections

#### 1.3 Submittals

- .1 Shop Drawings:
  - .1 Prepare and issue shop drawing register and schedule for review by Consultant.
  - .2 Submit shop drawings for all equipment including capacity, dimensions, motor characteristics, etc.
- .2 Informational Submittals:
  - .1 Factory Functional Test Report.
  - .2 Manufacturer's Certification of Compliance that the factory finish system is identical to the requirements specified herein.
  - .3 Special shipping, storage and protection, and handling instructions.
  - .4 Manufacturer's printed installation instructions.
  - .5 Manufacturer's Certificate of Proper Installation.
  - .6 Operating and Maintenance Data for all equipment in this Section
  - .7 Suggested spare parts list to maintain the equipment in service for a minimum period of 5 years. Include a list of special tools required for checking, testing, parts replacement, and maintenance with current price information.

.8 List all special tools, materials, and supplies furnished with the equipment for use prior to and during startup and for its future maintenance.

#### 1.4 Standards

- .1 The materials and workmanship employed in the manufacture of all equipment shall conform to the applicable standards established by the ASTM, AWWA, CEC, CGSB and CSA. Canadian Standards shall take precedence over American Standards in the event of duplication or conflicting requirements.
- .2 All electrical motors and equipment shall be built to EEMAC (Electrical and Electronic Manufacturers' Association of Canada) standards with Canadian threads and bearings throughout and all motorized and electrical equipment shall be CSA approved or supplied in accordance with ESA rules and regulations and subject to its approval.

### 1.5 Factory Testing

- .1 Where witnessed factory testing is specified in the Contract Documents, the Contractor shall provide a minimum of 10 Working Days notice of the date when equipment will be ready for testing. Confirmation of the test date and time shall be provided a minimum of 3 Working Days in advance of the tests. Equipment shall not to be delivered to the Site until factory testing has been completed to the satisfaction of the Consultant.
- .2 When certified factory testing of the equipment or any component is specified in the Contract Documents, the Contractor shall provide the Consultant with 2 copies of required certified test reports showing that the equipment complies with the Specification, before the equipment is delivered the Site. Additional copies of this information are also required for the Maintenance Data Manuals.

### 1.6 Sleeves

- .1 Install pipe sleeves at points where pipes pass through masonry, concrete or fire rated assemblies and as indicated on the Contract Drawings.
- .2 Use schedule 40 steel pipe or an approved equivalent for all sleeves.
- .3 Sleeves shall have puddle flange when they are installed in foundation walls and/or floor slabs on grade.
- .4 Provide a maximum of 6mm of clearance all around between sleeves and the uninsulated pipe and between the sleeves and insulation.

- .5 Terminate sleeves flush with the surface of concrete and masonry walls and concrete floors on grade and 25mm above all other floors.
- .6 Fill any voids around pipes as follows:
  - .1 Caulk between the sleeve and pipe in foundation walls and below grade with waterproof, fire retardant non-hardening mastic or approved equal.
  - .2 Where sleeves pass through walls or floors provide sufficient space for fire proofing. Where pipes/ducts pass through fire rated walls, floors and partitions, maintain the fire rated integrity.
  - .3 Ensure that there is no contact between copper piping and ferrous sleeve.
- .7 Provide fire stops as indicated on the Contract Drawings.

### 1.7 Escutcheons

- .1 Install escutcheons on pipes passing through walls, partitions, floors and ceilings.
- .2 Use chrome, plated brass or stainless steel 2 piece type escutcheons mechanically secured to adjacent surface.
- .3 The outside diameter of escutcheons shall cover the opening of the sleeve.
- .4 The inside diameter of the escutcheon shall fit around the finished pipe.

#### 1.8 Spare Parts

.1 Furnish all spare parts in accordance with Section 01 77 00 – Closeout Procedures.

#### 1.9 As-Built Information

.1 Submit as-built information in accordance with Section 01 77 00 – Closeout Procedures.

#### 1.10 Warranties and Bonds

- .1 Guarantee, and provide warranties and warranty work for, all equipment in accordance with all applicable sections of the Contract Documents, Section 01 77 00 Contract Closeout and Section 01 78 36 Extended Warranty.
- .2 All equipment shall be provided with a warranty of two (2) years from the date of Substantial Performance of the Work, unless a longer warranty is specified elsewhere in the Contract Documents.

#### 1.11 Measurement and Payment

- .1 The Work outlined in this Section shall be included in the lump sum price for as indicated in the Form of Tender.
- 2 Products (Not Used)

#### 3 Execution

#### 3.1 Delivery, Receiving and Storage Equipment

- .1 Arrange with the suppliers for delivery of all items of equipment to the Site of the Work as required to meet the Contract schedule.
- .2 Arrange for the delivery of all anchor bolts, templates, embedded metals, and other materials required during the concreting placement and the assembly of equipment.
- .3 The Contractor shall receive equipment at the Site, unload and examine it upon arrival for any damage or defects and shall be responsible for its safekeeping, storage and installation. Immediately notify the Consultant and the supplier of any damages or defects in the equipment delivered.
- .4 Special measures shall be taken to ensure that electrical motors are not exposed to moisture, dust, dirt or mechanical damage if they are stored or installed and inactive.
- .5 Equipment storage, safekeeping and relocation of equipment from one area of the Site to another, for whatever reason, shall be the sole responsibility of the Contractor from the time of initial off-loading at the Site until the date of completion of the Contract and acceptance by the Region.

### 3.2 Installation of Equipment

- .1 Provide any appurtenant fittings and materials, which are not herein or elsewhere specifically mentioned or included, but which are necessary for the proper installation and operation of the equipment without additional payment.
- .2 Provide all materials, labour and equipment required to completely install complete and place into full operation all the equipment specified herein.
- .3 Install the equipment in strict accordance with the manufacturer's instructions and to the satisfaction of the Consultant.
- .4 Install all instruments with an in-line isolating valve and a tee and valve on their sample line in order to allow easy isolation from the process for maintenance and in order to allow air or moisture removal.

- .5 Be fully acquainted with all Work involved in the complete installation of all equipment. Any misunderstandings by the Contractor in regard to the nature or amount of Work to be done will not constitute grounds for extra payment from the Region.
- .6 Ensure that no unnecessary strain is introduced into the equipment due to connections with piping or other appurtenances.

### 3.3 Time of Completion

.1 Any delay in delivery of the equipment or installation materials does not relieve the Contractor of the responsibility to complete the Contract within the Contract Time.

#### 3.4 Manufacturers Services and Certification of Installation

- .1 Provide for all necessary services and expenses of any trained personnel representing the manufacturers of various pieces of specified equipment, in order to ensure the correctness of installation and include any start-up costs required by the suppliers which may be necessary to ensure satisfactory installation, testing and commissioning of the equipment.
- .2 Provide all materials, labour and equipment necessary to make any adjustments to the installation as required by the manufacturer or the Consultant until the equipment is fully tested and commissioned.
- .3 Upon completion of installation and testing, obtain from the suppliers or the manufacturers concerned, certification that the equipment is installed correctly, is in full operational condition, and is operating in accordance with its design rating. Submit the original certificate to the Consultant and all copies necessary to comply with other submittal requirements. Certificates are to include a statement to the effect that any adjoining pipe is properly and independently supported and does not cause undue stress that would be detrimental to the performance of the equipment.
- .4 Co-ordinate the Work of all equipment suppliers, fully commission all equipment and provide representatives from the various manufacturers during plant testing and commissioning as required by the Consultant.

#### 3.5 Acquaintance with Work

.1 The Contractor shall be fully acquainted with all of the work involved in the complete installation of all equipment. At no time shall the Contractor make any claim that any misunderstanding existed in regard to the nature or amount of work to be done in relation to the installation, testing and commissioning of all specified equipment.

.2 Obtain all necessary details from equipment suppliers including dimensions and other information pertinent to the Work.

#### 3.6 Material and Workmanship

- .1 All materials and equipment are to conform to the latest edition of applicable standards referenced in each Specification Section in force at the time of tendering. In the event of any conflict between the Specifications with any standards, the more stringent of the two requirements shall apply.
- .2 Provide all materials and equipment in conformance with the following:
  - .1 Constructed and finished in a workmanlike manner.
  - .2 Fully suitable for the use or service intended.
  - .3 Selected and fabricated to industry standard engineering practice.
- .3 Furnish all safety devices, including shear pins, flexible coupling guards, belt guards and all other pertinent items with the equipment.
- .4 Design machinery such that working parts are readily accessible for inspection and repair, and so that each part is suitable for the service required.
- .5 Carefully pack and crate all equipment for shipment. Protect all polished and machined metal surfaces from corrosion and damage during shipment. Specially pack all electrical equipment to prevent damage by moisture. Cover any equipment having exposed bearings and glands to exclude any foreign matter.
- .6 Design equipment to have adequate strength, power and capacity for both continuous and intermittent service and to have motors and other parts capable of starting and operating under any conditions or loading likely to occur under normal plant operating conditions.
- .7 Design the general mechanical and electrical equipment and particularly gearings, contacts and other wearing parts in order to function for long periods of operation without frequent maintenance or attention.
- .8 Provide adequate and, as far as practicable, authentic means of lubrication for working parts. Arrange lubrication grease nipples, grease boxes and other lubrication devices so that they are readily accessible for routine greasing. Indicate on the working drawings submitted, the types of lubricants to be used (must be readily available in Ontario). Use grease nipples of a consistent type (Alemite button head type or an approved equivalent).

- .9 Make all lubrication points readily accessible using grease nipples and Type 316 stainless steel or copper tubing extensions where required. Secure the nipples and tubing to the equipment at appropriate locations.
- .10 Design all equipment to be installed outdoors for service under the climatic conditions typical for the area. Give particular attention to winter operating conditions.

### 3.7 Special Tools and Accessories

.1 Furnish a set of any special tools, wrenches and accessories which may be required for removing worn parts, for carrying out maintenance and for making any adjustments to the equipment. Special tools are those tools which, because of their limited use or purpose-made design, are not normally readily available, but which are necessary for maintaining the equipment.

#### 3.8 Temporary Supports

- .1 Provide all necessary temporary supports and bracing in order to prevent the overloading of all floors and walls, while the equipment is being installed. Ascertain the weights of all pieces of equipment from the manufacturer, and move the equipment into position in a manner and at a time approved by the Consultant.
- .2 Provide eye bolts or hooks for the safe handling of the equipment during installation. Eye bolts shall be left in place.

#### 3.9 Lubricants, Grease, Oil and Fuel

.1 Provide the complete initial lubrication of all equipment in accordance with the manufacturer's recommendations. Provide a complete schedule of all of the manufacturer's recommended lubricants. Fill all grease, oil and fuel tanks, as required for the initial operation of the equipment.

#### 3.10 Small Piping

.1 Supply and install all small connecting pipework, fittings and valves whether shown on the Drawings or not. Perform all such Work strictly in accordance with the instructions of the manufacturer whose equipment is being installed or connected.

#### 3.11 Anchor Bolts

.1 Unless otherwise specified in the Contract Documents, supply all stainless steel anchor bolts, such anchor bolts being of a diameter and size as recommended by the manufacturers of the equipment and machinery

being installed. Generally use expansive type anchorages in setting small equipment. Set large pumps by means of bolts with sleeves cast into the concrete to a minimum depth of 150mm. Elsewhere, cast in place anchor bolts may be used subject to the approval of the Consultant; these must be properly positioned by means of substantial templates.

#### 3.12 Pump and Machinery Bases

- .1 Provide concrete bases for all equipment, including pumps. Final setting of pump and machinery bases shall be on cement grout placed on concrete bases, or as otherwise recommended by the equipment supplier. Grouting shall be in accordance with Section 03 30 00 Cast-In-Place Concrete. Provide anchor bolts for all bases. Finish vertical sides of pump bases and bases to match the adjacent floor.
- .2 The final shapes and dimensions of bases and anchor bolt locations for the bases where not already finalized, will be determined by the Consultant after receipt of the equipment manufacturer's detail drawings. In general, the concrete bases are to be a minimum of 50mm larger than the supplied equipment base in each direction.
- .3 Reinforced concrete bases shall be firmly fixed to the parent concrete slab by adequate dowels as shown on the Drawings or as recommended by the equipment supplier and approved by the Consultant.

#### 3.13 Equipment Cabinet Bases

- .1 Install all floor-mounted cabinets on concrete bases whether shown on the Drawings or not. Concrete shall be as specified in Section 03 30 00 Cast-in-Place Concrete.
- .2 Anchor bases as recommended by manufacturer.
- .3 The final shape and dimensions shall be determined by the Consultant after receipt of equipment manufacturer's detail drawings.

#### 3.14 Field Welding and Fabrication

- .1 Ascertain the details of field welding and fabrication to be carried out for the erection and installation of the various items of equipment.
- .2 Fabricate the equipment in accordance with CSA Standard S16, Steel Structures for buildings and in accordance with the manufacturer's instructions.
- .3 Have the welding shielded, conforming to CSA Standard W59.0, General Specifications.

#### 3.15 Equipment Guards

- .1 Provide removable protective guards for all open rotating equipment including pulleys, belts, drives, shafts and couplings, etc.
- .2 Ascertain the extent of the work required for the installation and/or the supply etc., of equipment guards by direct contact with the equipment suppliers.

#### 3.16 **Protection of Equipment**

.1 After the equipment has been installed and prior to final acceptance, protect the equipment from damage. Ensure that all protection measures are to the satisfaction of the manufacturer and the Consultant.

#### 3.17 Alignment

- .1 All rotating equipment shall be set and aligned in accordance with the more stringent requirements of either the equipment manufacturer's instructions or the following:
  - .1 Level base, use a machinist's level on all machined surfaces.
  - .2 Base is to be true and leveled.
  - .3 Alignment of shafts, soft foot or motor and couplings shall be performed by reverse dial, rim to rim and face to face. Soft foot will be rim to rim vertical and horizontal mode.
    - .1 Soft foot of motor shall be checked to be within a tolerance of 0.03mm.
    - .2 Shaft shall be aligned within a tolerance of ±0.025mm to 0.070mm.
    - .3 Piping strains to pump shall be within a tolerance of ±0.025mm to 0.070mm
  - .4 Provide the Consultant with alignment reports.

#### 3.18 Vibration Monitoring

- .1 Without exception, all rotating equipment shall be checked and tested for vibration.
  - .1 The vibration level shall be within the specified limit in accordance with the manufacturer's recommendations. Generally, the peak vibration velocity shall not exceed 1 mm / second measured in the filter-in mode. Measurement shall be carried out with a Real Time analyzer, Thermo Fisher Scientific Inc. Corporation, Nicolet 100A. Provide a hard copy of the Vibration Signature Spectrum showing

vibration velocities over a frequency range of 0 to 2000 Hz, measured in a filter-in mode.

.2 Provide the Consultant with the original Vibration Monitoring reports and all copies necessary for the Maintenance Data.

### 3.19 Testing and Commissioning

- .1 Unless otherwise specified in the Contract Documents, provide testing, startup and commissioning in accordance with Sections 01 75 16 Startup Procedures and 01 91 00 Commissioning.
- .2 Unless otherwise specified in the Contract Documents, furnish a certificate of final inspection and approvals from the ESA to the Consultant.

### 3.20 Training

.1 Unless otherwise specified in the Contract Documents, provide Demonstration and Training in accordance with the requirements of Section 01 79 00 – Demonstration and Training.

# END OF SECTION
## 1. General

## 1.1 Scope

- .1 This specification covers hydrostatic testing and pneumatic testing of piping after erection and prior to initial operation.
- .2 References
  - .1 All references to codes and standards shall be to the latest edition of the following including addenda, etc.
  - .2 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME) B31.1 – Power Piping and B31.3 Process Piping.
  - .3 Applicable codes including ANSI/ASME B31.1, B31.3, and standards shall apply. All references to codes and standards shall be to the latest issue of the same.
  - .4 In the event repairs or additions are made following the pressure tests, the affected piping shall be retested, using the test procedures applied to the original system.
  - .5 All piping shall be hydrostatic tested.
  - .6 All piping shall be tested as required by the T.S.S.A.
  - .7 Acceptance of system under test shall follow Section 40 05 15 -Piping System Acceptance.

## 1.2 Responsibility and Records

- .1 Construction Contractor shall be responsible for all testing. Contractor shall see that all required tests are made in accordance with this specification and shall arrange for tests to be witnessed by Consultant.
- .2 The Contractor shall see that adequate records are maintained. These shall include test pressure, temperature, duration, date and time of day test fluid, and signatures of Consultant's and Contractor's representatives who witnessed the test, identification of piping system tested. Contractor shall provide a test plan and schedule to Consultant at start of work. The format of these records shall be approved by the Consultant before field pressure testing begins.

- .3 It shall be the responsibility of the Contractor, in accordance with the Consultant's instructions, to ensure that no equipment or piping is subjected to a higher pressure than indicated in the test requirement documents furnished by the Consultant.
- .4 Test procedures shall be reviewed with Consultant as part of the normal safety review.

## 2. Products (Not Used)

### 3. Execution

### 3.1 Preparation for Testing

- .1 Piping that is not to be tested shall be isolated. If isolation is impractical, the test conditions shall be determined by agreement with Consultant.
- .2 Lines (not intended to carry liquids) which are spring or counterweight supported shall be temporarily blocked up if hydrostatic tested, in order to sustain the weight of test fluid. Blocks shall be removed immediately after the system is drained.
- .3 All valves within the system to be tested, except as described in Paragraphs 3.1.4, and 3.1.6, shall be in an open position.
- .4 Shut-off valves in instrument lead lines from process lines and equipment shall be closed and instruments disconnected.
- .5 All dirt, debris or loose foreign materials shall be removed by flushing from piping prior to hydrostatic testing.
- .6 Relief valves and safety valves shall be blanked off at the inlet flange of the valves. Screwed relief and safety valves shall be removed and replaced with plugs or caps.
- All flanges, threaded joints and field welds shall be left bare of insulation and free of all visual obstructions. All underground pipe joints, except those encased in concrete anchors, if any, shall be left exposed. Underground lines shall be adequately shored to prevent pull-out of joints.

- .8 The Contractor shall supply all materials (blanks, plugs, vents, gaskets and drain valves) necessary for testing. Blank flanges, blank plates, etc., shall be selected to withstand the test pressure. After tests the materials shall remain the property of Contractor, except drain valves which shall remain in place.
  .9 Blank flanges, blank plates, etc., shall have handles painted a bright color to make them readily identifiable for removal prior to start-up operations.
  .10 After testing is completed, piping shall be blown out with plant air to remove all debris.
- .11 All welded attachments (such as pipe supports and hangers) shall be made before testing.
- .12 Piping and equipment shall be thoroughly vented of air before the final hydrostatic test pressure is applied. Vent connections shall be located at high points of system.
- .13 Insulation is not to be applied over any joints in the piping prior to completion of test.
- .14 All instrument floats not rated for the test pressure shall be removed before hydrostatic testing.
- .15 Control valves not resistant to the test pressure shall be removed from the piping system prior to test.
- .16 Expansion joints shall be provided with restraints to withstand the added pressure load under test, or shall be removed or isolated from the test.
- .17 Precautions shall be taken by opening vents or by other means to prevent building up excessive pressure in equipment adjacent to portions of the piping under tests.
- .18 Restrictions to flow, such as orifice plates and mixing nozzles, shall not be installed or shall be removed. Where necessary, items removed shall be replaced with temporary spool pieces provided by Contractor.
- .19 Lines containing check valves shall have the source of pressure on the upstream side of the valve. If this is impossible, the check valve shall be blanked off or removed.

- .20 If the test fluid in the system is subject to thermal expansion, precautions shall be taken to avoid excessive pressure.
- .21 All pipe runs and interconnecting branch lines subject to the same test conditions shall preferably be tested at the same time. Equipment shall be isolated from testing unless authorized by the Consultant.

## 3.2 Hydrostatic Test Pressure

- .1 The hydrostatic test pressure shall meet the ASME/ANSI B31.1 Piping Code Requirements for compressed air systems. Other piping systems hydrostatic test pressures shall be in accordance with ASME B31.3 for Normal Fluid Service.
- .2 Generally, the hydrostatic test pressure shall be determined within the following guidelines:
  - .1 1<sup>1</sup>/<sub>2</sub> times the pressure class of the piping and flanges (i.e. 1034 kPa system test pressure = 1550 kPa).
- .3 Non-metallic piping shall be tested as required by ASME B31.3 but within manufacturer's limitations.

## 3.3 Alternate Tests

- .1 When pressure testing is not feasible, (examples are large diameter lines not designed to withstand the weight of the water and refractory lined piping) an alternative test may be considered with the approval of the Owner. The alternatives are as follows:
  - .1 A combination of 100% radiography plus liquid penetrant examination plus a sensitive leak test.
  - .2 A combination of 100% radiography plus magnetic particle examination plus a sensitive leak test.

## 3.4 Test Procedure

.1 All testing must be scheduled and coordinated with the Consultant.

- .2 Hydrostatic pressure shall be applied by means of a suitable test pump which shall not be connected to the pipe line until ready to test. An approved operator shall constantly attend the pump whenever it is connected to the pipe line. The pump shall be disconnected whenever the pump operator or the inspector leaves the pump or test site for any reason.
- .3 The pump shall be disconnected or suitable block and bleed valves operated during the period the test pressure is being held.
- .4 At least two indicating test gages shall be provided, one on the pump or air source and one on the piping to be tested. The gages are to be checked frequently against a "standard" gage or dead weight tester and should read between 1½ times (min.) to 3 times (max.) the test pressure.
- .5 The piping under test shall be held at full test pressure for at least 2 hours without leaks.
- .6 Clean water shall be used as the testing medium when hydrostatic testing materials other than stainless steel. Other liquids may be used when necessary and upon approval by Owner.
- .7 Hydrostatic testing of austenitic stainless steel shall be performed using potable water. Test water in stainless steel piping shall be immediately drained after test and all residual water removed.
- .8 When water is used in cold weather, it shall be heated or protected by inhibited antifreeze to avoid freezing. Water temperature during testing shall be a minimum of 15.5°C. Prior approval shall be obtained from the Consultant for the use of antifreeze.
- .9 Retesting of lines after repair shall be done at pressures originally specified for the test.
- .10 Underground pressure lines shall be tested before backfilling.
- .11 Instruments shall be tested in accordance with the recommendations of Consultant.

# 3.5 Draining After Hydrostatic Testing

.1 All lines shall be drained after the hydrostatic test.

.2 After pump suction and discharge lines have been drained, the piping shall be reassembled. It is imperative that a temporary strainer be installed in the pump suction at this time.

### 3.6 Final Procedures After Pressure Testing

- .1 Replace all control valves and check valve action for proper direction.
- .2 Remove all temporary blocks from spring or counter-weight supported pipelines.
- .3 Replace all orifice plates and mixing nozzles, and other in-line instrumentation.
- .4 Connect all instruments removed for the testing operation.
- .5 Remove all temporary blanks and blinds.
- .6 Use all new gaskets when replacing control valves, orifice plates, blanks, blinds, etc.
- .7 Valves which were closed for pressure testing and/or draining shall be returned to the proper position.
- .8 Temporary piping supports shall be removed.
- .9 Replace all relief valves and safety valves.
- .10 Remove any restraints that may have been provided for expansion joints.
- .11 Disconnect test equipment, test pump, test gages and test safety valves.

# END OF SECTION

## 1. General

### 1.1 Scope

.1 This specification defines the requirements for testing and acceptance of construction of piping systems.

### 1.2 Purpose

- .1 A procedure for inspecting, testing and accepting completed process, utility, and other miscellaneous piping systems after installation by the Contractor.
- .2 The procedure develops the essential features based on the three phases of a testing program, namely:
  - .1 Pretest requirements
  - .2 Test requirements
  - .3 Post-test requirements
- .3 An organization routing from inception to acceptance is also described.

## 2. Products (Not Used)

#### 3. Execution

#### 3.1 Piping Testing Procedure

- .1 The focal point is the pipe test package, which is an accumulation of information about the pipeline system to be tested. For each test made, there is a particular package describing, through drawings and specifications, what is required to make that piping system complete. The pipe test package is separated into three phases, defined as follows:
  - .1 Pretest Pipeline system completed to the point that is physically ready for a test and that each component in the system can withstand the potentially greater than normal weights and pressures of the test. All radiographic examinations are complete and documented.

- .2 Test The piping system is filled with test media, pressurized, tested to specific requirements and witnessed.
- .3 Post-Test Test blinds and test medium have been removed and all items have been installed. The piping is now ready for precommissioning.
- .2 The exceptions to this system are "in-service" tests where the basic elements of this total procedure are followed, except that the proposed pressure test is deferred until after the service has been turned on.

## 3.2 Documentation

- .1 Pipe inspection, testing and acceptance require the preparation of a master testing plan for the systems. Piping test numbers are assigned and these documents are cross referenced to insure that all pipe lines to be constructed are included within the pipe test master plan.
- .2 The Contractor shall assemble individual test packages containing:
  - .1 P&ID P&ID highlights the pipelines to be included in the test system and establishes the in-line devices, line and equipment isolation that must be accomplished prior to the initiation of the test.
  - .2 Piping Inspection and Acceptance Record This form provides the pipe test descriptions. Sign-off locations are provided for pre-test inspection approval, hydrotest witness and post-test acceptance.
  - .3 Inspection Punch list Sheet Used to highlight incomplete and/or incorrect installation found during inspection. Same sheet is used for sign-off of the inspection punch list after completion.
- .3 Upon completion of the Piping Systems Acceptance Package, the Contractor shall prepare a progress tracking system based on the number of packages and the status of inspection, testing and acceptance.

# 3.3 Organizational Responsibilities

.1 The piping test package must be routed through the organizations involved with construction and operation of the piping systems. Any change or deficiency found during the pipe test and inspection process is best located and identified as soon as possible. Then the change or deficiency can be corrected without an additional and costly hydrostatic test.

- .2 The following outline shows the flow of the test package throughout the construction organization.
  - .1 Pre-Test
    - .1 Contractor prepares pipeline master testing plan.
    - .2 Contractor assembles test packages.
    - .3 Inspection by Contractor and sign-off of pre-test mechanical inspection or preparation of a punchlist list and correction before submitting to Consultant.
  - .2 Consultant Inspection Activities
    - .1 Inspection by Consultant and preparation of a punchlist.
    - .2 Consultant identifies punchlist items requiring completion prior to test. Returns punchlist list to Contractor. Contractor completes critical punch list items and returns to Consultant
    - .3 Consultant then checks that all punchlist items have been completed prior to signing the approval for test.
  - .3 Contractor Activities
    - .1 Works off punchlist list items and resubmits to Consultant for approval for hydrotest.
    - .2 Prepares for test.
  - .4 Test
    - .1 Contractor Activities
      - .1 Fills system to be tested with water or other test medium as noted on line list.
      - .2 Applies test procedure according to line list or as amended by Consultant.
      - .3 Tightens lines as needed.
      - .4 Holds pressure for at least one-half hour before calling Consultant to witness.
  - .5 Consultant's Construction Activities
    - .1 Witness hydrotest.

- .2 Sign-off test inspection portion of Piping Inspection and acceptance Record.
- .6 Contractor Activities (when applicable)
  - .1 Route copy of signed test package to mechanical, electrical, instrumentation, insulation and painting Contractors as a signal that pipeline system is now cleared for other work to proceed; i.e., final alignment of pumps, prime painting of welds, top-coating coating of insulated and uninsulated lines.
- .7 Post-Test
  - .1 Contractor Activities
    - .1 Vent lines
      - .1 Remove blinds.
      - .2 Plug vents and drains.
      - .3 Replace instruments and specialty items.
      - .4 Remove temporary supports.
      - .5 Check off and sign post-test check list.
    - .2 Rechecks the pipeline system to be sure line is mechanically complete.
  - .2 Consultant's Construction Activities
    - .1 Consultant shall re-inspect the pipeline system to make sure that all elements are complete except for heat tracing and insulation.
    - .2 Consultant then submits a post-test punchlist list or signs-off as complete and accepted.
- .3 Final Disposition
  - .1 Contractor Activities
    - .1 The Contractor transmits test packages to Consultant after each package is accepted by Consultant.
    - .2 Punchlist list items preventing completion of a test package due to material deliveries are considered complete if those punchlist list items are transferred to the master project punchlist list.

# END OF SECTION

### 1. General

#### 1.1 References

- .1 CGSB 1-GP-60M-78, Enamel, Interior, Gloss, Alkyd Type.
- .2 References shall be the latest update version.

#### 1.2 Samples

- .1 Submit samples in accordance with Section 01 33 00 Submittal Procedures.
- .2 Submit samples and lists of proposed wording for approval before engraving for the following:
  - .1 Nameplates.
  - .2 Pipe markers.
  - .3 Valve tags.

## 1.3 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

## 2. Products

#### 2.1 Manufacturer Nameplates

- .1 Provide metal nameplate on each piece of equipment, mechanically fastened complete with raised or recessed letters.
- .2 Indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors.

## 2.2 System Nameplates

- .1 Color:
  - .1 Hazardous: red letters, white background.
  - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

- .2 Construction:
  - .1 3 mm thick, laminated plastic or white anodized aluminum, matte finish, square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
  - .1 Conform to following table:

| Size | Dimensions<br>(mm x mm) | No. of Lines | Letter Height<br>(mm) |
|------|-------------------------|--------------|-----------------------|
| 1    | 10 x 50                 | 1            | 3                     |
| 2    | 13 x 75                 | 1            | 5                     |
| 3    | 13 x 75                 | 2            | 3                     |
| 4    | 20 x 100                | 1            | 8                     |
| 5    | 20 x 200                | 1            | 8                     |
| 6    | 20 x 100                | 2            | 5                     |
| 7    | 25 x 125                | 1            | 12                    |
| 8    | 25 x 125                | 2            | 8                     |
| 9    | 35 x 200                | 1            | 20                    |

- .2 Use average of 25 letters/numbers (maximum) per nameplate.
- .3 Use size #6 for terminal cabinets and control panels.
- .4 Use size #9 for equipment in equipment rooms.
- .5 Use size #9 for tanks.

# 2.3 Piping

- .1 General:
  - .1 To CGSB 24-GP-3a.
  - .2 Identify medium by lettered legend, classification by primary and secondary colours, and direction of flow by arrows.
  - .3 Complete painting of all ferrous piping, valves and fittings plus labelling every 3 meters.
  - .4 Non-ferrous materials will be colour banded maximum every 3 meters rather than completely painted.

- .2 Sizes:
  - .1 Legend: block capitals to following table:

| Outside Dia. of Pipe or Insulation<br>(mm) | Size of Letters<br>(mm) |
|--------------------------------------------|-------------------------|
| 30                                         | 13                      |
| 50                                         | 19                      |
| 150                                        | 32                      |
| 250                                        | 63                      |
| Over 250                                   | 88                      |

- .2 Primary colour bands:
  - .1 At valves and fittings: 500 mm long.
  - .2 Elsewhere: 1000 mm long.
- .3 Secondary colour bands: 50 mm wide, 75 mm in from one end of primary colour band.
- .4 Arrows:
  - .1 Outside diameter of pipe/insulation 75 mm and greater: 150 mm long x 50 mm high.
  - .2 Outside diameter of pipe/insulation less than 75 mm: 100 mm long x 50 mm high.
  - .3 Use double headed arrows where flow is reversible.
- .3 Material:
  - .1 Paint: to CGSB 1-GP-60M.
  - .2 Legend markers, arrow colour bands: plastic coated cloth material with protective over-coating and waterproof contact adhesive undercoating, suitable for 100% RH and continuous operating temperature of 150°C and intermittent temperature of 200°C. Apply to prepared surfaces. Wrap tape around pipe or pipe covering with ends overlapping one (1) pipe diameter.
  - .3 Waterproof and heat resistant plastic marker tags: for pipes and tubing 20 mm nominal and smaller.

- .4 Colors:
  - .1 Where not covered by table below, submit legend colours to Consultant for approval. Entire system to be painted with prime colour except stainless steel where bands shall be applied for primary and secondary colours.
- .5 Background colour marking and legends for piping systems:

| Legend Marking            | Background Colour     |
|---------------------------|-----------------------|
| Non-potable water line    | Blue with black bands |
| Potable water line        | Blue                  |
| Raw Sewage line           | Gray                  |
| Fuel oil/diesel           | Red                   |
| Plumbing drains and vents | black                 |

## 2.4 Valves and Controllers

- .1 Brass tags with 12 mm lettering and numbers.
- .2 Provide Consultant with six identification flow diagrams of approved size for each system. Include valve tag schedule, designating number, service, function and location of each tagged item and normal operating position of valves.

## 2.5 Controls Identification

- .1 Identify all systems, equipment, components, controls and sensors.
- .2 Inscription to identify function and, (where applicable) fail-safe position.

## 2.6 Equipment

- .1 Provide equipment nameplates for each piece of equipment.
- .2 Equipment nameplates shall contain lettering 100 mm high and be mounted on equipment in a location visible from normal passage/approach.

### 3. Execution

#### 3.1 General

- .1 Do identification work in accordance with CGSB 24-GP-3a except where specified otherwise.
- .2 Provide ULC and or CSA registration plates, as required by respective agency.
- .3 Provide identification only after all painting has been completed.

### 3.2 Location of Nameplates

- .1 In conspicuous location to facilitate easy reading from operating floor and to properly identify equipment and/or system.
- .2 Provide stand-offs for nameplates on hot surfaces and insulated surfaces.
- .3 Do not insulate or paint over plates.

### 3.3 Piping

- .1 Locations:
  - .1 On long straight runs in open areas.
  - .2 Adjacent to all changes in direction, exceeding 3 metres.
  - .3 At least once in each small room through which piping passes.
  - .4 On both sides of visual obstruction or where run is difficult to follow.
  - .5 On both sides of any separation such as walls, floors and partitions.
  - .6 Where piping is concealed in pipe chase, ceiling space, or other confined space, at entry and leaving points and adjacent to each access opening.
  - .7 At beginning and end points of each run and at each piece of equipment in run.
  - .8 At point immediately upstream of major manually operated or automatically controlled valves. Where this is not possible, place identification as close to valve as possible, preferably on upstream side.
  - .9 Legend to be easily and accurately readable from usual operating areas and all readily accessible points.

- .10 Plane of legend to be approximately at right angles to most convenient line of sight with consideration of operating positions, lighting conditions, reduced visibility of colour or legends caused by dust and dirt and risk of physical damage.
- .2 Application:
  - .1 Complete painting of all ferrous piping, valves and fittings plus labelling every linear 3 metres maximum identifying the contents and the direction of flow (comply with Occupational Health and Safety Act (OHSA) 66(1)(a), (b) and (c).
  - .2 For all non-ferrous material, piping will be colour banded every linear 3 metres maximum rather than completely painted.

## 3.4 Valves and Controllers

- .1 Secure tags with non-ferrous chains or closed "S" hooks for valves and operating controllers at plain sight of equipment they serve.
- .2 Install one copy of flow diagram and valve schedule mounted in frame with non-glare glass where directed by Consultant. Provide one copy in each operating and maintenance instruction manual.
- .3 Consecutively number valves in system.

# END OF SECTION

### 1 General

#### 1.1 Intent of Section

- .1 This section covers the supply, delivery, supervision of installation and commissioning of process piping and valves and fittings.
- .2 The term "Process Piping" includes pipes, valves and fittings within or outside structures.
- .3 The following piping systems are included in this section:
  - .1 Pumps Suction and Discharge Piping.
  - .2 Other Process Piping.
- .4 Piping Systems NOT included under this section include the following. These systems are included in other sections in the Specifications.
  - .3 Domestic water systems.
  - .4 Diesel generator cooling water system.
  - .5 Diesel generator exhaust piping.
  - .6 Diesel generator fuel pumping.
  - .7 Other miscellaneous plumbing/drainage piping.
  - .8 Heating.
  - .9 Ventilation.

## 1.2 References

- .1 ANSI B16.1-1975, Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
- .2 ANSI B16.5-1981, Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys.
- .3 ANSI B16.20-1973, Ring-Joint Gaskets and Grooves for Steel Pipe Flanges.
- .4 ANSI B16.21-1978, Nonmetallic Flat Gaskets for Pipe Flanges.
- .5 ANSI B18.2.1-1981, Square and Hex Bolts and Screws.
- .6 ASTM A47M-84, Specification for Ferritic Malleable iron Castings.

- .7 ASTM A53-87b, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
- .8 ASTM A120-84, Specification for Pipe, Steel, Black, and Hot-Dipped Zinc Coated, (Galvanized) Welded and Seamless, for Ordinary uses.
- .9 ASTM A536-84, Specification for Ductile Iron Castings.
- .10 ASTM B62-86, Specification for Composition Bronze or Ounce Metal Castings.
- .11 CSA B242-M1980, Groove and Shoulder type Mechanical Pipe Couplings.
- .12 CSA W47.1-1983, Certification of Companies for Fusion Welding of Steel Structures.
- .13 MSS-SP-70-1984, Cast Iron Gate Valves, Flanged and Threaded Ends.
- .14 MSS-SP-71-1984, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
- .15 MSS-SP-80-1979, Bronze Gate, Globe, Angle and Check Valves.
- .16 MSS-SP-85-1985, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.
- .17 ANSI 150, ASTM D-1784, all PVC valves with classification 12454A.
- .18 ASTM C76, Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.

## 1.3 Shop Drawings

.1 Submit the Shop Drawings and samples for review in accordance with Section 01 33 00 – Submittal Procedures.

## 1.4 Maintenance Data

.1 Refer to Section 01 77 00 – Closeout Procedures

# 2 Products

## 2.1 Pipe - General

.1 Supply all pipes, valves and fittings of the materials, size, classes and types as shown on the Contract Drawings and as specified herein.

# 2.2 Stainless Steel Piping and Fittings

- .1 The stainless steel pipe and fittings (excluding couplings) shall be manufactured from type 304 SS L produced from parent metal conforming to ASTM-A240 and AWWA Manual M11. All stainless steel piping and fittings shall be minimum schedule 10S.
- .2 The wall thickness of piping system (including tees, elbows, flanges, lateral fittings, specials, couplings, etc.) shall be designed to withstand full vacuum and a working pressure of 1035 kPa at 100°C. The pipe shall be carefully die-formed or rolled true to dimension and round within a tolerance plus or minus 1.5 mm. Ends of the pipe and fittings are to be perpendicular to the longitudinal axis. All joints shall be welded by either Tungsten Inert Gas or Metal Inert Gas method. Pipe surfaces shall be smooth and even and the interior weld bead shall not be higher than 1.5 mm. The pipes shall be pickled by immersion in acid bath for removal of weld discoloration and iron pick-up. After pickling, the pipe and fittings shall be thoroughly washed with fresh clean water. All pipes shall be properly secured for shipment and marked in the shop for identification at job site. The exterior finish of the pipework shall be in accordance with the Manufacturer's recommendation unless otherwise noted herein.
- .3 Joints shall be welded unless otherwise noted on the drawings. Flanged joints where shown shall be stub end type or rolled Van-Stones in Type 316 stainless steel and shall be suitable for a working pressure of 1035 kPa at 100°C. See schedule below for a detailed schedule of jointing methods and fittings required for the stainless steel piping systems.
- .4 After the piping system has been installed and tested, the Contractor shall pickle wash the stainless steel piping system to remove weld discoloration and iron pickup. After pickling, the pipe and fittings shall be thoroughly washed with fresh clean water and inspected by the Consultant if deemed necessary by the Consultant; the Contractor may be instructed to repeat the entire pickle wash procedure.

- .5 Pipe couplings shall be provided as deemed necessary for expansion and/or maintenance purposes. Apply flexible coupling and fittings to the expansion loops to absorb thermal expansion/contraction within the couplings at the elbows.
- .6 Main anchors shall be installed at terminal points, major branch connections or changes of piping direction. Use anchors to direct movement away from or to protect critical changes in direction, bend, branch connections and structure. Spacing and types of supports shall be considered in accommodating anticipated axial movements.

| Item     | Size                 | Description                                                                                                                                                                                                                                           |
|----------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pipe     | 50 mm and smaller    | Schedule 10S: ASTM A312/A312M,<br>Type 304 seamless, pickled and<br>passivated.                                                                                                                                                                       |
|          | 60 mm thru<br>500 mm | Schedule 40S: ASTM A778, Type 304L.                                                                                                                                                                                                                   |
|          | 500 mm and larger    | Schedule 10S: ASTM A778, Type 304L.                                                                                                                                                                                                                   |
| Joints   | 50 mm and smaller    | Threaded or flanged at equipment as required or shown on the Contract Drawings.                                                                                                                                                                       |
|          | 60 mm and<br>larger  | Butt-welded or flanged at valves and equipment.                                                                                                                                                                                                       |
| Fittings | 50 mm and smaller    | Threaded Forged: 1,000 CWP,<br>ASTM A182/A182M, Grade 316L.                                                                                                                                                                                           |
|          | 60 mm and<br>larger  | Butt-Welded: ASTM A774/A774M<br>Grade 316L in accordance with<br>MSS SP43, "as-welded" grade, pickled<br>and passivated; fitting wall thickness to<br>match adjoining pipe; long radius elbows<br>unless shown otherwise on the Contract<br>Drawings. |

.7 Refer to the below table for pipe and associated fitting details.

| Item                  | Size                | Description                                                                                                                                                                                               |
|-----------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Branch<br>Connections | 50 mm and smaller   | Tee or reducing tee in accordance with Fittings above.                                                                                                                                                    |
|                       | 60 mm and<br>larger | Butt-welding tee or reducing tee in accordance with Fittings above.                                                                                                                                       |
| Flanges               | All                 | Forged Stainless Steel:<br>ASTM A182/A182M, Grade 316L,<br>ANSI B16.5 Class 150 or Class 300,<br>slip-on weld neck or raised face.                                                                        |
| Unions                | 50 mm and smaller   | Threaded Forged: ASTM A182/A182M,<br>Grade 316L, 13800 or 20700 kPag<br>WOG, integral ground seats, design<br>meeting the requirements of<br>ANSI B16.11, bore to match pipe.                             |
| Bolting               | All                 | Forged Flanges: Type 316 stainless<br>steel, ASTM A320/A320M Grade B8M<br>hex head bolts and ASTM A194/A194M<br>Grade 8M hex head nuts.                                                                   |
|                       |                     | Van Stone Flanges: Carbon steel<br>ASTM A307 Grade B hex head bolts<br>and ASTM A563 Grade A hex head<br>nuts. Provide same on mating cast iron<br>flange on valve or equipment with flat<br>ring gasket. |

| ltem             | Size              | Description                                                                                                                                                                                                                                                       |
|------------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Gaskets          | All Flanges       | Flanged, Water and Sewage Service:<br>5 mm thick, unless otherwise specified<br>in the Contract Documents, red rubber<br>(SBR), hardness 80 (Shore A), rated to<br>93 degrees C, in accordance with<br>ANSI B16.21, AWWA C207, and<br>ASTM D1330, Grades 1 and 2. |
|                  |                   | Flanged, Hot Air and Fuel Gas Service:<br>3 mm thick, unless otherwise specified<br>in the Contract, homogeneous black<br>rubber (EPDM), hardness 60 (Shore A),<br>rated to 150 degrees C, in accordance<br>with ANSI B16.21 and ASTM D1330<br>Steam Grade.       |
|                  |                   | Blind flanges shall be gasketed covering<br>entire inside face with gasket cemented<br>to blind flange.                                                                                                                                                           |
| Thread Lubricant | 50 mm and smaller | Teflon tape.                                                                                                                                                                                                                                                      |

## 2.3 Fasteners

.1 Studs, nuts and washers shall be best quality Type 304 stainless steel ASTM A193 Grade B-8, Class 2.

## 2.4 Approved Manufacturers:

- .1 Douglas Barwick
- .2 Phillips Metal
- .3 Oshwin Overseas
- .4 Approved equivalent

## 3 Execution

### 3.1 Installation and Inspection

- .1 The piping, valves, fittings and accessories shall be installed as indicated on the Contract Drawings, in accordance with the Manufacturer's recommendations and as approved by the Consultant.
- .2 Provide the services of a factory trained representative(s) to inspect, operate, test, adjust, and troubleshoot the installation.
- .3 The factory trained representative(s), mentioned above, will certify that the equipment is ready for operation before use. In addition, the factory trained representative(s) shall instruct the Owner's operation personnel in the proper operation and maintenance of the equipment supplied.
- .4 Provide for additional supervision of installation by Equipment Supplier as required.
- .5 Arrange with the Consultant a mutually agreeable date when the representative should be on site.
- .6 Submit a report, signed by the Manufacturer's representative, describing in detail the inspection, tests, and adjustments made, quantitative results and suggestions for precautions to be taken to ensure proper maintenance. The report must verify that the equipment conforms to all specifications.
- .7 Inspection to include checking for:
  - .10 Cracks and other damaged or defective parts. The equipment must be undamaged, without cracks and free of defective parts.
  - .11 Completeness of installation as specified and as recommended by the Manufacturer.
  - .12 Correctness of setting, alignment and relative arrangement of various parts of the system.

## 3.2 Handling

- .1 Provide proper equipment and tools for safe and convenient handling and installation of pipes, fittings, valves and other accessories.
- .2 Exercise particular care to prevent abrasion of pipe coating.

## 3.3 Sizing

.1 Supply and install pipes, valves and other fittings according to the sizes indicated on drawings. Where sizes are not clearly indicated, obtain sizes form the Consultant before proceeding with the work.

## 3.4 Mechanical Testing and Certification

- .1 After start-up and prior to final acceptance, the Contractor shall conduct Consultant-witnessed performance tests on the equipment.
- .2 The field service representative will cause the piping, valves and fittings to perform all mechanical functions that they have been designed to perform.
- .3 The field service representative shall submit to the Consultant a written report stating that the equipment has been checked and is suitable for operation.

### 3.5 Supervision of Installation and Commissioning

.1 Test and commission the equipment in accordance with Section 01 91 00 – Commissioning.

#### 3.6 Storage

.1 Prior to the installation the piping, valves, fittings and accessories shall be protected and stored indoors in a dry area, in accordance with the Manufacturer's recommendations.

#### 3.7 Maintenance

.1 Provide maintenance on Supplier's equipment as required by the Supplier from the date of delivery to the initial startup.

#### 3.8 Pipe and Valve Supports

- .1 Refer to Section 40 05 07 Hangers and Supports for Process Piping.
- .2 Contractor shall provide concrete valve supports as indicated on the contract drawings. Reinforcement configurations to be submitted to Consultant for the review and approval.

## END OF SECTION

### 1. General

### 1.1 Related Sections

- .1 Section 09 90 00 Painting and Coatings
- .2 Section 40 05 06 Couplings, Adapter, and Specials for Process Piping
- .3 Section 40 05 10 General Equipment Requirements

## 1.2 References

- .1 Comply with the latest edition of the following statutes, codes, and standards, and all amendments thereto.
  - .1 American Petroleum Institute (API):
    - .1 API 600, Steel Valves-Flanged and Buttwelding Ends
    - .2 API 602, Compact Steel Gate Valves-Flanged, Threaded, Welded and Extended- Body Ends
    - .3 API 608, Metal Ball Valves-Flanged and Butt-Welding Ends
    - .4 API 589, Valve Inspection and Testing
- .2 American National Standards Institute (ANSI):
  - .1 B16.1, Cast Iron Pipe Flanges and Flanged Fittings.
  - .2 C111/A21.11, Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings
- .3 American Society of Sanitary Engineers (ASSE): 1011, Performance Requirements for Hose Connection Vacuum Breakers.
  - .1 ASTM International (ASTM):
    - .1 A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
    - .2 A276, Standard Specification for Stainless Steel Bars and Shapes.
    - .3 A351, Standard Specification for Castings, Austenitic, Austenitic Ferric (Duplex), for Pressure Containing Parts
    - .4 A564, Standard Specification for Hot Rolled and Cold Finished Age Hardening Stainless Steel Bars and Shapes

| .5  | A961, Standard Specification for Common Requirements for<br>Steel Flanges, Forged Fittings, Valves, and Parts for Piping<br>Applications    |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------|
| .6  | B61, Standard Specification for Steam or Valve Bronze<br>Castings                                                                           |
| .7  | B62, Standard Specification for Composition Bronze or<br>Ounce Metal Castings                                                               |
| .8  | B98, Standard Specification for Copper Silicon Alloy Rod,<br>Bar, and Shapes.                                                               |
| .9  | B127, Standard Specification for Nickel Copper Alloy (UNS N04400) Plate, Sheet, and Strip                                                   |
| .10 | B139, Standard Specification for Phosphor Bronze Rod, Bar, and Shapes.                                                                      |
| .11 | B164, Standard Specification for Nickel Copper Alloy Rod,<br>Bar, and Wire.                                                                 |
| .12 | B194, Standard Specification for Copper Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar                                                 |
| .13 | B584, Standard Specification for Copper Alloy Sand<br>Castings for General Applications.                                                    |
| .14 | B763, Standard Specification for Copper Alloy Sand<br>Castings for Valve Application                                                        |
| .15 | D429, Test Methods for Rubber Property—Adhesion to Rigid Substrates                                                                         |
| .16 | F992, Standard Specification for Valve Label Plates                                                                                         |
| .17 | F993, Standard Specification for Valve Locking Devices                                                                                      |
| .18 | F1030, Standard Practice for Selection of Valve Operators                                                                                   |
| .19 | D1784, Standard Specification for Rigid Poly (Vinyl Chloride)<br>(PVC) Compounds and Chlorinated Poly (Vinyl Chloride)<br>(CPVC) Compounds. |
| .20 | F1802, Standard Test Method for Performance Testing of Excess Flow Valves                                                                   |
| 21  | E1970 Standard Specification for Special Engineered                                                                                         |

.21 F1970, Standard Specification for Special Engineered Fittings, Appurtenances or Valves for use in Poly (Vinyl

1.3

|      |         | Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC)<br>Systems                                                              |  |  |
|------|---------|-------------------------------------------------------------------------------------------------------------------------------------|--|--|
| .2   |         | American Water Works Association (AWWA):                                                                                            |  |  |
|      |         | .1 C508, Swing Check Valves for Waterworks Service, 2 in. to 24 in. NPS                                                             |  |  |
|      |         | .2 C509, Resilient Seated Gate Valves for Water Supply Service.                                                                     |  |  |
|      |         | .3 C510, Double Check Valve, Backflow Preventer Assembly.                                                                           |  |  |
|      |         | .4 C511, Reduced Pressure Principle Backflow Prevention Assembly.                                                                   |  |  |
|      |         | .5 C540, Power Actuating Devices for Valves and Sluice Gates.                                                                       |  |  |
|      |         | .6 C550, Protective Epoxy Interior Coatings for Valves and Hydrants                                                                 |  |  |
|      |         | .7 C606, Grooved and Shouldered Joints                                                                                              |  |  |
|      |         | .8 C800, Underground Service Line Valves and Fittings                                                                               |  |  |
|      | .3      | Manufacturers Standardization Society (MSS):                                                                                        |  |  |
|      |         | .1 SP 81, Stainless Steel, Bonnetless, Flanged Knife Gate Valves.                                                                   |  |  |
|      |         | .2 SP 88, Diaphragm Type Valves                                                                                                     |  |  |
| Subr | nittals |                                                                                                                                     |  |  |
| .1   | Shop    | Drawings:                                                                                                                           |  |  |
|      | .1      | Product data sheets and supporting design recommendations for valves and actuators including make, model and Product specifications |  |  |
|      | .2      | Complete catalog information, descriptive literature, specifications, and identification of materials of construction.              |  |  |
|      | .3      | Power and control wiring diagrams, including terminals and numbers.                                                                 |  |  |

- .4 Complete motor nameplate data.
- .5 Actuator sizing calculations.
- .6 Recommended list of spare parts including individual pricing.

- .7 Summary list showing all valves, tag numbers where noted on the Contract Drawings, size and type of operator, valve class, location, motorized operator number where applicable and materials.
- .2 Information Submittals:
  - .1 Certificate of Compliance for:
    - .1 Electric operators; full compliance with AWWA C540.
    - .2 API ANSI classes 300 and 600 valves; full compliance with API standards
  - .2 Tests and inspection data
  - .3 Manufacturer's Certificate of Proper Installation.
  - .4 Operation and Maintenance Data and Manuals.

# 1.4 Measurement and Payment

.1 The Work outlined in this Section shall be included in the lump sum price as indicated in the Form of Tender.

# 2. Products

# 2.1 Approved Suppliers or Manufacturers

- .1 Knife Gate:
  - .1 Trueline
  - .2 DeZurick
- .2 Gate:
  - .1 AVK
  - .2 Clow Canada
  - .3 Mueller
  - .4 Approved equivalent.
- .3 Ball:
  - .1 Watts
  - .2 Crane
  - .3 Apollo

- .4 Approved equivalent
- .4 Flexible Disc Check Valve:
  - .1 Val-Matic Surgebuster
  - .2 Henry Pratt Company PSI
  - .3 Approved equivalent
- .5 Surge Anticipating:
  - .1 Singer 106-PRS-RR
  - .2 Cla-Val
  - .3 Approved equivalent
- .6 Combination Air Release:
  - .1 Val-Matic
  - .2 Hydro-Logic Environmental
  - .3 ARI
  - .4 Dezurik
  - .5 Approved equivalent
- .7 Electric Operators:
  - .1 Auma
  - .2 Rotork
  - .3 Approved equivalent
- .8 Plug Valves
  - .1 Dezurik
  - .2 Val-Matic
  - .3 Approved equal.

#### 2.2 General

.1 All valves shall include the operator, actuator, hand wheel, chain wheel, extension stem, floor stand, worm and gear operator, operating nut, chain, wrench, and accessories for a complete operation and as shown on the Contract Drawings and described in the Specifications.

- .2 Valves shall be suitable for intended service. Renewable parts shall not to be of a lower quality than specified in the Contract Documents.
- .3 Valves shall be of the same size as adjoining pipe.
- .4 Valve ends to suit adjacent piping.
- .5 Select and size each valve operator for the full range of pressures and velocities.
- .6 All valves shall open by turning counterclockwise.
- .7 Factory mount and test operator, actuator, and accessories as one complete assembly.

## 2.3 Valve Schedules

.1 Specific valve requirements covered by this section are shown on the Electric Operator Schedule and Valve Schedule included as supplements to this Section. The Valve Schedule does not include all valves as may be required for drains, flush and instrument connections. The Contractor shall verify and update the schedules including all other required process valves as part of the shop drawing submission process.

## 2.4 Materials

- .1 Brass and bronze valve components and accessories that have surfaces in contact with water to be alloys containing less than 16 percent zinc and 2 percent aluminum.
  - .1 Approved alloys are of the following ASTM designations: B61, B62, B98 (Alloy UNS No. C65100, C65500, or C66100), B139 (Alloy UNS No. C51000), B584 (Alloy UNS No. C90300 or C94700), B164, B194, and B127
  - .2 Stainless steel Alloy 18-8 may be substituted for bronze.

## 2.5 Factory Finishing

- .1 Epoxy Lining and Coating:
  - .1 Use where specified in the Contract Documents for the individual valves described herein.

- .2 In accordance with AWWA C550 unless otherwise specified in the Contract Documents.
- .3 Either two parts liquid material or heat activated (fusion) material except that only heat activated material if specified as "fusion" or "fusion bonded" epoxy.
- .4 Minimum 0.18mm dry film thickness except where limited by valve operating tolerances.
- .2 Exposed Valves:
  - .1 In accordance with Section 09 90 00 Painting and Protective Coatings.
  - .2 Safety isolation valves and lockout valves with handles, handwheels, or chain wheels shall be "safety yellow."

## 2.6 Valves

- .1 Knife Gate Valves
  - .1 Supply and install knife gate valves at the sizes and locations shown in the Contract Drawings and specified herein.
  - .2 Knife gate valves shall be resilient seated, non-rising extended stem style, solid one piece cast Type 316 stainless steel body, full port, suitable for bi-directional service complete with handwheel up to 300 mm. Knife gate valves size 350 mm and larger shall be supplied with gear. Valves must have full radius on both sides of the gate.
  - .3 The knife gate stems stanchion (Piler Posts), gland flange, stem couplings, nuts, screws, and bolts shall be constructed of stainless steel.
  - .4 The knife gate valves shall be supplied complete with a ductile iron epoxy coated handwheel.
  - .5 The valve shall have ANSI B16.5 150 lb flanges on both the inlet and outlet connections.
  - .6 Packing gland to be rounded in order to match the gate and to prevent leakage through the packing. The ring shall be backed up in the gland packing chamber.

- .7 The gate material shall be a minimum of Type 316 Stainless Steel material. Valves are to contain stoppers which will allow for tight seal against the seat.
- .8 The valves threads are to be ACME style, matched to yoke sleeves with tight tolerances and to give positive responses with no hysteresis.
- .9 Valves larger than 350 mm mounted horizontally will require rollers or sliders, or special support bearings as recommended by supplier, to prevent damage to the packing.
- .10 Valves shall be supplied with visual position indication of valve position.
- .2 Gate Valves
  - .1 Supply and install Gate Valves as shown on the Contract Drawings and/or as specified herein.
  - .2 Up to and including 50 mm diameter shall be Class 150, Bronze, screwed ends inside, non-rising stem, solid wedge equal to Crane 438, Jenkins 810 or WATTS GV.
  - .3 Larger than 50 mm diameter gate valves shall be resilient seated, OS&Y rising stem conforming to the latest revision of AWWA C509. Non-rising stem gate valve should be used for limited space or head room installations.
  - .4 The wedge shall be fully encapsulated in the elastomer, including the guides. The brass stem nut must be rigidly enclosed in the wedge to maintain alignment. The wedge elastomer shall be bonded to the wedge.
  - .5 The waterway shall be full size to allow for tapping use; no cavities or depressions are permitted in the seat area.
  - .6 Valve body and bonnet shall be electrostatically applied fusion bonded epoxy, coated both inside and out by the valve Manufacturer. The coating shall meet the requirements of AWWA C550. Coating to be applied only at the valve Manufacturer's facilities.
  - .7 Suitable for submerged service where indicated.
  - .8 Handwheel operated or 50 mm square operating nut where noted.

- .9 Valve coatings and lubricants must be suitable for potable water application and conform to the requirements of NSF 61.
- .10 Shaft spindle to have "O" rings to resilient materials.
- .11 Valve operators to be waterproof type suitable for continuous submergence duty. Operators to be greased packed, enclosed gear type.
- .12 If valve operator located more than 2 m from finished floor provide chain wheel.
- .13 Valves to open in a counter clockwise direction.
- .14 Approved suppliers or manufacturers in accordance with Section 2.1.
- .3 Ball Valves
  - .1 Supply and install ball valves size and location as shown on the Contract Drawings and/or specified herein.
  - .2 Ball valves shall be full port, stainless steel complete with Type 316 S.S. ball, stem and packing unit, Durafill seats, Type 304 S.S., lockable handle, NPT ends. Rated for 125 psi WSP.
  - .3 Approved suppliers or manufacturers in accordance with Section 2.1.
- .4 Flexible Disc Swing Check Valves:
  - .1 The valves shall be designed, manufactured, tested and certified to American Water Works Association Standard AWWA C508.
  - .2 The valve shall be certified to NSF/ANSI 61 Drinking Water System Components – Health Effects, and certified to be Lead-Free in accordance with NSF/ANSI 372.
  - .3 The valves shall be certified Lead Free to NSF/ANSI 372
  - .4 The valves shall have flanges with drilling to ANSI B16.1, Class 125.
  - .5 125-pound flanged ends, ductile iron body with fusion bonded epoxy coating on exterior and interior of the valve.
  - .6 The check valve shall be suitable for cold working pressures of 250 psig

- .7 The check valve shall be of the full body type, with a domed access cover and only two moving parts, the flexible disc and the disc accelerator.
- .8 The valve body shall be full flow equal to nominal pipe diameter at all points through the valve. The seating surface shall be on a 45 degree angle to minimize disc travel. The top access port shall be full size, allowing removal of the disc without removing the valve from the line.
- .9 A threaded port with pipe plug shall be provided on the bottom of the valve to allow for field installation of a backflow actuator, or oil cushion without special tools or removing the valve from the line.
- .10 The top access port shall be full size, allowing removal of the disc without removing the valve from the line. The access cover shall be domed in shape to provide flushing action over the disc for operating in lines containing high solids content. A threaded port with pipe plug shall be provided in the access cover to allow for field installation of a mechanical, disc position indicator.
- .11 The disc shall be of one-piece construction, precision molded with an integral o-ring type sealing surface, and contain alloy steel and nylon reinforcement in the flexible hinge area. The flex portion of the disc shall be warranted for twenty-five (25) years. Non-Slam closing characteristics shall be provided through a short 35 degree disc stroke and a disc accelerator to provide a cracking pressure of 0.3 psig.
- .12 The disc accelerator shall be of one piece construction and provide rapid closure of the valve in high head applications. The disc accelerator shall be enclosed within the valve and shall be field adjustable and replaceable without removal of the valve from the line. The disc accelerator shall be securely held in place by being captured between the cover and disc. It shall be formed with a large radius to allow smooth movement over the disc surface.
- .13 A screw-type backflow actuator shall be provided to allow opening of the valve during no-flow conditions.
- .14 Buna-N seals shall be used to seal the stainless steel stem in a Lead-Free bronze bushing. The backflow device shall be of the

rising-stem type to indicate position. A stainless steel T-handle shall be provided for ease of operation.

- .15 A mechanical indicator shall be provided to provide disc position indication. The indicator shall have continuous contact with the disc under all operating conditions to assure accurate disc position indication.
- .16 The valve body and cover shall be constructed of ASTM A536 Grade 65-45-12 ductile iron. The exterior and interior of the valve shall be coated with an ANSI/NSF 61 approved Fusion Bonded epoxy coating.
- .17 The disc shall be precision molded Buna-N (NBR), ASTM D2000-BG.
- .18 The disc accelerator shall be Type 302 stainless steel.
- .19 Approved suppliers or manufacturers in accordance with Section 2.1.
- .5 Surge Anticipating Valve
  - .1 Valve to be hydraulically operated Surge Anticipating Relief Globe Valve
  - .2 Valve must open when the header pressure rises faster than the rate determined by the pilot
  - .3 Valve also open when the header pressure reaches the set point of the pilot
  - .4 Valve to open on power failure
  - .5 The inner valve shall be top and bottom guided by means of replaceable bearing bushings. Inner valve assembly shall be the only moving part and be mounted onto a 316 Stainless steel stem.
  - .6 Main Valves 6" and larger shall provide smooth motion to ensure low flow Stability by using a Single Rolling Diaphragm
  - .7 Valve Body to be constructed of ASTM A536-65/45/12 ductile iron. Flanges shall be designed to ANSI Class 150
  - .8 All internal and external ferrous components shall be coated with an NSF-61 approved Fusion Bonded Epoxy Coating
  - .9 Seat ring to be 316 stainless steel constructions.
- .10 All external fasteners shall be stainless steel with stainless steel washers
- .11 The model 81-RP Pressure Relief Pilot shall be bronze construction with a spring range spring range of 20 to 200 psi (5 to 50, 10 to 80, or 100 to 300. Pilot should also be field adjustable without the use on any special tools
- .12 Valve to be supplied with a valve position indicator with bleed valve
- .13 Valve to be supplied with a Y-strainer that allows collected dirt to be flushed out directly to drain by opening the blow down valve
- .14 Valve to be supplied with Upstream gauges as part of valve assemble
- .15 The valve shall be covered by a minimum three (3) warranty against defects in material and workmanship.
- .16 The valve shall be equipped with a limit switch for "open" status indication to the PLC panel.
- .6 Combination Air Release / Air Vacuum Valve
  - .1 Location and size as shown on the Contract Drawings.
  - .2 Valve shall be NSF-61 Certified.
  - .3 Valve shall have adequate support provided.
  - .4 Shall be combination air valve with cast iron boot and cover with stainless steel internal parts.
  - .5 Class 125, 1035 kPa (150 psi) cold water working pressure.
  - .6 Shall have a stainless steel ball valve for isolation purposes with each combination valve, size to match inlet orifice diameter.
  - .7 Shall have the valve exhaust/discharge to nearest suitable funnel floor drain.
  - .8 Valves to be automatic float valves designed to regulate air discharge from the pump column to prevent shock and air entering the system with each start.
  - .9 With each pump stop, valve is to allow full flow unrestricted air back into the column preventing a vacuum from forming which can damage pump seals and to prevent the pump from re-starting against a full head in the column.

- .10 Includes threaded full port inlet, ASTM A536 65-45-12 Ductile Iron body with ANSI/NSF61 compliant fusion bonded epoxy coating suitable for potable water applications on interior and exterior surfaces. Valve to be NSF61 certified. Rated to 300 psi.
- .11 Valves equipped with stainless steel float, nitrile seals, stainless steel and Delrin components.
- .12 Approved suppliers or manufacturers in accordance with Section 2.1.
- .10 Plug Valves
  - .1 Supply and install bi-directional plug valves as shown on the contract drawings and/or as specified herein.
  - .2 The valve body shall be constructed of ASTM A126 Class B cast iron for working pressure up to 175 psig. Port area shall be 100 % of standard class pipe size and shall be rectangular. Bearings shall be sleeve type and made of sintered, oil-impregnated permanent lubricated type 316 SS per ASTM A743 Grade CF89M.
  - .3 The plug shall be of one-piece construction made of ASTM A 126 class B cast iron or ASM A536 Grade 65-45-12 ductile iron. The plug shall have a cylindrical seating surface eccentrically offset from the center of the shaft. Plug shall not contact the seat prior to 90% closed.
  - .4 Grit excluders made of PTFE shall be provided to prevent the entry of grit and solids into the bearing areas.
  - .5 Minimum pressure ratings shall be 175 psi for sizes 3 inch to 12 inch and 150 psi for 14 inch to 36 inch. Every valve shall be given a certified hydrostatic and seat test with test reports being available upon request.
  - .6 All valves 100 mm and larger shall be supplied with a gear actuator.
  - .7 Plug valves and actuators shall meet or exceed the latest revisions of AWWA C517 and other applicable standards.
  - .8 Valve actuator shall be suitable for continuous submerged conditions.

- .9 The interior and exterior of the valve shall be coated with a fusion bonded epoxy. Epoxy coating shall be applied at the manufacturer's facility
- .10 Approved suppliers or manufacturers in accordance with Section 2.1.

# 2.7 Operators

- .1 Manual Operator:
  - .1 General:
    - .1 Operator force not to exceed 18 daN under any operating condition, including initial breakaway. Gear reduction operator when force exceeds 18daN.
    - .2 Operator self locking type or equipped with self locking device.
    - .3 Position indicator on quarter turn valves
    - .4 Worm and gear operators shall be one piece design worm gears of gear bronze material. Worm hardened alloy steel with thread ground and polished. Traveling nut type operators shall be threaded steel reach rods with internally threaded bronze or ductile iron nut.
  - .2 Exposed Operator:
    - .1 Galvanized and painted handwheels.
    - .2 Lever operators allowed on quarter turn valves 200 mm and smaller.
    - .3 Cranks on gear type operators.
    - .4 Chain wheel operator with tiebacks, extension stem, floor stands, and other accessories to permit operation from normal operation level.
    - .5 Valve handles to take a padlock, and wheels a chain and padlock.
  - .3 Buried Operator:
    - .1 Buried service operators on valves larger than 63 mm shall have a 50mm AWWA operating nut. Buried operators on valves 50 mm and smaller shall have cross handle for

operation by forked key. Enclose moving parts of valve and operator in housing to prevent contact with the soil.

- .2 Design buried service operators for quarter turn valves to withstand 610 Newton-meter of input torque at the FULLY OPEN or FULLY CLOSED positions, grease packed and gasketed to withstand a submersion in water to 69 kPa.
- .3 Buried valves shall have extension stems, bonnets, and valve boxes.
- .2 Electric Operator:
  - .1 General:
    - .1 Comply with the requirements of AWWA C540.
    - .2 Size to 1 1/2 times required operating torque. Motor stall torque not to exceed torque capacity of valve.
    - .3 Controls integral with the actuator and fully equipped as specified in AWWA 540.
    - .4 Stem protection for rising stem valves.
  - .2 Actuator Operation General:
    - .1 Suitable for full 90 degree rotation of quarter turn valves or for use on multiturn valves.
    - .2 Manually override handwheel.
    - .3 Valve position indication.
    - .4 Operate from FULL CLOSED to FULL OPEN positions or the reverse in the number of seconds given in the Electric Operator Schedule.
  - .3 Open Close/Throttling Service:
    - .1 Size motors for one complete OPEN CLOSE OPEN cycle no less than once every 10 minutes.
    - .2 Actuator suitable for throttling operation of valve at intermediate positions.
    - .3 Integral OPEN STOP CLOSE pushbutton controls.
    - .4 OPEN and CLOSED indicating lights.
    - .5 Reversing motor starter with built in overload protection.

- .4 Modulating Service:
  - .1 Size motors for continuous duty.
  - .2 Feedback potentiometer and integral electronic positioner/comparator circuit to maintain valve position.
  - .3 HAND OFF AUTO (Local Off Remote) Selector Switch:
    - .1 OPEN STOP CLOSE pushbutton to control valve in HAND position.
    - .2 4 to 20 mA dc input signal to control valve in AUTO position.
    - .3 Auxiliary contact that closes in REMOTE position.
  - .4 Valves shall close upon loss of signal unless otherwise indicated in the Contract Documents.
  - .5 OPEN and CLOSED indicating lights.
  - .6 AC motor with reversing starter or DC motor with solid state reversing controller, and built in overload protection. Controller must be capable of 1200 starts per hour.
  - .7 Duty cycle limit timer and adjustable band width to prevent actuator hunting.
  - .8 Valve position output converter that generates a 4 to 20 mA dc signal in proportion to valve position, and which is capable of driving into loads up to 500 ohm at 24 volts dc.
- .5 Actuator Power Supply:
  - .1 570 volt, three phase unless otherwise indicated.
  - .2 Control power transformer, 120 volt secondary.
  - .3 Externally operable power disconnect switch.
- .6 Enclosure:
  - .1 As defined in NEMA 250, Type 4.
  - .2 Contain 120 volt space heaters.
- .7 Limit Switch:
  - .1 Single pole, double throw (SPDT) type, field adjustable cam operated, with contacts rated for 5 amps at 120 volts ac.

- .2 Each valve actuator to have a minimum of two transfer contacts at end position, one for valve FULL OPEN and one for valve FULL CLOSED.
- .3 Housed in actuator control enclosure.
- .8 Extended Warranty
  - .1 An additional 2 year extended warranty over and above the required 1 year contract warranty period is required for all electric actuators.
- .9 Manufacturers and Products:
  - .1 Approved suppliers or manufacturers in accordance with Section 2.1.

# 2.8 Accessories

- .1 Tagging: 38 mm diameter heavy brass or stainless steel tag attached with No. 16 solid brass or stainless steel jack chain for each valve and operator, bearing the valve tag number shown on the valve and operator schedules included as supplements to this Section.
- .2 Limit Switch:
  - .1 Factory installed limit switch by actuator manufacturer.
  - .2 SPST, rated at 5 amps, 120 volts ac.
- .3 T Handled Operating Wrench:
  - .1 One (1) galvanized operating wrenches, 1.22 metres long.
  - .2 Manufacturers and Products:
    - .1 Approved suppliers or manufacturers in accordance with section 2.1.
- .4 Extension Bonnet for Valve Operator: Complete with enclosed stem, extension, support brackets, and accessories for valve and operator.
  - .1 Manufacturers and Products:
    - .1 Approved suppliers or manufacturers in accordance with section 2.1.
- .5 Cast Iron Valve Box: Designed for traffic loads, sliding type, with minimum of 6 inch ID shaft.

- .1 Box: Cast iron with minimum depth of 225 mm.
- .2 Lid: Cast iron, minimum depth 75 mm, marked SEWER.
- .3 Extensions: Cast iron.
- .6 Concrete Valve Box: Designed for traffic loads, sliding type, with minimum of 200mm ID shaft.
  - .1 Box: Concrete, minimum depth 300 mm, cast iron ring seat.
  - .2 Lid: Cast iron, minimum depth 75 mm, marked SEWER
  - .3 Extensions: Concrete

## 3. Execution

### 3.1 Installation

- .1 Flange Ends:
  - .1 Flanged valve boltholes shall straddle vertical centerline of pipe.
  - .2 Clean flanged faces, insert gasket and bolts, and tighten nuts progressively and uniformly.
- .2 Screwed Ends:
  - .1 Clean threads by wire brushing or swabbing.
  - .2 Apply joint compound.
- .3 PVC and CPVC Valves: Install using solvents approved for valve service conditions.
- .4 Valve Orientation:
  - .1 Install operating stem vertical when valve is installed in horizontal runs of pipe having centerline elevations 1476 mm or less above finished floor, unless otherwise shown on the Contract Drawings.
  - .2 Install operating stem horizontal in horizontal runs of pipe having centerline elevations between 1476 mm and 2057 mm above the finish floor, unless shown otherwise on the Contract Drawings.
  - .3 If no plug valve seat position is shown on the Drawings, locate as follows:

- .1 Horizontal Flow: The flow shall produce an "unseating" pressure, and the plug shall open into the top half of valve.
- .2 Vertical Flow: Install seat in the highest portion of the valve.
- .5 Install a line size ball valve and union upstream of each solenoid valve, in line flow switch, or other in line electrical device, excluding magnetic flowmeters, for isolation during maintenance.
- .6 Install safety isolation valves on compressed air and fuel oil systems.
- .7 Locate valve to provide accessibility for control and maintenance. Install access doors in finished walls and plaster ceilings for valve access.
- .8 Extension Stem for Operator: Where the depth of the valve is such that its centerline is more than 984 mm below grade, furnish an operating extension stem with 50 mm operating nut to bring the operating nut to a point 152 mm below the surface of the ground and/or box cover.
- .9 Torque Tube: Where operator for quarter turn valve is located on floor stand, furnish extension stem torque tube of a type properly sized for maximum torque capacity of the valve.
- .10 Floor Box and Stem: Steel extension stem length shall locate operating nut in floor box.
- .11 Chain Wheel and Guide: Install chain wheel and guide assemblies or chain lever assemblies on manually operated valves over 2057 mm above finished floor. Where chains hang in normally traveled areas, use appropriate "L" type tie back anchors.

## 3.2 Tests and Inspection

- .1 Valve may be either tested while testing pipelines, or as a separate step.
- .2 Test that valves open and close smoothly under operating pressure conditions. Test that two way valves open and close smoothly under operating pressure conditions from both directions.
- .3 Inspect air and vacuum valves as pipe is being filled to verify venting and seating is fully functional.
- .4 Count and record number of turns to open and close valve; account for any discrepancies with manufacturer's data.

- .5 Set, verify, and record set pressures for all relief and regulating valves.
- .6 Automatic valves to be tested in conjunction with control system testing. Set all opening and closing speeds, limit switches, as required or recommended by the Consultant.

## 3.3 Manufacturer's Services

- .1 Process valves and operators larger than 50 mm listed in the schedules attached to this section require manufacturer's field services.
- .2 Manufacturer's Representative: The Contractor shall ensure that the manufacturer's representative will be present at the Site for the minimum number of person days listed below, travel time excluded, where one (1) person day is defined as a 10 hour working period:
  - .1 Two (2) person days for installation assistance and inspections.
  - .2 Two (2) person days for functional and performance testing and completion of the Manufacturer's Certificate of Proper Installation.
- .3 See Section 01 43 33 Manufacturers' Services, and Section 01 78 23 -Equipment Testing and Facility Start-Up for additional requirements.

### 3.4 Supplements

- .1 The supplements listed below, following "End of Section," form part of this Specification.
  - .1 Valve Schedule.

# END OF SECTION

## PART 1 GENERAL

#### 1.1 Intent of Section

- .1 This section covers the supply, delivery, supervision of installation and commissioning of three (3) submersible non clog raw sewage pumping station centrifugal pumps at the Bissett Lake Wastewater Pump Station.
- .2 The Contractor is responsible for overall coordination of the equipment package to ensure compatibility of all pump units with their respective motors, VFD's, accessories, and with the proposed works.

### 1.2 Related Sections

- .1 DIVISION 01 GENERAL REQUIREMENTS
- .2 DIVISION 03 CONCRETE
- .3 DIVISION 05 METALS
- .4 DIVISION 09 FINISHES
- .5 DIVISION 26 ELECTRICAL
- .6 DIVISION 40 PROCESS INTERCONNECTIONS

### 1.3 Shop Drawings

- .1 Submit the Shop Drawings for review in accordance with Section 01 33 00 – Submittal Procedures and Division 26- Electrical.
- .2 The shop drawing submission shall include, but not be limited to, the following:
  - .1 Dimensional drawings showing pump layout and sections together with motor and anchor bolt base plans.
  - .2 Refer to Division 26 for motor starter shop drawing submissions.
  - .3 For each major component include the name of the Manufacturer, type and model of equipment.
  - .4 Pump performance and efficiency curves, including NPSHr, RPM and brake horsepower data.
  - .5 Dimensional drawings and recommended installation.
  - .6 Description of the materials of construction of major components. Provide sufficient detail to show the general construction pertinent to the proper review of the equipment.

- .7 A precise list of all electrical requirements for the equipment including all controls, monitoring equipment and instruments shall be given including all power characteristics and materials of construction. A wiring schematic and single line diagram of the control panel(s) must be included.
- .8 The Supplier shall indicate a list of spare parts which he/she would recommend be purchased and individual prices for each item.
- .9 All ancillary equipment to be provided by the Contractor shall be listed.
- .10 Special accessories or tools for the adjustment or removal of parts required for any piece of equipment shall be listed and furnished as part of the supply.
- .11 Hydraulic test curve, which proves the pump can meet all the operating conditions.

### 1.4 Maintenance Data

.1 In accordance with Section 01 78 00 – Contract Closeout

## PART 2 PRODUCTS

### 2.1 General

.1 Provide a total of three (3) new submersible pumps and associated equipment that conforms to the requirements specified herein and suitable for the installation at the locations shown on the Contract Drawings.

| RAW SEWAGE PUMPS                 |                                   |
|----------------------------------|-----------------------------------|
| Location                         | Dry Well                          |
| Number of Pumps                  | 3 ( 2 duty, 1 standby)            |
| Pump Tag                         | XXXXXX                            |
| Туре                             | Submersible non-clog centrifugal  |
| Materials Being Pumped           | Raw wastewater ahead of screening |
| Each Pump Capacity at Rated Head | 223 L/s @ 42.89 m TDH             |

| Total pumping Capacity ( all duty pumps running) | 444 L/s@ 42.89 m TDH |
|--------------------------------------------------|----------------------|
| Static Head                                      | 19.81m               |
| Max. Motor Size                                  | 209 kW (280hp)       |
| (each pump)                                      |                      |
| Max. Motor Speed                                 | 1190 rpm             |
| Pump Suction/Discharge                           | 350/300 mm           |
| NPSH Required                                    | 9.37 m               |
| Min. Efficiency of Pump at Rated                 | 69%                  |
| Capacity                                         |                      |
| Voltage                                          | 575 V                |
| Phase/Cycle                                      | 3/60 Hz              |
| VFD                                              | Yes                  |

## 2.2 Pump Design

- .1 The dry pit submersible pumps shall have stand and a suction elbow.
- .2 The pumps design shall be a single passage, clog-free pump for solids handling. The overall pump design shall combine high efficiency, low required NPSH, a large solid passage, the ability to handle rags or other fibrous material without clogging.
- .3 The pump's design shall allow for dismantling and installation of the rotor and impeller in the axial direction without dismantling of the pump from the piping or from the foundation.

### 2.3 Pump Construction

- .1 The pump body shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces. All exposed nuts or bolts shall be of 316 stainless steel, ASTM A 276.
- .2 Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is

required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

- .3 Paint Standard The exterior of the pump, including all metal surfaces coming into contact with the pump shall be protected by a factory-applied non-toxic epoxy spray coating approved for both water and wastewater applications.
  - .1 Base coat: Epoxy
  - .2 Top coat: Oxirane ester, 2-pack
  - .3 Total fry film thickness: 500  $\Phi$ m

### 2.4 Motor

- .1 Motors shall be of the explosion-proof design, approved for uses in Class 1, Division 1, Group C & D hazardous locations. Provide Inverter duty motor on each pump.
- .2 The pump motor shall be of the close-coupled, suitable for full load continuous operation.
- .3 The motor shall be a NEMA-B design induction type suitable for variable frequency drives. The stator windings and leads shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be heat-shrink fitted into the stator housing providing for superior heat transfer. The motor shall be capable of withstanding at least 15 starts per hour. The rotor bars and short circuit rings shall be made of aluminum. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature.
- .4 The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of ±10%. The motor shall be designed for continuous operation in up to a 40°C (104°F) ambient and the winding temperature rise shall not exceed 80°C (176°F) at full nameplate rating. A motor performance chart shall be provided exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics.
- .5 Each motor unit shall be provided with an adequately designed cooling system. The cooling jacket shall encircle the stator housing, providing heat dissipation for the motor regardless of the type of installation. The cooling media channels and ports shall be non-clogging by virtue of their

dimensions. The cooling system shall provide for continuous pump operation in temperatures of up to 40°C (104°F).

.6 The power cable shall be sized according to the CEC and CSA standards and shall be of sufficient length to reach the junction box without the need of any splices

- .7 Lifting provisions (i.e. pump eyebolt) are to be provided to safely lift the motor/pump weight with a safety factor of 1.5 times the weight of the pump/motor combination.
- .8 A watertight seal must be provided at the motor cable entry point.
- .9 The motor horsepower shall be adequate so that the pump is nonoverloading throughout the entire pump performance curve from shut-off through run-out
- .10 A shielded cable shall be provided by the pump supplier.

### 2.5 Volute

.1 Pump volute shall be single piece, grey cast iron, Class 35B, design with smooth passages large enough to pass any solids that may enter the impeller.

### 2.6 cable entry seal

- .1 The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable.
- .2 The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be separated by a terminal board of non-hydroscopic material, which shall isolate the stator housing from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

## 2.7 cooling system

.1 Each unit shall be provided with an adequately designed cooling system. Built in isolated glycol cooling system designed to enable the motor to operate continuously without heating up in a dry pit environment.

### 2.8 Impeller

- .1 Provide a non-clog type impeller. The impeller shall be capable of handling solids, grit, fibres, sludge and other materials as may be normally found in wastewater. The impeller shall be of grey cast iron, Class 35B, statically and dynamically balanced, having a long throughlet without acute turns.
- .2 The impeller shall be externally adjustable to compensate for wear by means of shims or regulating screws so that the necessary running clearances between the liner and impeller can be maintained for optimum hydraulic efficiency.

### 2.9 Pump Shaft

- .1 Pump and motor shaft shall be the same unit; the pump shaft is an extension of the motor shaft.
- .2 The shaft shall be ANSI Series 431 stainless steel and shall be completely isolated from the pumped liquid.

### 2.10 Protection

- .1 All stators windings shall incorporate thermal sensors wired in series and embedded in the stator windings to monitor the temperature of each phase winding. If the winding temperature exceeds the rated operating temperature, the thermal sensors will open a protective circuit, stop the motor and activate an alarm. The sensors shall automatically reset when the winding temperature has cooled to a safe operating temperature which will enable the pump to start.
- .2 Each pump to come complete with:
  - .1 Stator housing leakage sensor: A float switch in the lower part of the stator housing reacts if liquid enters the stator housing and outputs alarm condition to monitoring unit.

## 2.11 Bearings

.1 Provide upper and lower bearings as needed to provide a minimum L10 bearing life of 100,000 hours at anticipated axial and radial loadings. The bearings shall be sealed, and permanently lubricated for the life of the bearing.

### 2.12 Mounting

.1 The pump shall be supported by a pedestal base with openings large enough to permit access to the suction line and to the inspection opening

in the suction elbow. The base shall be rugged enough to support the full weight of the pump and motor and shall be of such a height that the suction elbow of the pump will not touch the floor or level foundation upon which it stands. The pedestal base shall be cast-in-place concrete as much as possible, or a combination of cast-in-place concrete and pedestal supplied by the pump manufacturer.

.2 Suction and discharge flanges shall be drilled to meet ANSI 125 lb bolting.

### 2.13 Nameplates

- .1 Provide a stainless-steel name plate inscribed with the following information:
  - .1 Manufacturer's name.
  - .2 Year of manufacture
  - .3 Model number
  - .4 Serial number
  - .5 Capacity (ML/d)
  - .6 Total dynamic head (m)
  - .7 Impeller diameter (mm)
  - .8 Speed

### 2.14 controls

- .1 Local control panel shall be provided by General contractor. The LCP shall be mounted as shown on the contract drawings. Interconnected wiring between local, remote panels and MCC will be supplied and installed by the General Contractor.
- .2 Refer to contract drawings and Division 26 and 40 for details.

### 2.15 Acceptable Manufacturer

- .1 FLYGT
- .2 KSB

### PART 3 EXECUTION

### 3.1 product delivery, storage, and handling

.1 Furnish storage and maintenance requirements for equipment prior to shipping.

- .2 All equipment shall be skid mounted or crated to protect against damage during shipment. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed, and the units and equipment are ready for operation.
- .3 Finished surfaces of all exposed flanges shall be protected by fiberboard blank flanges strongly built and securely bolted thereto.
- .4 Shipment is not to be made until the Equipment Supplier coordinates shipment to the jobsites with the Installation Contractors, assuring that the equipment will be properly received and stored.

### 3.2 installation and inspection

- .1 Installation Check: The pump manufacturer shall provide the services of a qualified field representative according to the quality control section to assist during installation of the equipment by the Contractor. As a minimum, the manufacturer's field representative shall be made available as follows:
  - .1 Installation Inspection: 3 trips, 4 days total
  - .2 Startup Assistance: 3 trips, 4 days total
- .2 Field Evaluation Tests: A performance test shall be ran on the pumps after the installation is completed using clean water to ensure the pumps are operating properly as determined by the representative of the equipment manufacturer. The performance test shall be conducted by a capable representative of the pump manufacturer and accepted by the Engineer. The Owner's operating personnel shall assist the manufacturer's representative in the performance test. A designated representative of the Owner and/or the Engineer shall observe the performance test. As a minimum, the manufacturer's field representative shall be made available as follows:
  - .1 Performance Testing: 3 trips, 3 days total
- .3 At least two (2) weeks prior to the proposed testing date, the Contractor shall notify the Engineer of the testing date and shall submit a report from the equipment manufacturer detailing the proposed performance testing procedure and analysis. Testing shall be performed between 8:00 a.m. and 5:00 p.m. and shall begin on Monday or Tuesday. If more than one day of testing is required, the testing shall be done on consecutive days. The Engineer's initial observation of tests shall be at the Owner's expense. All costs of subsequent visits by the Engineer to witness or observe additional tests necessary because of failure of the initial tests or

inability to conduct the initial tests will be deducted from monies due the pump manufacturer.

- .4 Should the equipment not achieve consistent compliance during the tests, and then the manufacturer shall modify the equipment and repeat the field evaluation tests. Costs of modifying equipment, reducing or furnishing additional equipment, or subsequent retesting shall be borne by the manufacturer. Additional equipment shall include all items specified or indicted to be part of the conveying system. Should the equipment fail to meet all the design requirements after retesting, the equipment shall be rejected and shall be replaced by the Construction Contractor at the pump manufacturer's expense with acceptable equipment at no additional cost to the Owner.
- .5 Performance Test and Field Evaluation Report: The pump manufacturer shall prepare a form test report, including all measured data and other recorded data and observations. Six copies of the report shall be submitted to the Engineer within 30 days after completion of the tests.

## 3.3 factory testing

- .1 The effluent pump manufacturer shall perform the following inspections and tests on the prior to shipment from factory:
  - .1 A motor and cable check to test for insulation defects and moisture content shall be conducted prior to the wet pit test.
  - .2 A pressure test of the motor with dry air to detect leaks at joints and seals shall be conducted.
  - .3 A dry run test shall be performed to ensure mechanically integrity. After test, pump and motor shall be inspected for oil seepage and/or water infiltration.
  - .4 A motor and cable check to test for insulation defects and moisture content shall be conducted.
  - .5 Inspection and tests performed confirm the pump listed meets all established quality assurance standards set for similar materials. Pumps shall be warranted against defects in design, workmanship, and materials.
  - .6 Checks on monitoring devices such as for leakage detection or motor temperature monitoring.

## 3.4 supervision of installation and commissioning

.1 Test and commission the equipment in accordance with Section 01 91 00 –Commissioning.

- .2 The pump performance shall conform to ISO 2548-Code for Acceptance Tests Class C (1973). The performance tests shall be carried out to determine the performance of the pump with respect to discharge rate of flow, total head, power absorbed, etc. For a combined motor pump unit, the guarantee covers the efficiency of the entire unit.
- .3 The pump supplier shall supply the following test results, if requested:
  - .1 Hydraulic curve, proving that the pump meets the operating conditions in accordance with ISO 2548 Class C (1973) or latest revision.
  - .2 Current and power consumed during the test.
  - .3 Megger test verification of the electrical resistance to ground.
  - .4 Dry test test for 15 seconds. Minimum in a dry condition with verification that current or power consumption draw does not exceed the normal dry rating.
  - .5 Water infiltration and oil check.
  - .6 Monitoring device check includes but is not limited to motor temperature sensors and leakage detectors.
  - .7 Hydrostatic test of the pump volute or the complete pump unit and vibration test shall be conducted when specifically requested by Owner.
- .4 At the completion of satisfactory installation, each unit shall be started by the Contractor under the supervision of the Supplier and in cooperation with the facility operations staff. All controls and alarms shall be checked and tested to ensure proper control and equipment protection.
- .5 Equipment shall only be accepted after receipt of a satisfactory report submitted by the Manufacturer's representative.
- .6 At the completion of a satisfactory installation, each unit shall be started by the General Contractor under the supervision of the Supplier and in cooperation with the facility operations staff. All controls and alarms shall be checked and tested to ensure proper control and equipment protection.
- .7 Modify or replace equipment or materials failing required tests.
- .8 Perform additional testing required due to changes of materials, and/or failure of materials or construction to meet specifications at no extra cost to the Owner.
- .9 Commissioning: 2 trips, 4 days total.

# 3.5 training

- .1 In addition to the installation and operation check required by the General Equipment Stipulations and the manufacturer's field services required by the Quality Control Section, the manufacturer shall furnish the services of the competent and experienced operator of the equipment who is directly employed by the manufacturer to instruct the Owner's operating personnel in the proper operation and maintenance of the equipment. Training shall be provided as specified in Section 01 79 00.
- .2 Training: 2 trips, 3 days total.

### 3.6 warranty

- .1 Each unit shall be new and shall carry the full Manufacturer's warranty on parts, service, and performance. Warranty shall begin at substantial completion. The warranty shall include replacement of all defective equipment and shall extend minimum of two (2) years beyond substantial completion.
- .2 <u>Corrective Work</u>. Any location where corrosion is evident shall be considered a failure of the material or the protection system. Before starting corrective work, the Manufacturer shall submit to the Engineer for review an analysis of the cause of the failure and details of the proposed corrective work. The Manufacturer shall make repairs acceptable to the Engineer at all points where failures are observed within the Warranty Period.
- .3 <u>Inspection</u>. Each unit shall be inspected at the end of the warranty period by representatives of the Owner, the Engineer, and the Manufacturer to identify any failures that may have occurred. The Manufacturer shall establish the date of each inspection and shall notify the Owner at least 30 days in advance. The scheduled inspection shall not relieve the Manufacturer from the obligation to perform corrective work whenever needed.
- .4 The Manufacturer shall prepare and deliver to the Owner an inspection report covering each inspection, indicating the number and type of failures observed, material and part where materials have failed, the percentage of the surface area where corrosion protection system failure has occurred, and the names of the persons making the inspection. Colour photographs illustrating each type of failure shall be included in the report.

### TABLE 1 DATA FORM

for

# SUBMERSIBLE PUMPS

Contract No.

Location:

Notes:

This table covers the specific requirements of the equipment for the above project.

Complete Table 2 fully and submit prior to shop drawing submittal.

#### PUMPS - GENERAL

| No. of pumps required: |  |
|------------------------|--|
| Pump Type:             |  |
|                        |  |
| Pump Application:      |  |
| Liquid Pumped:         |  |

### **PUMP MECHANICAL FEATURES**

| Maximum Speed (RPM):                |  |
|-------------------------------------|--|
| Service (continuous/intermittent):  |  |
| Lineshaft (carbon/stainless steel): |  |

### PUMP OPERATING CONDITIONS

Design Point Capacity (each pump): \_\_\_\_\_

| Design Point Total Dynamic Head (m): |  |
|--------------------------------------|--|
|                                      |  |
|                                      |  |
| System Head Curve Included (Yes/No): |  |
|                                      |  |
|                                      |  |

SPECIAL REQUIREMENTS

Discharge Diameter: mm

Maximum Impeller Size: mm

### TABLE 2 DATA FORM

for

### SUBMERSIBLE PUMPS

Contract No.

Location:

### CONTRACTOR'S REFERENCE

Contractor's name, address and phone number:

Contractor's reference number and date:

### CONTRACTOR'S PUMP DATA

Number of pumps: \_\_\_\_\_\_Pump Manufacturer: \_\_\_\_\_

Place of Manufacture:

Model Number and Type: \_\_\_\_\_

Speed: \_\_\_\_\_rpm Performance Curve Attached: \_\_\_\_\_

Performance for each pump at or near design point:

L/s at \_\_\_\_\_m TDH

kW (HP)\_\_\_\_% Efficiency

Suction Diameter: \_\_\_\_\_ mm

Size of Impeller: \_\_\_\_\_ mm

Maximum Diameter of Solids:\_\_\_\_\_ mm

Weight of Pump/Motor: \_\_\_\_\_ kg

## PUMP MOTOR DATA

Motor Manufacturer:

Bissett Lake WWPS Upgrades Halifax Water July 2021

| Place of Manufacture:      |                  |                                |                 |
|----------------------------|------------------|--------------------------------|-----------------|
| Model Number and Type:     |                  |                                |                 |
| Type of Motor Cooling Sys  | tem:             |                                |                 |
| Nominal Rating of Motor:   |                  | kW                             |                 |
| Starting Inrush:           | Α                | Maximum Inrush:                | A               |
| Voltage/Phase/Frequency:   |                  |                                |                 |
| Full Load Speed:           |                  |                                | rpm             |
| Temperature Rise at Full L | .oad:            |                                | <u>°</u> C      |
| Permissible Number of Sta  | arts per hour: _ |                                |                 |
| Cable(s) to Motor for Powe | er (and Sensor)  | ) - Type, length, conductor nเ | umber and size: |
| Bearing Type at: Pump      | End:             |                                |                 |
| Other                      | End:             |                                |                 |
| Average Bearing Life:      |                  |                                |                 |
| Nominal Bearing Operating  | g Pressure:      |                                | kPa (psi)       |
| Painting Finish:           |                  |                                |                 |
| Submitted by:              |                  | Signature:                     |                 |
|                            | I                | Date:                          |                 |

**END OF SECTION** 





| TO:           | Becky Kent, B.A., Chair and Members of the Halifax Regional Water<br>Commission Board                                            |  |  |  |
|---------------|----------------------------------------------------------------------------------------------------------------------------------|--|--|--|
| SUBMITTED BY: | Reid     Digitally signed by Reid       Campbell     Date: 2022.06.17       10:30:44 - 03'00'                                    |  |  |  |
|               | Reid Campbell, P.Eng.                                                                                                            |  |  |  |
| APPROVED:     | Director, Engineering & Technology Services<br>Cathie Digitally signed by Cathie<br>O'Toole Date: 2022.06.17<br>12:55:39 -03'00' |  |  |  |
|               | Cathie O'Toole, MBA, FCPA, FCGA, ICD.D, General Manager                                                                          |  |  |  |
| DATE:         | June 10, 2022                                                                                                                    |  |  |  |
| SUBJECT:      | Churchill Drive Transmission Main Upgrades Project                                                                               |  |  |  |

### <u>ORIGIN</u>

The 2022/2023 Capital Budget.

#### **RECOMMENDATION**

The General Manager approve the Churchill Drive Transmission Main Upgrades project at a total cost to Halifax Water of \$11,379,000.

#### BACKGROUND

There is significant growth anticipated on the Halifax Peninsula in the next thirty years. The existing transmission mains that support the Peninsula area (Robie, Chain Control, MacDonald Bridge) have been identified by Halifax Water's IRP as having insufficient capacity to meet the long-term future demands. The existing Chain Control transmission mains were originally installed over 160 years ago (1856 and 1862).

The IRP recommended increasing the conveyance capacity to the Peninsula from Chain Control through a series of transmission main upgrade projects. The proposed next phase of this long-term program is to replace/upsize the sections of the Chain Control transmission mains from Chebucto Road, along Churchill Drive, though Flynn Park to Quinn Street. (See attached sketch).

As recommended in the IRP, the project will include:

- 1. Upsizing approximately 770 metres of the existing Chain Control Peninsula Low transmission main from 600mm (24-inch) to 750mm (30-inch) diameter.
- 2. Upsizing approximately 770 metres of the existing Chain Control Peninsula Intermediate transmission from 375mm (15-inch) to 500mm (20-inch) diameter.
- 3. Included above, is the replacement of the existing old transmission mains that pass through the NSP's Chebucto Road Substation and CN Railway right-of-way. In the case of the railway crossing, the existing mains are within an existing tunnel. Renewing the aging infrastructure in these critical areas is a significant component of this project.

WSP Consultants were retained in 2020 to provide engineering services relating to the design, construction administration, and construction services.

In conjunction with its Integrated Streets Program, HRM is planning to partner with Halifax Water on this project to carry out a range of Street Recapitalization work along Churchill Drive, Roosevelt Drive, Flinn Street and the related intersections. The estimated cost for HRM's Street Recapitalization work is \$1,775,000, excluding contingencies and net HST. The cost of HRM work is not included in the requested funding amounts in this report and will be recovered from HRM.

This projects was planned for 2022 construction. During the course of the design process, our consultant flagged that supply chain issues were resulting in shortages and much longer than normal delivery times for some critical fittings/materials for this project. On a large integrated project, this would have jeopardized completion requirements. To provide schedule certainty and reduce project risk, the decision was made by Halifax Water staff to tender the project in 2022 to allow time for these materials to be ordered/procured for construction/installation in 2023.

WSP provided a Pre-tender Construction Cost Estimate (June 10, 2022, Attachment No. 2). The consultant's estimate includes a normal pre-tender 10% contingency allowance and a 30% Market Contingency Allowance. WSP added this 30% Market Contingency allowance to account for current market volatility (eg. supply chain/inflation/pandemic-related cost variations, contractor capacity). The past 18 months have seen large variances in tender pricing throughout the construction industry. Halifax Water staff have elected to tender in 2022 for construction in 2023 as a strategy to mitigate any market volatility due to uncertain delivery times for materials and contractor capacity.

As part of the watermain replacement beneath the railway tracks, CN identified the need for additional structural shoring work within the CN right-of-way. In accordance with their policies, CN is in the process of tendering this work separately, which will require a cost-sharing agreement with Halifax Water. An allowance for this work has been included in the total project cost estimate.

The project is expected to be issued for tender in early June, with a tender closing on June 30, 2022.

The total Project Cost estimate, inclusive of construction, engineering, contingency, overheads and net HST is calculated to be \$11,379,000 (Attachment No.3). This includes funding in the amount of \$132,000 inclusive of net HST and contingencies for lead lateral replacements. The project also includes funding in the amount of \$111,000 inclusive of net HST and contingencies for miscellaneous stormwater capital work within the project limits.

Notwithstanding the tendering strategy, current market conditions are resulting in volatile pricing which is difficult to predict. After tender closing, should project costs exceed funding allocated in the approval being sought, Halifax Water will evaluate the new project cost and make a determination whether it is prudent to proceed with the project. If the decision is to proceed, Halifax Water staff will seek an expedited approval for an increase in funding from the Halifax Water Board. As the tender is scheduled to close on June 30, 2022, the application for funding approval to the NSUARB will be held until after the tender closing. The funding approval application to the NSUARB will be based on either this requested approval or a subsequent increase in funding approval by the Halifax Water Board, depending on the tender results.

### **BUDGET IMPLICATIONS**

Funding in the amount of \$250,000 was previously approved to carry out the Preliminary Design work (*SAP*# *3-3467*).

Additional funding in the amount of \$135,000 was previously approved in a GM report dated April 12, 2022 for the CN structural shoring component of the project.

Funding in the amount of \$9,420,000 is available from 2022/2023 Capital Budget (3.631 *Transmission Main Upgrades – Churchill Drive Corridor*).

Funding in the amount of \$132,000 is available from 2022/2023 Capital Budget (3.390 Lead Service Line Replacement Program).

Funding in the amount of \$111,000 is available from the 2022/2023 Capital Budget (*Item 1038 Integrated Stormwater Projects Program*) for the stormwater capital work.

The additional funding in the amount of \$1,331,000 for the Churchill Drive Transmission Main Upgrades Project is available from surpluses in previously closed projects or projects that have been deferred or cancelled.

As this project is required to support future growth, the sources of funding for this project includes \$8,352,000 from Regional Development Charges (RDC); 75% of \$11,136,000.

The proposed expenditure meets the "NO REGRETS- UNAVOIDABLE NEEDS" approach of the 2012 Integrated Resource Plan. The proposed work meets the NR-UN criteria of "Required to ensure infrastructure system integrity and safety and proposed work meets the NR-UN criteria of growth-related infrastructure supported by pre-design level master plan.

### **ALTERNATIVES**

The project scope could be reduced to align with budget, or the project could be deferred. These options are not the recommended option for three reasons:

- 1. There is no guarantee regarding future market conditions.
- 2. This project is required to meet the requirements of future growth, and the growth projections and pace of development are currently greater than what was reflected in the 2019 IRP.

### **ATTACHMENT**

Site Sketch WSP Cost Estimate Project Cost Estimate

| Report Prepared by:    | Tom Gorman, P. Eng.<br>Manager, Water Infrastructure Engineering |  |
|------------------------|------------------------------------------------------------------|--|
| Financial Reviewed by: | Louis de<br>Montbrun<br>Date: 2022.06.17<br>11:05:15-03'00'      |  |
|                        | Louis de Montbrun, CPA, CA<br>Director, Corporate Services/CFO   |  |



Churchill Transmission Main Upgrades

Haiffax Water The information contained on this map may not be complete and/or accurate in all areas. Should accurate information of completeness be required, please contact the Engineering Department of Haiffax Water. Halfax Water will not be held liable for misuse of this information.

Chocolate Lake

### Churchill Drive Transmission Main & Street Recapitalization Cost Estimate - Pre-Tender (HW Portion Only)



| PROJECT NO.                                                 | T07.2022      |
|-------------------------------------------------------------|---------------|
| DATE:                                                       | June-10-22    |
| CLIENT:                                                     | HALIFAX WATER |
| CONSULTANT:                                                 | WSP           |
| UNIT PRICE SOURCE:                                          | WSP / HRM     |
| NOTE: HST NOT INCLUDED IN INDICATED UNIT PRICES AND TOTALS. |               |

This estimate of probable construction cost is approximate only. Actual cost may vary significantly from this estimate due to market conditions such as material and labour costs, time of year, industry workload, competition, etc. This estimate has been prepared based on our experience with similar projects. This estimate has not been prepared by obtaining any estimates or quotes from contractors. Due to the uncertainties of what contractors bid, WSP cannot make any assurances that this estimate will be within a reasonable range of the tendered low bid. When assessing this project for business feasibility purposes this estimate should not be relied upon without considering these factors.

#### Churchill Drive, Roosevelt Drive, Flinn Street

| IT | EM   | DESCRIPTION                                                       | UNIT | EST.   |              |                |
|----|------|-------------------------------------------------------------------|------|--------|--------------|----------------|
| ١  | 10.  |                                                                   |      | QUANT. | UNIT PRICE   | PRICE          |
|    |      | WATER SYSTEM                                                      |      |        |              |                |
|    |      |                                                                   |      |        |              |                |
| 11 |      | Pipe                                                              |      |        |              |                |
|    | .1   | Pipe                                                              |      |        |              |                |
|    | .1.1 | 25mm dia. Type K Cooper incl. Curbstop (Blink Bonnie Terrace)     | m    | 9      | \$350.00     | \$3,150.00     |
|    | .1.2 | 50mm dia. Type K Cooper incl. Curbstop (Roosevelt Drive)          | m    | 61     | \$400.00     | \$24,400.00    |
|    | .1.3 | 200mm dia. DI CL52                                                | m    | 76     | \$1,000.00   | \$76,000.00    |
|    | .1.4 | 500mm dia. DI CL52                                                | m    | 680    | \$1,600.00   | \$1,088,000.00 |
|    | .1.5 | 500mm dia. DI CL52 TR Flex, Custom Lengths (CN Arch)              | m    | 41     | \$3,900.00   | \$159,900.00   |
|    | .1.6 | 500mm dia. DI CL52 TR Flex (NSPI Property)                        | m    | 52     | \$2,000.00   | \$104,000.00   |
|    | .1.7 | 750mm dia. DI CL52                                                | m    | 678    | \$2,800.00   | \$1,898,400.00 |
|    | .1.8 | 750mm dia. DI CL52 TR Flex, Custom Lengths (CN Arch)              | m    | 42     | \$6,100.00   | \$256,200.00   |
|    | .1.9 | 750mm dia. DI CL52 TR Flex (NSPI Property)                        | m    | 52     | \$3,600.00   | \$187,200.00   |
|    | .2   | Casing Pipe                                                       |      |        |              |                |
|    | .2.1 | 812mm dia. HDPE DR32.5 Casing Pipe (CN Arch)                      | m    | 42     | \$2,900.00   | \$121,800.00   |
|    | .2.2 | 1220mm dia. HDPE DR32.5 Casing Pipe (CN Arch)                     | m    | 42     | \$5,000.00   | \$210,000.00   |
|    | .3   | Thrust Collar                                                     |      |        |              |                |
|    | .3.1 | Thrust Collar at Sta. 0+145                                       | ea.  | 1      | \$20,000.00  | \$20,000.00    |
|    | .3.2 | Thrust Collar at Sta. 0+705                                       | ea.  | 1      | \$20,000.00  | \$20,000.00    |
| 12 |      | Fire Hydrants                                                     |      |        |              |                |
|    | .1   | Installation of Fire Hydrant (Single Lead)                        | ea.  | 5      | \$12,000.00  | \$60,000.00    |
|    | .2   | Installation of Fire Hydrant (Double Lead)                        | ea.  | 1      | \$18,000.00  | \$18,000.00    |
| 13 |      | Chambers                                                          |      |        |              |                |
|    | .1   | Meter/CAV Chamber at Sta. 0+600                                   | l.s. | 1      | \$150,000.00 | \$150,000.00   |
| 14 |      | Direct Buried Valves                                              |      |        |              |                |
|    | .1   | 200mm dia. GV                                                     | ea.  | 5      | \$3,500.00   | \$17,500.00    |
|    | .2   | 400mm dia. BFV                                                    | ea.  | 1      | \$25,000.00  | \$25,000.00    |
|    | .3   | 500mm dia. BFV                                                    | ea.  | 4      | \$11,000.00  | \$44,000.00    |
|    | .4   | 750mm dia. BFV                                                    | ea.  | 4      | \$35,000.00  | \$140,000.00   |
| 15 |      | Water Services                                                    |      |        |              |                |
|    | 15.1 | Reconnect Existing Water Service                                  |      |        |              |                |
|    | .1.1 | 19mm dia. Type K Cooper c/w Anode                                 | ea.  | 20     | \$2,800.00   | \$56,000.00    |
|    | .1.2 | 25mm dia. Type K Cooper c/w Anode                                 | ea.  | 6      | \$2,900.00   | \$17,400.00    |
|    | .1.3 | 32mm dia. Type K Cooper c/w Anode                                 | ea.  | 1      | \$3,000.00   | \$3,000.00     |
|    | .1.4 | 38mm dia. Type K Cooper c/w Anode                                 | ea.  | 1      | \$3,100.00   | \$3,100.00     |
|    | .1.5 | 50mm dia. Type K Cooper c/w Anode                                 | ea.  | 1      | \$3,200.00   | \$3,200.00     |
|    | 15.2 | Replace Existing Water Service (Lead Service) - Public            |      |        | . ,          |                |
|    | .2.1 | 19mm dia. Type K Cooper (to any length) incl. Curbstop            | ea.  | 9      | \$4,100.00   | \$36,900.00    |
|    | .2.2 | 25mm dia. Type K Cooper (to any length) incl. Curbstop            | ea.  | 2      | \$4,200.00   | \$8,400.00     |
|    | 15.3 | Replace Existing Water Service (Lead Service) - Private           |      |        | . ,          | •-,            |
|    | .3.1 | 19mm dia. Type K Cooper (to any length) incl. Building Connection | ea.  | 10     | \$3,000.00   | \$30,000.00    |
|    | .3.2 | 25mm dia. Type K Cooper (to any length) incl. Building Connection | ea.  | 2      | \$3,100.00   | \$6,200.00     |

| ľ  | TEM    | DESCRIPTION                                                                     | UNIT | EST.   |              |              |
|----|--------|---------------------------------------------------------------------------------|------|--------|--------------|--------------|
|    | NO.    |                                                                                 |      | QUANT. | UNIT PRICE   | PRICE        |
| 16 |        | Connections to Existing Mains                                                   |      |        |              |              |
|    | 16.1   | Transmission Main                                                               |      |        |              |              |
|    | .1.1   | Chebucto Road - Existing Mains at Sta. 0+018 (both mains, incl. 400.600mm pipe) | l.s. | 1      | \$87,000.00  | \$87,000.00  |
|    | .1.2   | Quinn Street Existing Mains at Sta. 0+785 (both mains, incl. 400.600mm pipe)    | l.s. | 1      | \$42,000.00  | \$42,000.00  |
|    | 16.2   | Intersections                                                                   |      |        |              |              |
|    | .2.1   | Joseph Street - Bypass at 0+245 (200mm to 150mm)                                | ea.  | 2      | \$17,000.00  | \$34,000.00  |
|    | .2.2   | Philip/Patricia Street - Bypass at 0+350 (200mm to 150mm)                       | ea.  | 2      | \$17,000.00  | \$34,000.00  |
|    | .2.3   | Blink Bonnie Terrace - Jumper at 0+710 (25mm to 150mm)                          | l.s. | 1      | \$8,000.00   | \$8,000.00   |
| 17 |        | Watermain Protection                                                            |      |        |              |              |
|    | 17.1   | Rigid Insulation - Main                                                         | sq.m | 830    | \$60.00      | \$49,800.00  |
| 18 |        | Temporary Water                                                                 | l.s. | 1      | \$75,000.00  | \$75,000.00  |
| 19 |        | Watermain Abandonment in Place                                                  |      |        |              |              |
|    | 19.1   | 375mm dia. Watermain                                                            | m    | 150    | \$250.00     | \$37,500.00  |
|    | 19.2   | 600mm dia. Watermain                                                            | m    | 100    | \$400.00     | \$40,000.00  |
| 20 |        | Complex Crossings (Above & Beyond Pipe & Casing)                                |      |        |              |              |
|    | 20.1   | CN Rail Crossing (Arch 1) - Allowance incl. arch grouting & access etc.         | l.s. | 1      | \$200,000.00 | \$200,000.00 |
|    | 20.2   | NSPI Substation Crossing (sta. 0+020 to 0+065) - Allowance                      | l.s. | 1      | \$125,000.00 | \$125,000.00 |
| _  |        |                                                                                 | 1    | 1      |              |              |
|    |        | SANITARY SEWER                                                                  |      |        |              |              |
|    |        |                                                                                 |      |        |              |              |
| 21 |        | Gravity Pipe (incl. reinstatement)                                              |      |        |              |              |
|    | 21.1   | 200mm dia. PVC DR18 (New Mains between Blink Bonnie and Quinn)                  | m    | 31     | \$1,100.00   | \$34,100.00  |
|    | 21.2   | 300mm dia. PVC DR18 (Replace Existing at Blink Bonnie)                          | m    | 14     | \$1,200.00   | \$16,800.00  |
|    | 21.3   | 375mm dia. PVC DR35 (Combined Extension on Flinn)                               | m    | 11     | \$1,200.00   | \$13,200.00  |
| 23 |        | Manholes                                                                        |      |        |              |              |
|    | 23.1   | 1050mm dia.                                                                     | ea.  | 4      | \$8,000.00   | \$32,000.00  |
| 24 |        | Sanitary Services                                                               |      |        |              |              |
|    | 24.1   | Sewer Lateral Reconnection to Existing                                          |      |        |              |              |
|    | .1.1   | Reconnect to Existing Main                                                      | ea.  | 6      | \$5,000.00   | \$30,000.00  |
|    | .1.2   | Reconnect to New Main                                                           | ea.  | 3      | \$5,000.00   | \$15,000.00  |
| 26 |        | Closed Circuit Television Inspection                                            |      |        |              |              |
|    | 26.1   | Pre-Construction of Existing Mains                                              | m    | 126    | \$15.00      | \$1,890.00   |
|    | 26.2   | Post Construction of Existing Mains and New Mains                               | m    | 182    | \$15.00      | \$2,730.00   |
|    | 26.3   | Warranty for New Mains                                                          | m    | 56     | \$20.00      | \$1,120.00   |
|    |        |                                                                                 |      |        |              |              |
|    |        | STORM SEWER                                                                     |      |        |              |              |
| 33 |        | Catch Basins                                                                    |      |        |              |              |
|    | 33.1   | Installation of Catch Basins                                                    |      |        |              |              |
|    | 33.1.1 | 1050 mm dia. Precast Concrete c/w S361 frame and grate                          | ea.  | 1      | \$5,500.00   | \$5,500.00   |
|    | 33.1.2 | 1050 mm dia. Precast Concrete c/w S361 double frame and grate                   | ea.  | 2      | \$6,000.00   | \$12,000.00  |
|    | 33.2   | Removal of Existing Structures at Flinn Street Sta. 20+058                      |      |        |              |              |
|    | 33.2.1 | Removal of Existing Manholes/Catch Basins                                       | ea.  | 3      | \$1,500.00   | \$4,500.00   |
|    | 33.2.2 | Removal of Existing Catch Basin Leads                                           | m    | 8      | \$300.00     | \$2,400.00   |
| 34 |        | Catch Basin Leads                                                               |      |        |              |              |
|    | 34.1   | 200mm dia. PVC DR18                                                             | m    | 29     | \$1,100.00   | \$31,900.00  |
|    | 34.2   | 250mm dia. PVC DR18                                                             | m    | 25     | \$1,500.00   | \$37,500.00  |
| 38 | _      | Closed Circuit Television Inspection                                            |      |        | . ,          | ,            |
|    | 38.1   | Post Construction                                                               | m    | 54     | \$15.00      | \$810.00     |
|    | 38.2   | Warranty                                                                        | m    | 54     | \$20.00      | \$1,080,00   |

| ITEM    | DESCRIPTION                                                              | UNIT  | EST.   |             |              |
|---------|--------------------------------------------------------------------------|-------|--------|-------------|--------------|
| NO.     |                                                                          |       | QUANT. | UNIT PRICE  | PRICE        |
|         | STREET SYSTEM (included in HRM Part B)                                   |       |        |             |              |
|         |                                                                          |       |        |             |              |
| 41      | Gravels                                                                  |       |        |             |              |
| 41.1*   | Type 1 - 150 mm thick (HW portion)                                       | m²    | 688    | \$18.00     | \$12,380.00  |
| 41.6*   | Type 2 - 250 mm thick - Walkway - HW Portion                             | m²    | 207    | \$25.00     | \$5,180.00   |
| 43      | Asphaltic Concrete                                                       |       |        |             |              |
| 43.1.1* | Type B-HF - 50 mm thick (HW portion)                                     | m²    | 688    | \$24.00     | \$16,510.00  |
| 43.1.2* | Type Special C - 40 mm thick (HW portion)                                | m²    | 688    | \$22.00     | \$15,140.00  |
| 45.2.1* | Asphalt Walkway - 75 mm thick - HW Portion                               | m²    | 207    | \$70.00     | \$14,490.00  |
| 44      | Curb                                                                     |       |        |             |              |
| 44.1*   | Concrete Curb and Gutter (HW Portion)                                    | m     | 100    | \$170.00    | \$17,000.00  |
| 69      | Flinn Park Landscaping Reinstatement                                     | LS    | 1      | \$22,000.00 | \$22,000.00  |
|         |                                                                          |       |        |             |              |
|         | ADDITIONAL ITEMS                                                         |       |        |             |              |
|         |                                                                          |       |        |             |              |
| 71      | Trench Excavation - Rock                                                 | cu. m | 550    | \$200.00    | \$110,000.00 |
| 76      | Disposal of Pyritic Slate Rock                                           | cu. m | 550    | \$120.00    | \$66,000.00  |
| •       |                                                                          |       | •      |             |              |
|         | MISCELLANEOUS                                                            |       |        |             |              |
|         |                                                                          |       |        |             |              |
| 102     | Exploratory Hydro Excavations - Water Service                            | ea.   | 8      | \$3,000.00  | \$24,000.00  |
| 103     | Utility Pole Sleeve (Provisional)                                        | ea.   | 1      | \$600.00    | \$600.00     |
|         |                                                                          |       |        |             | ,            |
|         | OTHER INCIDENTALS                                                        |       |        |             |              |
|         | Included in other pay items in bid:                                      |       |        |             |              |
| incl.   | Dust Control                                                             | l.s.  | 1      | \$50,000.00 | \$50,000.00  |
| incl.   | CN Flagging Costs @ \$159x8hrs/day (estimate based on 10 week duration)  | l.s.  | 1      | \$63,600.00 | \$63,600.00  |
| incl.   | NSPI Supervision Costs @ \$1000/day (estimate based on 10 week duration) | l.s.  | 1      | \$50.000.00 | \$50.000.00  |
| incl.   | Traffic Control, Bonding, Insurance, ESC, Overhead, etc. (% of subtotal) | incl. | 1      | 10%         | \$606,588.00 |
|         | Direct costs to HW, excl. from bid:                                      |       |        |             |              |
| Direct  | Pole Replacement (Flinn Park) - By NSPI                                  | ea.   | 2      | \$5,000.00  | \$10,000.00  |
| Direct  | NSPI Substation Costs (per NSPI)                                         | l.s.  | 1      | \$45,000.00 | \$45,000.00  |

Estimate Notes:

- Asphalt and Type 1 Gravels to be cost-shared with HRM. 50% of total quantity for watermain work is included in HW Estimate.

- HRM Estimate includes all asphalt and gravels for full recapitalization area, including

tranmission main trench. +30% Market Contingency \$2,274,052.44 - Street System (included in HRM Part B) only includes cost sharing for areas where HRM PROJECT TOTAL INCL. CONTINGENCIES \$9,854,227.24 recapitalization work is occurring. All other reinstatement is incidential to the work

(included within other pay items). - 30% Market Contingency added to reflect uncertainty in 2022 pricing fluctuation

witnessed on recent tenders.

- The work is being tendered as an integrated project with HRM street recapitalization

work, which could influence incidental project costs such as mobilization, traffic control,

ESC, overhead, etc.

Sub Total

TOTAL

10% Contingency

\$6,891,068.00

\$7,580,174.80

\$689,106.80

| Description                                                                                                                            | Amount                          |
|----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| WSP - Design Phase Subtotal                                                                                                            | \$187,000.00                    |
| WSP - Tender Phase Subtotal                                                                                                            | \$9,175.00                      |
| WSP - Construction Phase Subtotal                                                                                                      | \$192,310.00                    |
| Consultant Sub-total                                                                                                                   | \$388,485.00                    |
| WSP Construction Estimate (Jun 10, 2022) - Includes 10% Contingency<br>and additional 30% Market Contingency as per WSP recommendation | \$9,854,227.24                  |
| CN - Shoring Wall Design & Construction (Estimate)                                                                                     | \$430,000.00                    |
| Construction Sub-Total                                                                                                                 | \$10,284,227.24                 |
| Communications/Public Engagement Allowance                                                                                             | \$30,000.00                     |
| Geotechnical/Materials Testing (Estimated)                                                                                             | \$30,000.00                     |
| Halifax Water Engineering - Design (Estimated)                                                                                         | \$35,000.00                     |
| Halifax Water Engineering - Project Management/Admin (Estimated)                                                                       | \$40,000.00                     |
| Sub-total                                                                                                                              | \$10,807,712.24                 |
| Net HST (4.286%)                                                                                                                       | \$463,218.55                    |
| Overhead/Interest (1%)                                                                                                                 | \$108,077.12                    |
| Total Estimated Project Cost                                                                                                           | \$11,379,000.00                 |
| Less Lead Services (Separate Funding)<br>Subtotal                                                                                      | \$132,000.00<br>\$11,247,000.00 |
| Less Storm Integrated Work (Separate Funding)<br>Subtotal                                                                              | \$111,000.00<br>\$11,136,000.00 |
| Less Funding Previously Approved<br>TOTAL                                                                                              | \$385,000.00<br>\$10,751,000.00 |

### Churchill TM Upgrades - Project Cost Estimate - June 10, 2022

 Funding Required for 2022/23 (ROUNDED)
 \$10,751,000.00



| SUBJECT:      | First Lake Pumping Station Upgrades                                                                                             |    |
|---------------|---------------------------------------------------------------------------------------------------------------------------------|----|
| DATE:         | June 3, 2022                                                                                                                    |    |
|               | Cathie O'Toole, MBA, FCPA, FCGA, ICD.D, General Manager                                                                         |    |
| APPROVED:     | Director, Engineering & Technology Services<br>Cathie Digitally signed by Cathie<br>O'Toole Date: 2022.06.17<br>12:57:11-03'00' |    |
| SUBMITTED BY: | CampbellDate: 2022.00.1711:11:12-0300'Reid Campbell, P.Eng.                                                                     |    |
|               | Reid Digitally signed by Reid Campbell                                                                                          |    |
| TO:           | Becky Kent, B.A., Chair and Members of the Halifax Regional Wat<br>Commission Board                                             | er |

### <u>ORIGIN</u>

The 2020/2021 & 2021/2022 Capital Budget.

### **RECOMMENDATION**

The Halifax Water Board approve an increase in funding of \$442,000 for the First Lake Pumping Station Upgrades project for an estimated revised total project cost of \$1,200,000 (including net HST).

#### **BACKGROUND & DISCUSSION**

The First Lake Pumping Station is located on Kingfisher Way in Lower Sackville, NS. It was originally constructed in 1971 and services approximately 125 ha of sewershed. It was originally constructed as a duplex submersible pumping station with a small concrete block building that housed electrical and control systems, a generator and fuel tank. In 1983, the capacity of the pumping station was increased with the addition of a second wet well.

In 2012, Halifax Water replaced and twinned the original forcemain, replaced internal station piping, two pumps and installed a valve/flowmeter chamber. No upgrades have been completed to the building or interior components.

The pumping station currently has two fully operating wet wells; the larger wet well (#1) contains two submersible pumps with infrastructure in place to accept a third pump. The smaller wet well (#2) has two submersible pumps.

The First Lake Pumping Station was initially identified by Halifax Water's Wastewater Operations Department as a potential candidate for rehabilitation due to several operational issues, including but not limited to:

- Obsolete electrical and control panels that are increasingly challenging to maintain
- Existing standby-power generator is at end of useful life and requires replacement
- No odour control system in existing pump station:
  - The pumping station is adjacent to a local park, and there have historically been odour complaints reported by Halifax Water Operations staff
- An operational need to consolidate pumps to a single wet well to simplify regular maintenance activities
- The existing building structure is no longer required:
  - A monument style pumping station removes the risk of hazardous gases in an indoor environment
  - Removal of the existing building reduces maintenance requirements of pumping station
- There is no existing fence to secure the property

WSP was retained in October 2020 to provide engineering services relating to the design, construction administration, and quality control to rehabilitate the pumping station. The intention is to decommission wet well #2, and re-purpose wet well #1 to handle all flows at the station. WSP has designed a monument style pumping station to replace the existing pumping station and building arrangement, and they have recommended a new additional pump to install in wet well #1.

The scope of the project generally includes:

- Demolition and removal of the existing pumping station building
- Removal of the two existing pumps and piping from wet well #2
- Installation of a new, third pump in wet well #1
- Installation of a dual-panel monument with new electrical and control panels
- Installation of new standby-power generator and fuel tank
- Upgrade of the cover of wet well #1 to a traffic load rated cover
- Installation of security gated fence and lighting
- Site grading, reinstatement, and paving

The project is currently in the final stages of design with an anticipated public tender process in June 2022. Construction is planned to begin in 2022. Approval to construct has been issued by Nova Scotia Department of Environment and Climate Change.
#### **BUDGET IMPLICATIONS**

In October 2020, \$118,000 was approved by the General Manager to proceed with the design phase of the project. To complete the construction phase, \$640,000 was identified in the 2021-22 Capital Budget under item 2.825 – *First Lake Pumping Station Upgrades*. This original estimate was based on recent pumping station rehabilitation projects of similar scope at the time.

WSP has prepared an updated cost estimate for construction based on the detailed design and current market conditions. The cost estimate for construction has considered recent inflationary effects experienced on other similar projects related to rising fuel costs, supply chain risks and current industry capacity.

The revised estimated total project cost is \$1,200,000. This amount is greater than the original estimated total project cost of \$758,000 and estimated that an additional \$442,000 is required to complete the project.

Additional funding of \$442,000 is available from surpluses in previously closed projects, or projects that have been deferred or cancelled.

The proposed expenditure meets the "NO REGRETS- UNAVOIDABLE NEEDS" approach of the 2012 Integrated Resource Plan. The proposed work meets the NR-UN criteria of "Directly supports the implementation of the Asset Management program", and "Required to ensure infrastructure system integrity and safety". The project meets these criteria based on the following: The existing electrical & instrumentation components, as well as the existing standby-power generator & and fuel tank are at the end of their useful life (Asset Management), and are causing recurring performance/operational issues (Infrastructure System Integrity).

#### **ALTERNATIVES**

There are no recommended alternatives.

#### **ATTACHMENTS**

- 1. Halifax Water First Lake Pumping Station Upgrades Pre-Tender Project Cost Estimate (June 3, 2022)
- 2. WSP First Lake Pumping Station Upgrades Consultant Pre-Tender Cost Estimate (May 25, 2022)
- 3. WSP First Lake Pumping Station Final Design Report (May 25, 2022)

| Report Prepared by:    | Brand Barbar                                                                                                        |
|------------------------|---------------------------------------------------------------------------------------------------------------------|
| Financial Reviewed by: | Brad Baxter, P.Eng., Project Engineer, 902-237-5390<br>Louis de<br>Montbrun<br>Date: 2022.06.17<br>12:07:18 -03'00' |
|                        | Louis de Montbrun, CPA, CA<br>Director, Corporate Services/CFO                                                      |

| <b>First</b> | lake Pum   | ning Statio  | n Ungrades  | – Pre-Tender  | Project ( | <b>`</b> ost Estimate |
|--------------|------------|--------------|-------------|---------------|-----------|-----------------------|
| FIISU        | Lake ruiii | iping statio | ii Opgraues | - FIE-TEIIUEI | ΓΙΟJΕLΙ   | Jost Estimate         |

| Item                                     | Total Cost      |
|------------------------------------------|-----------------|
| Construction Costs (Estimated)           | \$<br>727,535   |
| Consultant Costs (Construction Phase)    | \$<br>96,320    |
| Sub-total                                | \$<br>823,855   |
| Construction Contingency (10%)           | \$<br>82,385    |
| Consultant Costs (Design/TenderPhase)    | \$<br>89,310    |
| Sub-total                                | \$<br>995,550   |
| Net HST (4.286%)                         | \$<br>42,669    |
| Sub-total                                | \$<br>1,038,219 |
| Halifax Water Staff and Related Expenses | \$<br>50,000    |
| Streets & Services Permit                | \$<br>5,000     |
| Sub-total                                | \$<br>1,093,219 |
| Overhead (1%)                            | \$<br>10,932    |
| Total Project Cost Estimate              | \$<br>1,104,151 |
| Rounded Total                            | \$<br>1,200,000 |
| Already approved in 2020/21 Budget WW    | \$<br>758,000   |
| Additional funding required              | \$<br>442,000   |
| Source of funding - Wastewater           | \$<br>442,000   |

June 3, 2022

| First L                                                     | ake Pumping Station Upgrades                                                                                   |                                                             |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | MED                                                                                |  |
|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|--|
| Estim                                                       | ate of Probable Cost                                                                                           |                                                             |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | יןריי                                                                              |  |
| Tende<br>PROJI<br>DATE:<br>CLIEN<br>CONS<br>UNIT I<br>NOTE: | r<br>ECT NO.<br>T:<br>ULTANT:<br>PRICE SOURCE:<br>HST <u>NOT</u> INCLUDED IN INDICATED UNIT PRICES AND TOTALS. | 201-11341-00<br>May 25, 2022<br>Halifax Water<br>WSP<br>WSP |                | This estimate of probable construction cost is<br>approximate only. Actual cost may vary<br>significantly from this estimate due to market<br>conditions such as material and labour costs, tir<br>of year, industry workload, competition, etc. Thi<br>estimate has been prepared based on our<br>experience with similar projects. This estimate<br>has not been prepared by obtaining any<br>estimates or quotes from contractors. Due to ti<br>uncertainties of what contractors bid, WSP can<br>make any assurances that this estimate will be |                                                                                    |  |
| ITEM<br>NO.                                                 | DESCRIPTION                                                                                                    | UNIT                                                        | EST.<br>QUANT. | bid. When assessing this p<br>feasibility purposes this est<br>relied upon without consid<br>UNIT PRICE                                                                                                                                                                                                                                                                                                                                                                                                                                             | roject for business<br>imate should not be<br>ering these factors.<br><b>PRICE</b> |  |
|                                                             | PROCESS UPGRADES                                                                                               |                                                             |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                    |  |

| 1 | Supply and install odor control system (Ambio)                                 | LS  | 1 | \$34,500.00 | \$34,500.00 |
|---|--------------------------------------------------------------------------------|-----|---|-------------|-------------|
| 2 | Remove 2 existing pumps and piping in older wetwell. Cap pipe and conduit.     | LS  | 1 | \$11,500.00 | \$11,500.00 |
| 3 | Supply and install 2 quick disconnects at old forcemain connections in older w | LS  | 1 | \$2,875.00  | \$2,880.00  |
| 4 | Supply and install new pump in newer wetwell                                   | LS  | 1 | \$40,250.00 | \$40,250.00 |
| 5 | Supply and install new SS piping in newer wetwell.                             | LS  | 1 | \$11,500.00 | \$11,500.00 |
| 6 | Supply and install 2 pressure relief valves and piping in newer wetwell        | ea. | 2 | \$5,750.00  | \$11,500.00 |
| 7 | Supply and install flowmeters                                                  | ea. | 2 | \$8,625.00  | \$17,250.00 |
| 8 | Supply and install wetwell depth sensors                                       | ea. | 1 | \$7,475.00  | \$7,480.00  |
|   |                                                                                |     |   |             |             |

#### Sub Total \$136,860.00

| ITEM | DESCRIPTION                                                                        | UNIT | EST.   |             |             |
|------|------------------------------------------------------------------------------------|------|--------|-------------|-------------|
| NO.  |                                                                                    |      | QUANT. | UNIT PRICE  | PRICE       |
|      | CIVIL UPGRADES                                                                     |      |        |             |             |
|      |                                                                                    |      |        |             |             |
| 1    | Supply and install fencing                                                         | m    | 90     | \$258.75    | \$23,290.00 |
| 2    | Supply and install sliding gates                                                   | m    | 8      | \$948.75    | \$7,590.00  |
| 3    | Remove asphalt concrete pavement                                                   | m²   | 300    | \$17.25     | \$5,180.00  |
| 4    | Remove existing base course                                                        | m²   | 300    | \$11.50     | \$3,450.00  |
| 5    | Site grading                                                                       | LS   | 1      | \$11,500.00 | \$11,500.00 |
| 6    | Supply and install new base course (150mm Type 1, 150 mm Type 2)                   | m²   | 350    | \$57.50     | \$20,130.00 |
| 7    | Supply and install new asphalt concrete, 75mm                                      | m²   | 350    | \$46.00     | \$16,100.00 |
| 8    | Supply and install generator pad, concrete, reinforced, 150mm thick                | ea.  | 1      | \$1,725.00  | \$1,730.00  |
| 9    | Supply and install odor control system pad, concrete, reinforced, 150mm thick      | ea.  | 1      | \$2,875.00  | \$2,880.00  |
| 10   | Supply and install precast concrete control panel pedestal                         | ea.  | 1      | \$5,750.00  | \$5,750.00  |
| 11   | Supply and install bollards                                                        | ea.  | 4      | \$1,322.50  | \$5,290.00  |
| 11   | Supply and install traffic rated renovation style hatches (triplex + single hatch) | LS   | 1      | \$34,500.00 | \$34,500.00 |
| 12   | Demolition and disposal of existing building, equipment and foundation             | LS   | 1      | \$40,250.00 | \$40,250.00 |
| 13   | Yard piping                                                                        | LS   | 1      | \$37.95     | \$40.00     |
|      |                                                                                    |      |        |             |             |

|                                                 |    |   | Sub Total    | \$177 680 00 |
|-------------------------------------------------|----|---|--------------|--------------|
|                                                 |    |   | Sub Total    | \$177,000.00 |
| ELECTRICAL UPGRADES                             |    |   |              |              |
|                                                 |    |   |              |              |
| 1 Supply and install control panel              | LS | 1 | \$115,000.00 | \$115,000.00 |
| 2 Supply and install meter socket and enclosure | LS | 1 | \$6,900.00   | \$6,900.00   |
| 3 Supply and install disconnect switch          | LS | 1 | \$5,750.00   | \$5,750.00   |
| 4 Supply and install site lighting              | LS | 1 | \$4,600.00   | \$4,600.00   |
| 5 Provision of temporary power                  | LS | 1 | \$9,200.00   | \$9,200.00   |
| 5 Supply and install automatic transfer switch  | LS | 1 | \$138,000.00 | \$138,000.00 |
| 6 Supply and install backup generator           | LS | 1 | \$51,750.00  | \$51,750.00  |
| 7 Demolition of existing electrical equipment   | LS | 1 | \$6,900.00   | \$6,900.00   |
| 8 Supply and install conduits and wiring        | LS | 1 | \$11,500.00  | \$11,500.00  |
| 9 Supply and install underground conduits       | LS | 1 | \$11,500.00  | \$11,500.00  |
|                                                 |    |   | 1            |              |

Sub Total \$361,100.00

| ITEM | DESCRIPTION                                                                  | UNIT | EST.   |             |             |
|------|------------------------------------------------------------------------------|------|--------|-------------|-------------|
| NO.  |                                                                              |      | QUANT. | UNIT PRICE  | PRICE       |
| 1    | MISCELLANEOUS Traffic control during paving and subgrade placement (2 weeks) | LS   | 1      | \$17,250.00 | \$17,250.00 |

Sub Total \$17,250.00

| \$692,890.00 | Subtotal                        |
|--------------|---------------------------------|
| \$34,644.50  | Mobilization/Demobilization @5% |
| \$72,753.45  | Contingency (10%)               |
| \$800,287.95 | Total (Excluding HST)           |

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#### HALIFAX WATER WSP REPORT NUMBER: 201-11341-00

## FIRST LAKE PUMPING STATION FINAL DESIGN REPORT

May 25, 2022

CONFIDENTIAL



## wsp



## FIRST LAKE PUMPING STATION FINAL DESIGN REPORT

HALIFAX WATER

DESIGN REPORT (VERSION 00) CONFIDENTIAL

PROJECT NO.: 201-11341-00 CLIENT REF:CLIENT REF. NO DATE: MAY 25, 2022

WSP 1 SPECTACLE LAKE DRIVE DARTMOUTH, NS

T: (902) 835-9955 WSP.COM

# vsp

May 25, 2022 Confidential

Brad Baxter, P.Eng. Project Engineer Halifax Water 450 Cowie Hill Road Halifax, NS

Subject: First Lake Pumping Station, Final Design Report

Dear Brad:

Please find attached our Pumping Station Final Design Report for the First Lake Pumping Station.

If you have any questions or concerns, please don't hesitate to contact me.

KEVIN O'LEARY

Kevin O'Leary, P.Eng. Municipal Engineer

Encl.

cc: File

WSP ref.: 201-11341-00

## REVISION HISTORY

#### FIRST ISSUE

| May 25, 2022                                              | Issued for Halifax Water review and approval               |                                                            |   |  |  |
|-----------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------|---|--|--|
| Prepared by                                               | Reviewed by                                                | Approved By                                                |   |  |  |
| Kevin O'Leary, P.Eng.<br>Municipal Engineer,<br>Dartmouth | Pat Lewis, P.Eng.<br>Manager, Municipal<br>Engineering, NS | Pat Lewis, P.Eng.<br>Manager, Municipal<br>Engineering, NS |   |  |  |
|                                                           |                                                            |                                                            |   |  |  |
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|                                                           |                                                            |                                                            |   |  |  |

### SIGNATURES

PREPARED BY



Kevin O'Leary, P.Eng. Municipal Engineer

REVIEWED<sup>1</sup> BY

Pat Lewis, P.Eng. Manager, Municipal Engineering, NS May 25, 2022

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First Lake Pumping Station Project No. 201-11341-00 Halifax Water

# wsp

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### 1 INTRODUCTION AND BACKGROUND

#### 1.1 BACKGROUND

WSP Canada Inc. (WSP) has been engaged by Halifax Water to provide surveying, geotechnical, engineering design, and construction support services associated with the upgrades to the First Lake pumping station located in Lower Sackville, NS. The most recent upgrade to the pumping station was completed in 2012 with the addition of a new wetwell complete with two new pumps and a valve chamber.

This final design report describes the major design rationale and features of the proposed First Lake Pumping Station upgrade design to continue to deliver wastewater approximately 500m away into the gravity collection manhole located on Glendale Drive.

In general, this project involves:

- General civil improvements including site fencing, paving, lighting and sliding access gates.
- Installation of a third pump in the wetwell constructed in 2012.
- Demolition of the existing controls building.
- Removal of the two existing pumps and ancillary equipment in the older wetwell.
- New external mounted pump controls.
- Installation of an odor control system.
- Installation of a new standby diesel generator with automatic transfer switch.

#### 1.2 OBJECTIVES

The objectives of this design report are as follows:

- Finalize the configuration, sizing and selection of the third pump based on the existing pumps and forcemains.
- Finalize the design criteria to establish and confirm the sizing of major project components.
- Design a pump station and site configuration including site servicing infrastructure, process mechanical, electrical, instrumentation and control that meets the requirements of Halifax Water.

#### 1.3 PERMITS AND REGULATORY APPROVALS

#### 1.3.1 Nova Scotia Environment (NSE)

An application for the scope of work included in the project was made to NSE in August of 2021. Halifax Water received the approved permit on or about April 5, 2022.

#### 1.3.2 Nova Scotia Power (NSP)

The addition of the third pump is not expected to require any changes to the NSP transformer. This feed is located at the utility pole near at the southwest corner of Kingfisher Way and Metropolitan Avenue.

The installation of the new controls monument and demolition of the existing controls buildings will require an application for renovation, disconnection and reconnection. This application will be coordinated and applied for by the successful contractor on the project. The application requires to be made by a provincially licensed electrician and should be completed as early in the project as possible to allow proper scoping and scheduling by NSP.

#### 1.3.3 HRM Demolition Permit

The demolition of the existing controls buildings will require an application for demolition and disposal of the construction debris. This application will be coordinated and applied for by the successful contractor on the project. The application should be completed as early in the project as possible to allow time for HRM review and approval.

#### 1.3.4 Halifax Regional Municipality (HRM)

With the exception of driveway paving, all work will be completed within Halifax Water and HRM owned property. As the station straddles multiple parcels, it is strongly recommended that at the completion of the project that the pumping station property boundaries and intersecting parcels have all of relevant easements and property boundaries clarified.

#### 1.4 SURVEY (TOPOGRAPHIC AND LEGAL)

As part of the preliminary design of the First Lake pump station upgrade, WSP has reviewed the existing survey and has subsequently completed a topographic survey of the existing ground surface elevation in the vicinity of the pumping station to support the detailed design and associated site grading. The topographic survey also included pickup of existing surface features along the public road rights-of-way to support the detailed design. This survey information has been incorporated into the preliminary design drawings and is presented in the Appendices.

#### 1.5 GEOTECHNICAL INVESTIGATION

As part of the geotechnical investigation for the First Lake pumping station upgrades, under the direction of WSP, exploratory boreholes were drilled at the site. Fieldwork for the subsurface investigation was conducted on December 18, 2020 and consisted of excavating two (2) test pits (TP-01 and TP-02). Test pit TP-01 was terminated at 3.0 metres below ground surface in unsuitable fill at the maximum reach of the excavator. Test pit TP-02 was terminated at 2.4 metres in till at the maximum reach of the excavator. In general, a grass/topsoil layer overlying unsuitable fill deposits was encountered in the subject test pits. Undisturbed till was noted in test pit TP-02 below the fill deposits. Groundwater was observed in both test pits at 2.7 and 2.1 metres below the ground surface at the time of excavation, respectively. The complete geotechnical investigation report is presented in the appendices.

The main implication of the geotechnical investigation is that the underlying material at the control panel monument and generator may likely have to be excavated to the depth of native material and suitable granular material (or other suitable fill) serve as its replacement.

#### 1.6 SITE DESCRIPTION

The First Lake pumping station is located on a 4.37 ha parcel owned by HRM and bound by Kingfisher Avenue, Glendale Avenue and two other parcels owned by HRM. The cleared area of the site is a mix of gravel and paved parking. Most of the remaining parcel is treed with young to semi-mature deciduous and evergreen trees. A small watercourse or drainage channel passes south of the pump station and discharges to First Lake after passing under a traffic bearing culvert. Stormwater runoff from the pump station site flows towards the drainage channel. For reference, an aerial view of the site is shown in Figure 1.



Figure 1: Aerial view of First Lake pumping station. (Source: Google Earth, 2015)

### 2 WASTEWATER PUMPING SYSTEM DESIGN REQUIREMENTS

The First Lake pumping station sewershed accepts wastewater flows from 125.3 ha of developed area. The sewershed consists mainly of single family and multi-unit residential properties with some institutional and commercial properties abutting First Lake. For reference, a copy of the sewershed mapping completed by Halifax Water is included in the appendices.

#### 2.1 SANITARY FLOW - BASIS OF DESIGN FLOW

Dry weather wastewater flows to the First Lake pumping station were previously projected (AECOM, 2011). Average and peak dry weather flows were estimated at 18.3 L/sec and 45.8 L/sec respectively (290 USGPM and 726 USGPM).

The 2011 AECOM report did not discuss wet weather flow directly for the First Lake pumping station. Although reference values vary, newly constructed gravity wastewater collection systems should have an I&I no greater than 0.14 L/sec/ha (12,500 L/day/ha). At 0.28 L/sec/ha, the upper limit on I&I allowance listed in the Environment Canada guidelines, yields 35.1 L/sec (556 USGPM) of wet weather flow. I&I values that exceed this allowance typically warrant initiating investigation and mitigation measures.

The First Lake station has two electromagnetic flowmeters installed as part of the previous upgrade in 2012. Flow data was supplied for both flowmeters for dates between February 2019 and December 2020. The data was supplied in one-minute intervals. After checking and compilation into daily flows, the average daily flow to the station for the period was determined to be 240,000 USGPD (166 USGPM, 657,000 LPD, 10.6 L/sec). The observed peak to average daily flow for the sample period was 6.1 yielding a peak flow of 64.7 L/sec. This peak flow is slightly larger than the pumping supplier reviewed capacity of 63 L/sec as identified in the AECOM report. Although observed flow and daily rainfall was not compared for this station.

With the proposed third pump, accommodating the peak flow is accomplished utilizing two duty pumps and one standby. The simultaneous operation of the third pump can occur increasing the overall flow capacity but it should not be relied upon to carry peak flows in its role as the standby pump.

As part of the design, WSP did not review the downstream sewershed for available capacity as previous work has examined this capacity to Halifax Water's satisfaction. In the event that downstream capacity becomes a concern, the control panel can act to limit the pumping rates from the First Lake pumping station. However, this comes with the risk of exceeding the emergency storage and overflowing the pumping station.

#### 2.2 OPERATIONAL HEALTH AND SAFETY CONSIDERATIONS

We have reviewed the previous design and construction of the components within the First Lake pumping station and appear to have been designed to meet all of the Occupational Health and Safety and Construction Safety Legislation in the Province of Nova Scotia, as well as the requirements of the Canadian Electrical Code, as interpreted by Nova Scotia Power on behalf of the Government of Canada. In keeping with the requirements of the Canadian Electrical Code, the station wetwell has been classified as a Class 1 Division 2 zone, with regard to the potential for the presence of explosive gases and all equipment installed within the wetwell must be certified for use in a Class 1 Division 1 zone.

The Flygt or approved access hatches installed on the wetwell should be equipped with operable safety gratings to protect operations staff against falling into the wetwell.

#### 2.3 ELECTRICAL REQUIREMENTS AND SCADA SYSTEM

The electrical power transmission will be drawn from the existing 600 VAC, 3-phase transmission system at the last utility pole prior to the lift station property. Power will be disconnected from the overhead mast system at the existing control building. New power supply will be delivered to the new electrical panel via an underground conduit system. Power

will be redistributed to the wetwell, valve chamber and standby power generator via buried electrical conduits.

A switchable, local yard light will be installed on the pump control panel pedestal to provide lighting for maintenance purposes. The pedestal will also be equipped with a 120/220 volt, 1-phase utility plug-in receptacle for use by operations staff during maintenance work.

Electrical power to the pumping station will be provided from the adjacent 600-volt, 3 phase system as illustrated in the attached electrical drawings. This drawing also provides elevation details of the pump control cabinets, the Automatic Transfer Switch (MTS), distribution panel, and ancillary electrical items.

The pumping station functions shall be monitored by the Halifax Water supervisory control and data acquisition (SCADA) system as stated in the Halifax Water Design & Construction Specifications (latest version), to ensure the station is performing satisfactorily. Monitoring signals and alarms shall be transmitted to the Halifax Water SCADA system by a separate communication remote terminal unit (RTU). The programmable logic controller shall have eight (8) extra digital points and eight (8) extra analog points and will transmit the signals and alarms to the central monitoring system, as stated in the design manual. The pump control panel will be equipped with an uninterruptable power supply (UPS) to maintain communications and programming through a power outage in the event the generator does not take over power supply to the station.

#### 2.4 MECHANICAL REQUIREMENTS

It is understood that the pump rail and bottom bracket has been installed as part of the 2012 project. The installation of the third pump will therefore be a relatively straightforward electrical connection.

#### 3 WASTEWATER PUMPING STATION DESIGN

#### 3.1 EXISTING PUMP STATION DEMOLITION

The existing First Lake pump station will require the demolition of the existing controls building.

The hazardous materials survey was completed in February 2021 and is attached to this report for reference. In summary, no asbestos containing material was found within the tested areas of the building. Low level lead paint was detected on the interior cinder block walls which does not require specialized disposal but does require dust control and general health and safety measures as outlined in the report.

#### 3.2 DUTY PUMP CAPACITY REQUIREMENTS

The proposed pump is the next generation Flygt pump in the same family as the two existing pumps.

#### 3.3 WETWELL OPERATION AND STORAGE REQUIREMENTS

#### *3.3.1 Operating Levels*

Wetwell operating levels have already been established as part of the previous construction project of 2012. We do not expect any changes to the current wetwell operating setpoints and

recommend any changes. It is expected that the proposed use of VFDs will allow the wetwell to be set to a fixed level with intermittent drawdowns for solids and related flush out. New floats and a new laser level will be installed to monitor the operating level in the wetwell.

#### 3.3.2 System Curve Calculations and Total Dynamic Head

System curves for the various operating scenarios are presented in the appendices. The system curves represent the system operation for the following 18 scenarios:

- One, two and three pumps in service
- Southern PVC DR18 forcemain in operation, northern PVC DR18 forcemain in operation and both forcemains in operation.
- Minimum and maximum wetwell operating levels.

#### *3.3.3 Pump Selection*

The existing Flygt pumps are no longer available for purchase as the model has been discontinued in favour of the next generation model. The old and new model numbers are the same and their operational characteristics are very similar. Therefore, we are proposing the new Flygt model CP 3152.181 MT as the third pump.

#### *3.3.4 Power Requirements*

Based upon existing and proposed electrical loads it is estimated that the upgraded station requires 60 kW of power

After estimating power requirements and discussing with Nova Scotia Power, it is expected that the existing feed transformer will be capable of supplying the required power for the new station.

#### *3.3.5 Transient Analysis Check*

As part of this project WSP as part of their due diligence, completed a hydraulic transient analysis to facilitate addition of the third pump in Wet-Well #1 of the First Lake Wastewater Pumping Station (PS). The First Lake PS has two wet wells: #1 (main) and #2 (overflow). Wet-Well #1 was designed to accommodate three (3) pumps of model, Flygt 3152.181, while only two were initially installed Halifax Water proposes to add the remaining third pump. Although it is assumed that wet-well #2 will be decommissioned the analysis included the two older pumps in the event that Halifax Water wished to keep them in service for the short term.

To perform the analysis, WSP built an all-pipe HAMMER® model of the pump station and forcemain. In order to check the adequacy of proposed pumps system with and without protection, WSP modeled all five (5) pumps experiencing a global power failure (sudden shut-off) and conveying flow downstream only via one (1) 300mm forcemain to reflect the most critical transient event at the maximum water level in the wet well for conservative results. WSP also modelled a scenario with only the three (3) pumps at Wet- Well #1 (main) operational while the other two (2) pumps at Wet-Well #2 were kept inactive (representing abandoned Wet-Well #2). Scenarios simulated can be summarised as follows:

• Scenario 1: Five (3 + 2) Pumps without Protection. Both Wet-Well #1 and Wet-Well #2 are active.

- Scenario 2: Five (3 +2) Pumps with Protection. Both Wet-Well #1 and Wet-Well #2 are active
- Scenario 3: Three (3) Pumps without Protection. Wet-Well #1 is active while Wet-Well #2 is inactive (abandoned/decommissioned).
- Scenario 4: Three (3) Pumps with Protection. Wet-Well #1 is active while Wet-Well #2 is inactive (abandoned/decommissioned).

The simulation results predict the maximum and minimum transient pressure envelopes expected within the PS and along the forcemain are improved with an air valve (one for each of the two common discharge headers). The sewage combination air valves will primarily improve air-handling by expelling air from pipes normally and letting air into the line upon power failure to minimise the duration of minimum sub-atmospheric pressures in the forcemain. Accordingly, the selected DR 18 pipe's sub-atmospheric and also its high-pressure tolerance will be able to withstand both "negative" and subsequent positive pressures during an emergency pump stop or power failure with 3 or 5 pumps initially operating. The results of the transient analysis are provided in Appendix B.

#### 3.4 ODOUR CONTROL

A small odor control unit rated at 175 CFM shall be utilized to maintain the wetwells under slightly negative pressure and to draw wetwell gases through an active carbon filter prior to discharge. The air inlet of the drum filter shall be plumbed in series to the older duplex wetwell and the new triplex wetwell.

#### 3.5 EMERGENCY OVERFLOW UTILIZATION

It is understood that the overflow located in the older wetwell was capped and removed from service during the 2012 project. With no emergency overflow, the First Lake pumping station must be suitably sized to carry the expected peak flow unless mandated to restrict pumping capacity due to downstream restrictions.

#### 3.6 EMERGENCY GENERATOR

Selection of the standby emergency generator requires a model with 125 kVA at 80 amps.

Given the size of the wetwell and the peak flows discharged to the station, that emergency storage will not yield enough time for an operator to arrive at site and start the backup generator. Therefore, an automatic transfer switch will be included with the generator.

While the generator will have sufficient power to run three duty pumps simultaneously, the emergency generator will be not be sized to start duty pumps simultaneously and the pump control system will be designed to stagger pump starts. The pump control panel will be equipped with an automatic transfer switch to allow the system to switch to back-up power.

The generator, equipped with a double wall fuel storage tank, will be located adjacent to the station wetwell. The generator will be equipped with a sound attenuating cover designed to reduce ambient noise when the generator is running and to protect the equipment from the weather.

#### 3.7 CONSTRUCTION SEQUENCING

The main issue facing construction sequencing is the gap in time between NSP's disconnection and reconnection of the power supply to the pumping station and the possible

gap in time between control panel disconnect and reconnect of pump power and controls. Options to consider are outlined below:

- Install the new generator and control panel. Allow the generator to run the two (or three) pumps in the newer wetwell. Demolition of the existing controls building would follow. Reconnect the power to the new panel. This option is not strongly recommended since the generator would be running long-term leading to additional costs due to fuel consumption, additional run time being placed on the new generator and potential noise issues.
- 2. Install a temporary diesel drive pump with the capacity to handle the entire flow entering the newer wetwell. This would require temporary piping connections into one of the forcemains. Demolition of the existing controls building, and construction of the new panel pedestal and generator would follow. Reconnect the power to the new panel. The temporary piping connection could serve as a permanent point of attachment that could be brought above ground to serve as an emergency pump around for future O&M needs. This option is not strongly recommended since the diesel driven pump would be running long term leading to additional costs due to fuel consumption and potential noise issues.
- 3. Install the new panel (at a temporary or permanent location) to allow at a minimum the basic operation of the pumps (alternation and response to liquid level in the wetwell). Demolish the building, install all remaining conduit and complete the electrical connections.
- 4. Install a temporary panel (or utilize the old panel at a temporary location) capable of running the two pumps in the newer wetwell. Demolition of the existing controls building, and construction of the new panel pedestal and generator would follow. Reconnect the power to the new panel.
- 5. Utilize the older wetwell pumps while the other pumps are taken out of service while the new panel is installed and electrical and communications are made. Demolition of the existing controls building, would follow. This is our recommendation that we suggest be discussed with the contractor as the preferred methodology.

#### 3.8 CIVIL SITE ISSUES

#### 3.8.1 Fencing

With the demolition of the existing controls building, 8-foot-high fencing will be installed around the perimeter of the site. Operator ingress/egress into the site will be accomplished using a double wide vehicle sliding gate.

#### *3.8.2 Fuel Containment*

Given the proximity of the tributary to First Lake we are proposing a partial secondary containment system beyond the double wall fuel tank. Concrete curbing will be used to direct the fuel onto the paved area to give sufficient time for fuel delivery personnel to notice and act upon a small spill.

#### 3.9 SPECIFICATIONS

Project specifications will be included with the final design submission.

### 4 WASTEWATER PUMPING STATION DESIGN SUMMARY

The First Lake Pumping Station will be designed to conform with the current requirements of Halifax Water's Design and Construction Specifications for Municipal Water and Wastewater Systems (latest edition). Final design drawings for the pump station marked "*Issued for Tender*", are presented in the Appendices for Halifax Water's review and comment.

The hydraulic transient analysis of the forcemain system can support the long-term peak design flow requirements within the sewershed.

The older existing wetwell will have its pumps removed and returned to Halifax Water for repurposing. The wetwell will be kept in service as additional emergency storage. The overflow piping will be plugged and filled with grout.

The wetwell will contain one new identical 20-hp submersible duty pumps which will meet the requirements of the peak design flow from the tributary area. The triplex arrangement (two duty and one standby) will allow the station to operate beyond the current design capacity with both pumps working, should the future peak wet weather flows significantly exceed the current understanding of the ultimate peak tributary loading. This should be subject to investigation of the downstream capacity of the receiving sewershed(s).

In keeping with current Halifax Water policy, the duty pumps and electric motors have been selected with additional capacity so that the original impellors may be replaced with larger diameter units to increase station capacity, should this become necessary in the future.

Pump operation will be controlled with the existing level measurement device with programmable pump controls. The pumps will be mounted on rails to facilitate pump removal and installation.

The electrical service (600V, 3-phase) will be fed underground from a new service pole to be located on HRM lands near the pumping station to the pump control panel located on a pedestal next to the wetwell. Electrical panels including main service breaker, NSPI meter, motor starters, automatic transfer switch, and SCADA system are to be installed in a NEMA4X, stainless steel, weatherproof equipment enclosure, mounted on a pre-cast concrete pedestal next to the pumping station wetwell.

A diesel driven generator with two-day run time will be installed onsite. An automatic transfer switch will be installed at the panel for automatic switchover during power outages. Additional spill protection is warranted due to the proximity of a water course/drainage channel.

The pump controls, communications radio and antenna system, and SCADA panel will be specified during the detailed design phase of the project. It is understood that Halifax Water will complete a Radio Propagation Study for the area and provide direction on the type of radio and antenna system required for this station. Halifax Water will provide the communications radio, the antenna, and cabling for installation in the NEMA4 control panel and the construction contractor will be responsible for the remainder of the pump control and electrical infrastructure.

### 5 COST ESTIMATE

#### 5.1 FINAL PRE-TENDER COST ESTIMATE

Pricing for the First Lake Pumping Station project was developed based on quoted prices from suppliers, recent tenders and costing sources like RS Means. Pricing reflects the April-May 2022 period and allows a 10% contingency. The final pricing table is included in the appendices.

### 6 SCHEDULE

#### 6.1 TENDER AND CONSTRUCTION SCHEDULE

The construction schedule will be heavily impacted by supply chain issues witnessed over the past two years and will be very difficult to predict based on previous similar project. For this project, we are assuming that the generator will be the longest lead time item. Recent experience puts the lead time anywhere between six to eight months. With this project, we expect some of the civil site works can be completed this summer and into the fall which includes underground piping and conduit. The control panel may also be ready in time for fall installation. If the panel is available within this time frame it is possible that all of the station's components can be installed and commissioned except for the generator. The generator can then be installed in the spring and commissioned separately.

| ٠ | Halifax Water Internal Review and Processes Completion | 27-Jun-2022     |
|---|--------------------------------------------------------|-----------------|
| ٠ | Tender Award to Contractor                             | 25-Jul-2022     |
| • | UARB Approval                                          | 01-Aug-2022     |
| • | Civil Works and Process Installation and Commissioning | Jul - Nov-2022  |
| ٠ | Electrical Installation (Control Panel, ATS            | Aug. – Nov 2022 |
| ٠ | Generator Installation and Commissioning               | Apr-2023        |
| • | Project Closeout and Completion of All Deficiencies    | May 2023        |

#### BIBLIOGRAPHY

- AECOM. (2011). First Lake Drive Sewage Pumping Station Preliminary Design Concepts Station Piping/Forcemain Replacement Technical Memorandum.
- Environment Canada. Atlantic Canada Wastewater Guidelines Manual for Collection, Treatment, and Disposal (2006).

# APPENDICES



# FINAL DESIGN REPORT APPENDIX

# A GEOTECHNICAL INVESTIGATION REPORT

# vsp

January 19, 2021

Brad Baxter, P.Eng. Project Engineer Halifax Water 450 Cowie Hill Rd Halifax, NS B3K 5M1 Email: bradb@halifaxwater.ca

#### Subject: Geotechnical Investigation Report – First Lakes Pump Station Civic No. 1A Kingfisher Way, Lower Sackville, NS

#### 1.0 GENERAL

WSP Canada Inc. (WSP) has completed the field investigation for the above-mentioned site and recommendations are provided below. It is understood that the existing building will be demolished and replaced with a pedestal structure supported by a typical shallow foundation.

An explanation of the symbols and terms used in this report are enclosed in Appendix A. Test pit logs and a photo log detailing the subsurface conditions are enclosed in Appendix B. Confirmatory laboratory test results from Stantec Inc. are presented in Appendix C. Laboratory test results from AGAT Labs are presented in Appendix D. Report Limitations are outlined in Appendix E.

#### 2.0 SUBSURFACE CONDITIONS

Fieldwork for the subsurface investigation was conducted on December 18, 2020 and consisted of excavating two (2) test pits (TP-01 and TP-02) at the approximate locations shown on the attached figure. Test pit TP-01 was terminated at 3.0 metres below ground surface in unsuitable fill at the maximum reach of the excavator. Test pit TP-02 was terminated at 2.4 metres in till at the maximum reach of the excavator.

A grass/topsoil layer overlying unsuitable fill deposits was encountered in the subject test pits. Undisturbed till was noted in test pit TP-02 below the fill deposits. Groundwater was observed in both test pits at 2.7 and 2.1 metres below the ground surface at the time of excavation, respectively. Groundwater levels can be expected to fluctuate seasonally.

#### 3.0 ENVIRONMENTAL LAB TESTING

Two (2) select soil samples were submitted to AGAT Laboratory in Dartmouth, NS and tested for several chemical parameters.

Test results including Total Petroleum Hydrocarbons (BHH/BTEX), Polycyclic Aromatic Hydrocarbons (PAH) and available metals, are provided in Appendix D. Laboratory certificates from BV Labs are also provided in Appendix D.

1 Spectacle Lake Drive Dartmouth, NS Canada B3B 1X7

T: +1 902-835-9955 F: +1 902-835-1645 wsp.com

# wsp

Results for available metals in soils are provided in Table 1, Appendix D. Test results indicate levels are within the NSE EQS Tier 1 guidelines for commercial, non-potable, coarse-grained, with the exception of Iron.

Laboratory results for BHH/BTEX's and PAHs are provided in Tables D1 and D2 in Appendix D. BTEX (benzene, toluene, ethyl benzene and xylenes) results generally comply with Nova Scotia Environment (NSE) Environmental Quality Standards (EQS) guidelines for a commercial land use, coarse-grained soil type and a non-potable water site. Test results indicate levels of PAHs in the soil comply with commercial criteria of the NSE Soil Quality Guidelines.

#### 4.0 DISCUSSION AND RECOMMENDATIONS

Spread footings may be set directly on engineered fill (above till) or undisturbed till. To prepare the site, it will be necessary to remove all fill materials from within the proposed foundation bearing areas. Excavation should be taken to competent stratum (i.e. undisturbed till).

Importation of approved structural fill may be required following initial excavation to reach design grades. Bearing capacity estimates for Serviceability Limit State (SLS – un-factored geotechnical resistance) and Ultimate Limit State (ULS – geotechnical resistance factor of 0.5) design are provided as follows and are based on criteria in the Canadian Foundation Engineering Manual (4<sup>th</sup> edition).

• For design purposes an allowable bearing pressure of 150 kPa (SLS) and 225 kPa (ULS) may be used for structures set on engineered fill (over till) or compact till. Estimated total and differential settlements at the SLS loading are not expected to exceed 25 and 19 mm, respectively.

Assessment of the foundation bearing surface (footing subgrade) will be required to confirm the recommended bearing pressures noted above. The footing subgrade should be inspected by qualified geotechnical personnel during bearing surface preparation.

Bearing capacity estimates generally assume that the foundation footing depth (Df) is at least 1.2 metres, and that the confining soil weight is included in the estimates. Footings should be founded at a minimum depth of 1.2 metres below exterior grade elevation for frost protection.

The on-site fill deposits are not suitable for re-use as backfill. Importation of an approved material will be required. Saturated material is not suitable for re-use in structural applications and removal of oversize material (particle size greater then 200mm) will be required prior to re-use for backfilling. Proper construction methods during excavation, handling and stockpiling of the on-site materials will be required to prevent addition and excessive water content in the soil.

Generally, backfill should be placed in compacted lifts not exceeding 300 mm and compacted to 95 percent of the material's Standard Proctor Maximum Dry Density (SPMDD). Structural backfill should be compacted to a higher approved standard (i.e. 100 percent of the material's SPMDD (ASTM D698 procedure)).

Recommended soil design parameters are provided in Table 1, below:

#### **Table 1 - Summary of Recommended Soil Design Parameters**

| Parameter                                                | Till | NSTIR Type 2 or<br>Equivalent |
|----------------------------------------------------------|------|-------------------------------|
| Total Unit Weight (KN/m <sup>3</sup> )                   | 20   | 21                            |
| Submerged Unit Weight<br>(KN/m <sup>3</sup> )            | 10   | 11                            |
| Angle of Internal Friction                               | 30°  | 36°                           |
| Coefficient of Active Earth<br>Pressure, K <sub>a</sub>  | 0.33 | 0.26                          |
| Coefficient of Passive Earth<br>Pressure, K <sub>p</sub> | 3.00 | 3.85                          |

#### 5.0 CLOSURE

This report has been prepared for the sole benefit of Halifax Water and is not intended for use by others. This report may not be reproduced without the prior written permission of WSP and Halifax Water. Contractors undertaking work must draw their own interpretations of the investigation results provided in this report as it affects construction costs, procedures and scheduling.

As test pits provide a localized representation of the total study area, subsurface conditions may vary between and/or beyond the test pit locations. If conditions encountered at the site vary significantly from the reported herein, we should be notified immediately so that our interpretations and recommendations can be reviewed and revised if necessary.

We trust this report meets your present requirements. If you have any questions with the information contained in the report, please do not hesitate to contact us at your convenience.

Sincerely,

Clayton J. Rogers, P.Eng. Manager - Atlantic Geotechnical

Jonathan Steeves

Jonathan K. Steeves, P.Eng. Project Geotechnical Engineer

WSP ref.: 201-11341





# A TEST PIT LOG EXPLANATION FORM

#### BOREHOLE LOG EXPLANATION FORM

This explanatory section provides the background to assist in the use of the borehole logs. Each of the headings used on the borehole log, is briefly explained.

#### **DEPTH**

This column gives the depth of interpreted geologic contacts in metres below ground surface.

#### STRATIGRAPHIC DESCRIPTION

This column gives a description of the soil based on a tactile examination of the samples and/or laboratory test results. Each stratum is described according to the following classification and terminology.

| Soil Classification*          |                                       | <u>Terminology</u>                                                  | Proportion                     |  |  |
|-------------------------------|---------------------------------------|---------------------------------------------------------------------|--------------------------------|--|--|
| Clay                          | <0.002 mm                             |                                                                     |                                |  |  |
| Silt                          | 0.002 to 0.06 mm                      | "trace" (e.g. trace sand)                                           | <10%                           |  |  |
| Sand                          | 0.06 to 2 mm                          | "some" (e.g. some sand)                                             | 10% - 20%                      |  |  |
| Gravel                        | 2 to 60 mm                            | adjective (e.g. sandy)                                              | 20% - 35%                      |  |  |
| Cobbles                       | 60 to 200 mm                          | "and" (e.g. and sand)                                               | 35% - 50%                      |  |  |
| Boulders                      | >200 mm                               | noun (e.g. sand)                                                    | >50%                           |  |  |
| Gravel<br>Cobbles<br>Boulders | 2 to 60 mm<br>60 to 200 mm<br>>200 mm | adjective (e.g. sandy)<br>"and" (e.g. and sand)<br>noun (e.g. sand) | 20% - 35%<br>35% - 50%<br>>50% |  |  |

\* Extension of MIT Classification system unless otherwise noted.

The use of the geologic term "till" implies that both disseminated coarser grained (sand, gravel, cobbles or boulders) particles and finer grained (silt and clay) particles may occur within the described matrix.

The compactness of cohesionless soils and the consistency of cohesive soils are defined by the following:

| COHES       | IONLESS SOIL                                             | COHESIVE SOIL |                                                          |  |  |  |  |  |
|-------------|----------------------------------------------------------|---------------|----------------------------------------------------------|--|--|--|--|--|
| Compactness | Standard Penetration<br>Resistance "N",<br>Blows / 0.3 m | Consistency   | Standard Penetration<br>Resistance "N",<br>Blows / 0.3 m |  |  |  |  |  |
| Very Loose  | 0 to 4                                                   | Very Soft     | 0 to 2                                                   |  |  |  |  |  |
| Loose       | 4 to 10                                                  | Soft          | 2 to 4                                                   |  |  |  |  |  |
| Compact     | 10 to 30                                                 | Firm          | 4 to 8                                                   |  |  |  |  |  |
| Dense       | 30 to 50                                                 | Stiff         | 8 to 15                                                  |  |  |  |  |  |
| Very Dense  | Over 50                                                  | Very Stiff    | 15 to 30                                                 |  |  |  |  |  |
| -           |                                                          | Hard          | Over 30                                                  |  |  |  |  |  |

The moisture conditions of cohesionless and cohesive soils are defined as follows.

| COHESIONLESS SOILS               | COHESIVE SOILS               |             |                                                                                                                |  |  |  |  |
|----------------------------------|------------------------------|-------------|----------------------------------------------------------------------------------------------------------------|--|--|--|--|
| Dry<br>Moist<br>Wet<br>Saturated | DTPL<br>Apl<br>WTPL<br>MWTPL | -<br>-<br>- | Drier Than Plastic Limit<br>About Plastic Limit<br>Wetter Than Plastic Limit<br>Much Wetter Than Plastic Limit |  |  |  |  |

#### **STRATIGRAPHY**

Symbols may be used to pictorially identify the interpreted stratigraphy of the soil and rock strata.

#### **MONITOR DETAILS**

This column shows the position and designation of standpipe and/or piezometer ground water monitors installed in the borehole. Also the water level may be shown for the date indicated.



Where monitors are placed in separate boreholes, these are shown individually in the "Monitor Details" column. Otherwise, monitors are in the same borehole. For further data regarding seals, screens, etc., the reader is referred to the summary of monitor details table.

#### **SAMPLE**

These columns describe the sample type and number, the "N" value, the water content, the percentage recovery, and Rock Quality Designation (RQD), of each sample obtained from the borehole where applicable. The information is recorded at the approximate depth at which the sample was obtained. The legend for sample type is explained below.

| SS  | =    | Split Spoon                    | GS =       | Grab Sample    |
|-----|------|--------------------------------|------------|----------------|
| ST  | =    | Thin Walled Shelby Tube        | CS =       | Channel Sample |
| AS  | =    | Auger Flight Sample            | WS =       | Wash Sample    |
| CC  | =    | Continuous Core                | RC =       | Rock Core      |
|     |      |                                |            |                |
| % R | ecov | ery = Length of Core Recovered | ed Per Run | x 100          |

Total Length of Run

Where rock drilling was carried out, the term RQD (Rock Quality Designation) is used. The RQD is an indirect measure of the number of fractures and soundness of the rock mass. It is obtained from the rock cores by summing the length of core recovered, counting only those pieces of sound core that are 100 mm or more in length. The RQD value is expressed as a percentage and is the ratio of the summed core lengths to the total length of core run. The classification based on the RQD value is given below.

| <u>RQD (%)</u> |
|----------------|
| < 25           |
| 25 - 50        |
| 50 - 75        |
| 75 - 90        |
| 90 - 100       |
|                |

#### TEST DATA

The central section of the log provides graphs which are used to plot selected field and laboratory test results at the depth at which they were carried out. The plotting scales are shown at the head of the column.

Dynamic Penetration Resistance - The number of blows required to advance a 51 mm diameter, 60° steel cone fitted to the end of 45 mm OD drill rods, 0.3 m into the subsoil. The cone is driven with a 63.5 kg hammer over a fall of 750 mm.

Standard Penetration Resistance - Standard Penetration Test (SPT) "N" Value - The number of blows required to advance a 51 mm diameter standard split-spoon sampler 300 mm into the subsoil, driven by means of a 63.5 kg hammer falling freely a distance of 750 mm. In cases where the split spoon does not penetrate 300 mm, the number of blows over the distance of actual penetration in millimetres is shown as <u>xBlows</u>

тт

Water Content - The ratio of the mass of water to the mass of oven-dry solids in the soil expressed as a percentage.

W<sub>P</sub> - Plastic Limit of a fine-grained soil expressed as a percentage as determined from the Atterberg Limit Test.

W<sub>L</sub> - Liquid Limit of a fine-grained soil expressed as a percentage as determined from the Atterberg Limit Test.

#### **REMARKS**

The last column describes pertinent drilling details, field observations and/or provides an indication of other field or laboratory tests that were performed.



# B TEST PIT LOGS AND PHOTOS

|       |                       | 115           | WSP Canada Inc.<br>1 Spectacle Lake Drive<br>Dartmouth, NS B3B 1X7<br>Telephone: (902) 835-9955 |                                       |          |          | IE:                      | 51 P | II NU      | JMR                                        | ER<br>PAGE | <b>I P-01</b><br>E 1 OF 1 |
|-------|-----------------------|---------------|-------------------------------------------------------------------------------------------------|---------------------------------------|----------|----------|--------------------------|------|------------|--------------------------------------------|------------|---------------------------|
| CLIEI | NT Ha                 | alifax W      | ater                                                                                            | PROJECT NAME First Lakes Pump Station |          |          |                          |      |            |                                            |            |                           |
| PRO.  | IECT N                | UMBER         | 201-11341                                                                                       | PROJECT                               | T L(     | OCATION  | TION Lower Sackville, NS |      |            |                                            |            |                           |
| DATE  | STAR                  | <b>TED</b> _1 | 8/12/20 COMPLETED 18/12/20                                                                      | GROUND ELE                            | EVA      |          |                          | TES  | ST PIT SI  | <b>ZE</b> 1m                               | n x 3m     | approx.                   |
| EXCA  | VATIO                 |               | TRACTOR TI Terra Construction                                                                   | GROUND WA                             | TE       | R LEVELS | :                        |      |            |                                            |            |                           |
| EXCA  | VATIO                 | N METH        | HOD Mini-Excavator                                                                              | _ $\square$ AT TIM                    | IE C     | OF EXCAV | ATION _2.                | 70 m |            |                                            |            |                           |
| LOG   | GED BY                | J. St         | eeves CHECKED BY C. Rogers                                                                      |                                       | D O      | F EXCAV  | ATION                    |      |            |                                            |            |                           |
| NOTE  | S W                   | eather:       | Cloudy, 2 degrees C                                                                             | AFTER                                 | EX       | CAVATIO  | N                        |      |            |                                            |            |                           |
|       |                       |               |                                                                                                 |                                       |          |          |                          |      | <b>A</b> : | SPT N VAL                                  | UE 🛦       |                           |
|       | <u></u>               | NO            |                                                                                                 |                                       | N<br>N   | YPE      | Cr co                    |      | 20         | 40                                         | 60         | 80                        |
| L a   | H<br>H<br>B<br>B<br>H | л Д           | MATERIAL DESCRIPTION                                                                            |                                       | 2        | ABE T    | STG                      |      | PL         | MC                                         | L          | _L<br>4                   |
|       | GR/                   |               |                                                                                                 |                                       | Ē        | MPL      | БЩ                       |      | 20         | 40                                         | 60         | 80                        |
|       |                       | ш             |                                                                                                 |                                       | $\leq$   | SAI      |                          |      |            | ES CONTE                                   | NT (%) □   | ]                         |
|       | 7 <u>11</u>           |               | Grass / Topsoil                                                                                 |                                       | +        |          |                          |      | 20         | 40<br>:                                    | 60         | 80                        |
| F     | 1, 11,                |               |                                                                                                 |                                       |          |          |                          |      |            |                                            |            |                           |
|       |                       |               | FILL: silty sand, some gravel, trace clay, loose, mois                                          | st, brown.                            |          |          |                          |      |            |                                            |            |                           |
| F     |                       |               |                                                                                                 |                                       |          |          |                          |      | :          |                                            |            |                           |
| ŀ     | -888                  |               |                                                                                                 | · · · · · · · · · · · · · · · · · · · |          |          |                          |      |            | ·<br>· · · · · · · · · · · · · · · · · · · |            |                           |
|       |                       |               | and olfactory, loose, moist to saturated, grey to blac                                          | content                               |          |          |                          |      | -          |                                            |            |                           |
| F     |                       |               |                                                                                                 |                                       |          |          |                          |      |            |                                            |            | •                         |
| 1     |                       |               |                                                                                                 |                                       |          |          |                          |      |            | ;                                          | ;          |                           |
|       |                       |               |                                                                                                 |                                       |          |          |                          |      |            |                                            |            |                           |
| -     |                       |               |                                                                                                 |                                       |          |          |                          |      |            |                                            |            |                           |
| -     | -1000                 |               |                                                                                                 |                                       |          |          |                          |      |            |                                            |            |                           |
|       |                       |               |                                                                                                 |                                       |          |          |                          |      |            |                                            |            |                           |
| Γ     |                       |               |                                                                                                 |                                       |          |          |                          |      |            |                                            | :          | :                         |
| F     |                       |               |                                                                                                 |                                       |          |          |                          |      | :          |                                            |            |                           |
| _ 2   |                       |               |                                                                                                 |                                       |          |          |                          |      |            |                                            |            |                           |
|       |                       |               |                                                                                                 |                                       |          |          |                          |      |            |                                            |            |                           |
| F     | -1000                 |               |                                                                                                 |                                       |          |          |                          |      |            |                                            |            |                           |
| -     |                       |               |                                                                                                 |                                       |          |          |                          |      |            |                                            |            |                           |
|       |                       |               |                                                                                                 |                                       |          |          |                          |      | :          |                                            |            |                           |
| -     |                       |               |                                                                                                 |                                       | $\nabla$ |          |                          |      |            |                                            |            |                           |
| -     | -1000                 |               |                                                                                                 |                                       |          |          |                          |      |            | ·<br>· · · · · · · · · ·                   |            |                           |
| 3     |                       |               |                                                                                                 |                                       |          |          |                          |      |            |                                            |            |                           |
|       |                       |               | End of test pit at 3.0 metres in unsuitable fill deposit                                        | ts.                                   |          |          |                          |      |            |                                            |            |                           |
| -     | -                     |               | Groundwater was observed at 2.7 metres below the                                                | e ground                              |          |          |                          |      |            |                                            |            |                           |
|       |                       |               | surface at the time of excavation.                                                              |                                       |          |          |                          |      |            |                                            |            |                           |
|       |                       |               |                                                                                                 |                                       |          |          |                          |      |            |                                            |            |                           |
| -     | -                     |               |                                                                                                 |                                       |          |          |                          |      |            |                                            |            |                           |
|       |                       |               |                                                                                                 |                                       |          |          |                          |      |            |                                            |            |                           |
|       |                       |               |                                                                                                 |                                       |          |          |                          |      |            |                                            |            |                           |
| 4     | 1                     |               |                                                                                                 |                                       |          |          |                          |      |            |                                            |            |                           |
| F     | 4                     |               |                                                                                                 |                                       |          |          |                          |      |            |                                            |            |                           |
|       |                       |               |                                                                                                 |                                       |          |          |                          |      |            |                                            |            |                           |
| F     | 1                     |               |                                                                                                 |                                       |          |          |                          |      |            |                                            |            |                           |
| F     | 4                     |               |                                                                                                 |                                       |          |          |                          |      |            |                                            |            |                           |
|       |                       |               |                                                                                                 |                                       |          |          |                          |      |            |                                            |            |                           |
| F     | 1                     |               |                                                                                                 |                                       |          |          |                          |      |            |                                            |            |                           |
| 5     |                       |               |                                                                                                 |                                       |          |          |                          |      |            |                                            |            |                           |

|            |                                        | 115          | WSP Canada Inc.<br>1 Spectacle Lake Drive<br>Dartmouth, NS B3B 1X7<br>Telephone: (902) 835-9955                 |                      |      |                                 | TES         | ST PIT N                              | UMB            | PAGE      | TP-02   |
|------------|----------------------------------------|--------------|-----------------------------------------------------------------------------------------------------------------|----------------------|------|---------------------------------|-------------|---------------------------------------|----------------|-----------|---------|
| CLIEN      | IT Ha                                  | alifax W     | ater                                                                                                            | PROJEC               | ΤN   | AME Fire                        | st Lakes Pu | mp Station                            |                |           |         |
| PROJ       | ECT N                                  | UMBER        | 201-11341                                                                                                       | PROJEC               | ΤL   | OCATION                         | Lower Sad   | ckville, NS                           |                |           |         |
| DATE       | STAR                                   | <b>TED</b> 1 | 8/12/20 COMPLETED 18/12/20                                                                                      | GROUND EL            | EV   | ATION                           |             | TEST PIT S                            | <b>SIZE</b> 1n | n x 3m    | approx. |
| EXCA       | VATIO                                  |              | <b>TRACTOR</b> TI Terra Construction                                                                            | GROUND WA            | ATE  | R LEVELS                        | <b>;</b> :  |                                       |                |           |         |
| EXCA       | VATIO                                  | N METH       | IOD _Mini-Excavator                                                                                             | _ $	extstyle AT TIN$ | /E ( | OF EXCAV                        | ATION 2.    | 10 m                                  |                |           |         |
| LOGG       | ED B                                   | / _J. St     | eeves CHECKED BY C. Rogers                                                                                      | AT EN                | DC   | OF EXCAV                        | ATION       |                                       |                |           |         |
| NOTE       | s_w                                    | eather:      | Cloudy, 2 degrees C                                                                                             | AFTER                | R E) | CAVATIO                         | N           |                                       |                |           |         |
|            |                                        | Z            |                                                                                                                 |                      | /EL  | PE/                             |             | 20                                    | SPT N VAL      | UE 🔺      | 80      |
| UTH (      | Ηg                                     | ATIC (       |                                                                                                                 |                      | Ē    | E<br>B<br>B<br>B<br>B<br>B<br>B | HER<br>STS  | PL                                    | MC             | 1         | _L      |
| DEF<br>DEF | LC                                     | l N L        | MATERIAL DESCRIPTION                                                                                            |                      | TER  | NPLE                            | 1ES<br>TES  | 20                                    | 40             | 60        | 80      |
|            |                                        |              |                                                                                                                 |                      | WA   | SAN                             |             |                                       | NES CONTE      | ENT (%) [ | ]       |
| <u> </u>   | <u>[<u>x</u>1,<u>x</u>], <u>x</u>1</u> |              | Grass / Topsoil                                                                                                 |                      |      |                                 |             | 20                                    | 40             | 60        | 80      |
| .          | 1, 1,                                  |              |                                                                                                                 |                      |      |                                 |             |                                       |                |           |         |
|            |                                        |              | FILL: sand and gravel, trace silt/clay, loose, moist, g                                                         | jrey.                |      |                                 |             |                                       |                |           |         |
|            |                                        |              |                                                                                                                 |                      |      |                                 |             | · · · · · · · · · · · · · · · · · · · |                |           |         |
|            |                                        |              | FILL: silty sand, some gravel, trace clay, high organ<br>and olfactory, loose, moist to saturated, grey to blac | ic content<br>k.     |      |                                 |             |                                       |                |           |         |
|            |                                        |              |                                                                                                                 |                      |      |                                 |             |                                       |                |           |         |
|            |                                        |              |                                                                                                                 |                      |      |                                 |             |                                       |                |           |         |
|            |                                        |              |                                                                                                                 |                      |      |                                 |             |                                       |                | :         |         |
|            |                                        |              |                                                                                                                 |                      |      |                                 |             |                                       |                |           |         |
|            |                                        |              |                                                                                                                 |                      |      |                                 |             |                                       |                | :         |         |
|            |                                        |              |                                                                                                                 |                      |      |                                 |             |                                       |                |           |         |
|            |                                        |              |                                                                                                                 |                      |      |                                 |             | · · · · · · · · · · · · · · · · · · · |                |           |         |
|            |                                        |              |                                                                                                                 |                      |      |                                 |             |                                       |                |           |         |
| 2          |                                        |              |                                                                                                                 |                      |      |                                 |             |                                       |                |           |         |
|            |                                        |              |                                                                                                                 |                      | Į    |                                 |             |                                       |                |           |         |
|            |                                        |              | saturated, brown.                                                                                               | t, wet to            | 4    | m GB<br>1                       |             | •                                     | C              | ]         |         |
|            |                                        | [            | End of test pit at 2.4 metres in unsuitable fill deposit                                                        | is.                  |      | ·                               |             |                                       |                |           |         |
|            |                                        |              | Groundwater was observed at 2.1 metres below the surface at the time of excavation.                             | ground               |      |                                 |             |                                       |                |           |         |
|            | 1                                      |              |                                                                                                                 |                      |      |                                 |             |                                       |                |           |         |
| 3          | -                                      |              |                                                                                                                 |                      |      |                                 |             |                                       |                |           |         |
|            |                                        |              |                                                                                                                 |                      |      |                                 |             |                                       |                |           |         |
| 2          |                                        |              |                                                                                                                 |                      |      |                                 |             |                                       |                |           |         |
|            | 1                                      |              |                                                                                                                 |                      |      |                                 |             |                                       |                |           |         |
|            | -                                      |              |                                                                                                                 |                      |      |                                 |             |                                       |                |           |         |
|            |                                        |              |                                                                                                                 |                      |      |                                 |             |                                       |                |           |         |
|            | 1                                      |              |                                                                                                                 |                      |      |                                 |             |                                       |                |           |         |
| - 4        | -                                      |              |                                                                                                                 |                      |      |                                 |             |                                       |                |           |         |
|            |                                        |              |                                                                                                                 |                      |      |                                 |             |                                       |                |           |         |
|            |                                        |              |                                                                                                                 |                      |      |                                 |             |                                       |                |           |         |
|            | 1                                      |              |                                                                                                                 |                      |      |                                 |             |                                       |                |           |         |
|            | -                                      |              |                                                                                                                 |                      |      |                                 |             |                                       |                |           |         |
|            |                                        |              |                                                                                                                 |                      |      |                                 |             |                                       |                |           |         |
|            |                                        |              |                                                                                                                 |                      |      |                                 |             |                                       |                |           |         |
| 5          |                                        |              |                                                                                                                 |                      |      |                                 |             |                                       |                |           |         |

201-11341 - First Lakes Pump Station Test Pits Photographic Log December 18, 2020

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# Mini Excavator

201-11341 - First Lakes Pump Station Test Pits Photographic Log December 18, 2020








TP-02 Excavation



# C LAB RESULTS (STANTEC)



#### **Stantec** STANTEC MATERIALS TESTING REPORT

| Client:  | WSP Canada          |
|----------|---------------------|
| Project: | First Lakes Station |
| Source:  | TP2-GB1 2.1 - 2.4m  |

|          | GRADING | 6               |
|----------|---------|-----------------|
| SAMPLE # | TP2-GB1 |                 |
| SIEVE    | %       | Gradation Spec. |
| (mm)     | PASSING |                 |
| 75.0     | 100.0   | -               |
| 50.0     | 100.0   | -               |
| 37.5     | 100.0   | -               |
| 25.0     | 100.0   | -               |
| 19.0     | 97.6    | -               |
| 16.0     | 97.6    | -               |
| 12.5     | 97.6    | -               |
| 9.5      | 97.5    | -               |
| 4.75     | 97.0    | -               |
| 2.36     | 96.1    | -               |
| 1.18     | 95.1    | -               |
| 0.600    | 93.7    | -               |
| 0.300    | 90.1    | -               |
| 0.150    | 67.7    | -               |
| 0.075    | 56.6    | -               |

|                | Project #:       | 121621777 |
|----------------|------------------|-----------|
|                | Task #:          | 500.534   |
| Material Type: | Geotech          |           |
| Date Received: | December 21,2020 |           |
| Date Tested:   | January 7,2021   |           |
|                |                  |           |

| PHYSICAL P                   | ROPERTY | TESTS         |
|------------------------------|---------|---------------|
| Sample Number                | TP2-GB1 | Specification |
| Gravel, %                    | 3.0     |               |
| Sand, %                      | 40.4    |               |
| Silt & Clay, %               | 56.6    |               |
| Natural Moisture Content, %  | 19.5    |               |
| Abrasion Loss, %             |         |               |
| Soundness Loss, %            |         |               |
| Micro Deval Loss, %          |         |               |
| Fine Absorption, %           |         |               |
| Flat & Elongated Particles,% |         |               |
| Coarse Absorption, %         |         |               |
| Coarse Spec. Gravity,        |         |               |
| Fractured Faces, %           |         |               |
| Liquid Limit, %              |         |               |
| Plastic Limit, %             |         |               |
| Plasticity Index, %          |         |               |
| Max. Dry Density: Standard   |         |               |
| Optimum Moisture Content %   |         |               |



Technician: HM

Reviewed By: S. Aldous



# D LAB RESULTS (AGAT)

Available Metals in Soil First Lakes Pump Station Test Pits Project No.: 201-11341 TABLE 1

|   | samples                |                   |                    |          |          |         |        |           |         |       |         |                  |        |        |       |       |         |           |         |            |        |          |          |        |           |          |       |         |          |       |
|---|------------------------|-------------------|--------------------|----------|----------|---------|--------|-----------|---------|-------|---------|------------------|--------|--------|-------|-------|---------|-----------|---------|------------|--------|----------|----------|--------|-----------|----------|-------|---------|----------|-------|
|   | SOILS                  |                   |                    |          |          |         |        |           |         |       |         |                  |        |        |       |       |         |           |         |            |        |          |          |        |           |          |       |         |          |       |
|   |                        |                   |                    |          |          |         |        |           |         |       |         |                  |        |        |       |       |         |           |         |            |        |          |          |        |           |          |       |         |          |       |
|   |                        | TP-02<br>-        | 0.75m<br>18-Dec-20 | 10600    | Ý        | 2       | 47     | <2        |         | 3     | <0.3    | 16               | 6      | 18     | 18000 | 9.8   | 23      | 289       |         | <2         | 21     |          | <1<br><  | <0.5   | 2         | <0.1     | 3     | 1.3     | 19       | 47    |
|   |                        | TP-01<br>-        | 0.6m<br>18-Dec-20  | 10600    | Ŷ        | 6       | 52     | <2        |         | 2     | <0.3    | 18               | 10     | 20     | 18800 | 30.7  | 23      | 482       | -       | <2         | 38     | -        | <4       | <0.5   | 2         | <0.1     | 3     | 0.7     | 24       | 54    |
| : | Guideline <sup>1</sup> | NSE<br>Tier 1 EQS | Commercial         | 15400    | 63       | 31      | 15000  | 320       | ,       | 24000 | 49      | 630              | 250    | 4000   | 11000 | 260   |         |           | 24      | 1200       | 2200   |          | 125      | 490    | 9400      | 1        | 9400  | 33      | 160      | 47000 |
|   |                        | RDL               |                    | 10       | 2        | 2       | 5      | 2         |         | 5     | 0.3     | 2                | 1      | 2      | 50    | 0.5   | 5       | 2         |         | 2          | 2      |          | ٢        | 0.5    | 5         | 0.1      | 2     | 0.1     | 2        | 5     |
|   |                        | Units             |                    | mg/kg    | mg/kg    | mg/kg   | mg/kg  | mg/kg     | mg/kg   | mg/kg | mg/kg   | mg/kg            | mg/kg  | mg/kg  | mg/kg | mg/kg | mg/kg   | mg/kg     | mg/kg   | mg/kg      | mg/kg  | mg/kg    | mg/kg    | mg/kg  | mg/kg     | mg/kg    | mg/kg | mg/kg   | mg/kg    | mg/kg |
|   |                        | Parameter         |                    | Aluminum | Antimony | Arsenic | Barium | Beryllium | Bismuth | Boron | Cadmium | Chromium (total) | Cobalt | Copper | Iron  | Lead  | Lithium | Manganese | Mercury | Molybdenum | Nickel | Rubidium | Selenium | Silver | Strontium | Thallium | Tin   | Uranium | Vanadium | Zinc  |

<sup>1</sup> Nova Scotia Environment (NSE) Tier 1 Environmental Quality Standards (EQS) - updated July 6, 2013

shading denotes a guideline exceedance denotes laboratory reported detection limit

Notes:

denotes no value/not analysed RDL ,

WSP Sample ID Sampling date Sample Details TP-01 18-Dec-20 -0.6m Land Use = Commercial Groundwater Use = Non-Potable Exposure Pathway = All Soil Type = Coarse Tier 1 EQS **Guideline Details** 

Laboratory Sample ID Sample depth/interval in metres below grade surface

dsm

## Petroleum Hydrocarbons in Soil First Lakes Pump Station Project No.: 201-11341 **TABLE 2**

| I Dect N | 1-1070 |                        |           |           |  |              |  | • |
|----------|--------|------------------------|-----------|-----------|--|--------------|--|---|
|          |        | Guideline <sup>1</sup> |           |           |  | Soil Samples |  |   |
|          |        | NSE                    | TP-01     | TP-02     |  |              |  |   |
| nite     |        | Tier 1 EQS             | •         | •         |  |              |  |   |
| 5        | Z      | Commercial             | 0.6m      | 0.75m     |  |              |  |   |
|          |        |                        | 18-Dec-20 | 18-Dec-20 |  |              |  |   |
|          |        | Non-Potable            | ×         | ×         |  |              |  |   |
| mg/kg    | 0.025  | 2.5                    | <0.03     | <0.03     |  |              |  |   |
| mg/kg    | 0.05   | 1 0000                 | 0.32      | 0.28      |  |              |  |   |
| mg/kg    | 0.025  | 1 0000                 | <0.03     | <0.03     |  |              |  |   |
| mg/kg    | 0.05   | 110                    | <0.05     | <0.05     |  |              |  |   |
| mg/kg    | 2.5    | 1                      | 33        | <3        |  |              |  |   |
| mg/kg    | 10     |                        | <15       | <15       |  |              |  |   |
| mg/kg    | 10     |                        | <15       | <15       |  |              |  |   |
| mg/kg    | 15     |                        | <15       | 19        |  |              |  |   |
|          |        | G 870                  |           |           |  |              |  |   |
| mg/kg    | 15     | FO 4000                | <20       | <20       |  |              |  |   |

Return to Baseline at C32 (Y/N) Notes:

Laboratory Comments

Fuel Type<sup>3</sup>

<sup>1</sup> Nova Scotia Environment (NSE) Tier 1 Environmental Quality Standards (EQS) - updated July 6, 2013

Yes

Yes Yes

Yes

ГO

10000

2

mg/kg

Modified TPH<sup>2</sup>

>C10-C16 >C16-C21

>C21-C32

Ethylbenzene Xylenes

Toluene Benzene

C6-C10

Parameter

<sup>2</sup> Modified TPH = Total Petroleum Hydrocarbons less BTEX [Benzene, Toluene, Ethylbenzene, Xylenes]
<sup>3</sup> Euel Type selected based on laboratory comments and % distribution of hydrocarbon ranges; G = Gas, FO = Fuel Oil, LO = Lube Oil

shading denotes a guideline exceedance

denotes laboratory reported detection limit RDL

denotes no value/not analysed ,

| Guideline Details                        | Sample Details |                                                     |
|------------------------------------------|----------------|-----------------------------------------------------|
| Tier 1 - Environmental Quality Standards | TP-01          | WSP Sample ID                                       |
| Land Use = Commercial                    |                | Laboratory Sample ID                                |
| Groundwater Use = Non-Potable            | 0.6m           | Sample depth/interval in metres below grade surface |
| Exposure Pathway = All                   | 18-Dec-20      | Sampling date                                       |
| Soil Type = Coarse                       | XX             | VOC Reading (ppm)                                   |

## 

Polycyclic Aromatic Hydrocarbons (PAHs) in Soil First Lakes Pump Station Test Pits Project No.: 201-11341

**TABLE 3** 

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dsw

| Farment         Int         Text ISS<br>Interiors         Text ISS Interiors         < |                         |          | _    | Guideline   |                   |                    | 00        |       |      |      |      |      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|----------|------|-------------|-------------------|--------------------|-----------|-------|------|------|------|------|
| Famemer         Uns         Optimized         Unstantiation         Unstantion <thunstantion< th=""> <thunsta< th=""><th></th><th></th><th></th><th>NSE</th><th>TP-01</th><th>TP-02</th><th></th><th></th><th></th><th></th><th></th><th></th></thunsta<></thunstantion<>                                                        |                         |          |      | NSE         | TP-01             | TP-02              |           |       |      |      |      |      |
| Terrent         Terrent         Commercial         0.07m         0.7m         0.7m <th>a chomore</th> <th>- Invite</th> <th></th> <th>Tier I EQS</th> <th></th> <th>,</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>                                                                                                                                                                                                                                                                                                     | a chomore               | - Invite |      | Tier I EQS  |                   | ,                  |           |       |      |      |      |      |
| $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | rarameter               |          | J.   | Commercial  | 0.6m<br>18-Dec-20 | 0.75m<br>18-Dec-20 |           |       |      |      |      |      |
| Administration         mg/g         0.01         560         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01                                                                                                                                                                                                                                                                                                                                                                                                                             |                         |          |      | Non-Potable |                   | ,                  |           |       |      |      |      |      |
| Anderthanten         mg/g         0.01         560         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01         -0.01                                                                                                                                                                                                                                                                                                                                                                                                                               | 1-Methylnaphthalene     | mg/kg    | 0.01 | 560         | <0.01             | <0.01              |           |       |      |      |      |      |
| Accomplythere         mg/g         0.01         6000/1         -0.0071         -0.0071         -0.0071         -0.0071         -0.0071         -0.0071         -0.0074         -0.0074         -0.0074         -0.0074         -0.0074         -0.0074         -0.0074         -0.0074         -0.0074         -0.0074         -0.0074         -0.0074         -0.0074         -0.0074         -0.0074         -0.0074         -0.0074         -0.0074         -0.0074         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.017         -0.                                                                                                                                                                                                                                                                                                                                                                             | 2-Methylnaphthalene     | mg/kg    | 0.01 | 560         | <0.01             | <0.01              |           |       |      |      |      |      |
| deciditatione         mg/g         0.01         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004         5004                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Acenaphthene            | mg/kg    | 0.01 | 8000        | <0.00671          | <0.00671           |           |       |      |      |      |      |
| Anticine         mg/g         0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Acenaphthylene          | mg/kg    | 0.01 | 66          | <0.004            | <0.004             |           |       |      |      |      |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Acridine                | mg/kg    | 0.01 |             | <0.01             | <0.01              |           | -     |      |      |      |      |
| Benzcialpanteneret         mgkg         0.01         · · · · · · · · · · · · · · · · · · ·                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Anthracene              | mg/kg    | 0.01 | 37000       | <0.01             | <0.01              |           |       |      |      |      |      |
| Berzolajorent         mgva         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         ···         0.01         0.01         0.01         0.01         0.01         0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Benzo(a)anthracene*     | mg/kg    | 0.01 |             | 0.02              | <0.01              |           |       |      |      |      |      |
| Berzo(b)turanthene*         mg/g         0.01         ·         0.04         0.01         ·         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0 </td <td>Benzo(a)pyrene*</td> <td>mg/kg</td> <td>0.01</td> <td></td> <td>0.01</td> <td>&lt;0.01</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>                                                                                                                                                                                                                                                                                                                                                                                                                         | Benzo(a)pyrene*         | mg/kg    | 0.01 |             | 0.01              | <0.01              |           |       |      |      |      |      |
| Berzolchylthorathene*         mg/g         0.01         ···         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Benzo(b)fluoranthene*   | mg/kg    | 0.01 |             | 0.04              | <0.01              |           | -     |      |      |      |      |
| Barzo(c)pyrene         mg/kg         0.01         · · · · · · · · · · · · · · · · · · ·                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Benzo(b+j)fluoranthene* | mg/kg    | 0.01 |             |                   |                    |           |       |      |      |      |      |
| Benzolghilpenylene*         mg/g         0.01         · · · · ·         0.02         < · · · · ·         0.01         · · · ·         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0     <                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Benzo(e)pyrene          | mg/kg    | 0.01 |             | 0.02              | <0.01              |           |       |      |      |      |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Benzo(g,h,i)perylene*   | mg/kg    | 0.01 |             | 0.02              | <0.01              |           |       |      |      |      |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Benzo(k)fluoranthene    | mg/kg    | 0.01 |             |                   |                    |           |       |      |      |      |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Chrysene*               | mg/kg    | 0.01 |             | 0.03              | <0.01              |           |       |      |      |      |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Dibenzo(a,h)anthracene* | mg/kg    | 0.01 |             | <0.006            | <0.006             |           |       |      |      |      |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Fluoranthene            | mg/kg    | 0.01 | 5300        | 0.04              | <0.01              |           |       |      |      |      |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Fluorene                | mg/kg    | 0.01 | 4100        | <0.01             | <0.01              |           |       |      |      |      |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Indeno(1,2,3)pyrene*    | mg/kg    | 0.01 |             | 0.02              | <0.01              |           |       |      |      |      |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Naphthalene             | mg/kg    | 0.01 | 25          | <0.01             | <0.01              |           |       |      |      |      |      |
| $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Perylene                | mg/kg    | 0.01 |             | 0.01              | <0.01              |           |       |      |      |      |      |
| Pyrene         mg/kg         0.01         3200         0.04 $< 0.01$ $< 30.01$ $< 30.01$ $< 30.01$ $< 0.01$ $< 0.01$ $< 0.01$ $< 0.01$ $< 0.01$ $< 0.01$ $< 0.01$ $< 0.01$ $< 0.01$ $< 0.01$ $< 0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.00$ $0.0$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Phenanthrene            | mg/kg    | 0.01 |             | 0.01              | <0.01              |           |       |      |      |      |      |
| $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Pyrene                  | mg/kg    | 0.01 | 3200        | 0.04              | <0.01              |           |       |      |      |      |      |
| $ \begin{array}{c c c c c c c c c c c c c c c c c c c $                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Quinoline               | mg/kg    | 0.01 |             | <0.01             | <0.01              |           |       |      |      |      |      |
| B[a]P TPE <sup>3</sup> mg/kg         -         5.3         0.02         0.01         0.01         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Total PAHs <sup>2</sup> | mg/kg    |      | 50          | 0.31              | 0.11               | <br>0.00  | 0.00  | 0.00 | 0.00 | 0.00 | 0.00 |
| ACR <sup>4</sup> - 1 - 1 0.13 0.06 0.00 0.00 0.00 0.00 0.00 0.00 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | B[a]P TPE <sup>3</sup>  | mg/kg    |      | 5.3         | 0.02              | 0.01               | <br>00.00 | 00.0  | 00.0 | 0.00 | 0.00 | 0.00 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | IACR <sup>4</sup>       |          |      |             | 0.13              | 0.06               | 00.00     | 00.00 | 00.0 | 0.00 | 0.00 | 0.00 |

Notes:

1 Nova Scotia Environment (NSE) Tier 1 Environmental Quality Standards (EQS) OR Tier 2 Pathway Specific Standards (PSS) - updated July 6, 2013

<sup>2</sup> Nova Scotia Environment, Guidelines for Disposal of Contaminated Soils in Landfills, May 2005. For all calculations, 1/2 of the detection limit was used for "non-detect" parameters

<sup>3</sup> Benzo(alpyrene Total Potency Equivalents which is the sum of estimated cancer potency relative to B[a]P for all potentially carcinogenic unsubstituted PAHs

Guldeline value is based in a incremental lifetime cancer risk (ILCR) of 1 in 100,000 (10 <sup>5</sup>) <sup>4</sup> Index of Additive Cancer Risk (IACR) calculated to protect potable water resources. Target hazard index = 1. <sup>8</sup> RDL denotes laboratory reported detection limit

denotes no value/not analysed

denotes potentially carcinogenic PAH compound · \*

Guideline Details

| Tier 1 - Environmental Quality Standards | 10-01     | WSP Sample ID                                       |
|------------------------------------------|-----------|-----------------------------------------------------|
| Land Use = Commercial                    |           | Laboratory Sample ID                                |
| Groundwater Use = Non-Potable            | 0.6m      | Sample depth/interval in metres below grade surface |
| Exposure Pathway = All                   | 18-Dec-20 | Sampling date                                       |
| Soil Type = Coarse                       |           |                                                     |



#### CLIENT NAME: WSP CANADA INC. 1 SPECTACLE LAKE DRIVE DARTMOUTH , NS B3B1X7 (902) 835-9955 ATTENTION TO: Jonathan Steeves PROJECT: 201-11341 First Lakes PS AGAT WORK ORDER: 20X692480 SOIL ANALYSIS REVIEWED BY: Marta Manka, Data Reporter TRACE ORGANICS REVIEWED BY: James MacDonald, Technical Services Manager DATE REPORTED: Dec 30, 2020 PAGES (INCLUDING COVER): 14 VERSION\*: 1

Should you require any information regarding this analysis please contact your client services representative at (902) 468-8718

\*Notes

Disclaimer:

- All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may
  incorporate modifications from the specified reference methods to improve performance.
- All samples will be disposed of within 30 days following analysis, unless expressly agreed otherwise in writing. Please contact your Client Project Manager if you require additional sample storage time.
- AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.
- This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
- The test results reported herewith relate only to the samples as received by the laboratory.
- Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of
  merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines
  contained in this document.
- All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.

**AGAT** Laboratories (V1)

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| Environmental Services Association of Alberta (ESAA)                          |

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AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation. Measurement Uncertainty is not taken into consideration when stating conformity with a specified requirement.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               |                                       |          | 0                   | Certificate of Analysis                                       | 11 Morris Drive, Unit 122<br>Dartmouth, Nova Scotia      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------|----------|---------------------|---------------------------------------------------------------|----------------------------------------------------------|
| シタピ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |               | Laborat                               | tories   | Ă E                 | GAT WORK ORDER: 20X692480<br>ROJECT: 201-11341 First Lakes PS | CANADA B3B 1M2<br>TEL (902)468-8718<br>FAX (902)468-8924 |
| CLIENT NAME: WSP CANADA I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | NC.           |                                       |          |                     | ATTENTION TO: Jonathan Steeves                                | http://www.agatlabs.com                                  |
| SAMPLING SITE:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |                                       |          |                     | SAMPLED BY:                                                   |                                                          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               |                                       |          | Av                  | ailable Metals in Soil                                        |                                                          |
| DATE RECEIVED: 2020-12-18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               |                                       |          |                     | DATE REPORTEI                                                 | ): 2020-12-30                                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | SA            | MPLE DESCRIP                          | TION:    | TP-01               | TP-02                                                         |                                                          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               | SAMPLE                                | ΓΥΡΕ:    | Soil                | Soil                                                          |                                                          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               | DATE SAMF                             | CED:     | 2020-12-18<br>12:00 | 2020-12-18<br>12:00                                           |                                                          |
| Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Unit          | G/S R                                 | DL       | 1856134             | 1856136                                                       |                                                          |
| Aluminum                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | mg/kg         |                                       | 10       | 10600               | 10600                                                         |                                                          |
| Antimony                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | mg/kg         |                                       | +        | Ŷ                   | √                                                             |                                                          |
| Arsenic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | mg/kg         |                                       | -        | 0                   | 7                                                             |                                                          |
| Barium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | mg/kg         |                                       | 5        | 52                  | 47                                                            |                                                          |
| Beryllium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | mg/kg         |                                       | 2        | 42                  | <2                                                            |                                                          |
| Boron                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | mg/kg         |                                       | 2        | 2                   | 3                                                             |                                                          |
| Cadmium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | mg/kg         | 0                                     | 0.3      | <0.3                | <0.3                                                          |                                                          |
| Chromium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | mg/kg         |                                       | 2        | 18                  | 16                                                            |                                                          |
| Cobalt                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | mg/kg         |                                       | -        | 10                  | 6                                                             |                                                          |
| Copper                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | mg/kg         |                                       | 2        | 20                  | 18                                                            |                                                          |
| Iron                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | mg/kg         |                                       | 50       | 18800               | 18000                                                         |                                                          |
| Lead                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | mg/kg         | 0                                     | ).5      | 30.7                | 9.8                                                           |                                                          |
| Lithium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | mg/kg         |                                       | 5        | 23                  | 23                                                            |                                                          |
| Manganese                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | mg/kg         |                                       | 2        | 482                 | 289                                                           |                                                          |
| Molybdenum                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | mg/kg         |                                       | 2        | 42                  | <2                                                            |                                                          |
| Nickel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | mg/kg         |                                       | 2        | 38                  | 21                                                            |                                                          |
| Selenium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | mg/kg         |                                       | -        | Ŷ                   | Ŷ                                                             |                                                          |
| Silver                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | mg/kg         | 0                                     | ).5      | <0.5                | <0.5                                                          |                                                          |
| Strontium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | mg/kg         |                                       | 5        | 7                   | 7                                                             |                                                          |
| Thallium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | mg/kg         | 0                                     | 0.1      | <0.1                | <0.1                                                          |                                                          |
| Tin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | mg/kg         |                                       | 2        | ი                   | ę                                                             |                                                          |
| Uranium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | mg/kg         | 0                                     | 0.1      | 0.7                 | 1.3                                                           |                                                          |
| Vanadium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | mg/kg         |                                       | 2        | 24                  | 19                                                            |                                                          |
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| Comments:         RDL - Reported Detection           1856134-1856136         Results are based on a series of the ser | tion Limit; 0 | 3 / S - Guideline /<br>of the sample. | Standard |                     |                                                               |                                                          |
| Analysis performed at AGAT Halifax (unle                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | ss marked by  | (*                                    |          |                     |                                                               |                                                          |
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Certified By:

Marta Manta 

**AGAT** CERTIFICATE OF ANALYSIS (V1)

Results relate only to the items tested. Results apply to samples as received.

Page 2 of 14

| Laboratories |
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# **Certificate of Analysis**

AGAT WORK ORDER: 20X692480 PROJECT: 201-11341 First Lakes PS **ATTENTION TO: Jonathan Steeves** 

SAMPLED BY:

11 Morris Drive, Unit 122 Dartmouth, Nova Scotia CANADA B3B 1/M2 TEL (902)468-8718 FAX (902)468-8924 http://www.agatlabs.com

# CLIENT NAME: WSP CANADA INC.

SAMPLING SITE:

# Atlantic RBCA Tier 1 Hvdrocarhons in Soil (Version 3.1) - Field Preserved

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Ska<br>ng/kg<br>ng/kg<br>ng/kg<br>ng/kg<br>ng/kg<br>ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg<br>Ng/kg | SAMPLE DESC<br>SAMP<br>SAMP<br>BATE S<br>DATE S<br>DATE S<br>DATE S<br>SAMP<br>SAMP<br>SAMP<br>SAMP<br>SAMP<br>SAMP<br>SAMP<br>SAM | SAMPLE DESCRIPTION:<br>SAMPLE TYPE:<br>DATE SAMPLE TYPE:<br>DATE SAMPLED:           Unit         G/S         RDL           ng/kg         0.03         0.03           ng/kg         0.03         15           ng/kg         15         3           ng/kg         20         15           ng/kg         15         16           ng/kg         15         15           ng/kg         15         16           ng/kg         60-140         20           %         60-140         60-140 | SAMPLE DESCRIPTION:         TP-01           SAMPLE DESCRIPTION:         SAMPLE TYPE:         Soil           SAMPLE TYPE:         SAMPLE TYPE:         Soil           SAMPLE TYPE:         SAMPLE TYPE:         Soil           DATE SAMPLE:         SAMPLE TYPE:         Soil           ng/kg         C)         12:00           ng/kg         0.03         0.03         12:00           ng/kg         0.03         0.03         0.03           ng/kg         0.04         0.320         12:00           ng/kg         15         <15 | ID           SAMPLE DESCRIPTION:         TP-01         TP-02           SAMPLE TYPE:         Soul         Soul         Soul           DATE SAMPLE:         Soul         Soul         Soul           DATE SAMPLE:         Soul         Soul         Soul         Soul           DATE SAMPLE:         Soul         Soul         Soul         Soul           DATE SAMPLE:         2020-12-18         Soul         Soul         Soul           DATE SAMPLE:         2020-12-18         Soul         Soul         Soul           DATE SAMPLE:         2020-12-18         2020-12-18         Soul         Soul           DATE SAMPLE:         2020-12-18         2020-12-18         2020-12-18         Soul           DATE SAMPLE:         2020-12-18         212:00         12:00         12:00           DAGE OU         0.03         0.03         0.03         0.03         0.03           DAGE OU         15         <15 |

Certified By:

|                                                                                                                                                                                                                                                                                                                                                                                      | Certificate of Analysis                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| Laboratories                                                                                                                                                                                                                                                                                                                                                                         | AGAT WORK ORDER: 20X692480<br>PROJECT: 201-11341 First Lakes PS                                                   |
| CLIENT NAME: WSP CANADA INC.<br>SAMPLING SITE·                                                                                                                                                                                                                                                                                                                                       | ATTENTION TO: Jonathan Steeves<br>SAMDI ED RV·                                                                    |
| Atlantic RBCA Tier 1 I                                                                                                                                                                                                                                                                                                                                                               | vdrocarbons in Soil (Version 3.1) - Field Preserved                                                               |
| DATE RECEIVED: 2020-12-18                                                                                                                                                                                                                                                                                                                                                            | DATE REPORTED: 2020-12-30                                                                                         |
| Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard<br>1856134-1856136 Modified TPH, Xylene(Total)and C6-C10(less BTEX) are calculated p<br>Results are based on the drv weight of the soil                                                                                                                                                                       | rameters. The calculated parameter is non-accredited. The component parameters of the calculation are accredited. |
| Resemblance Comment Key:<br>GF - Gasoline Fraction<br>WGF - Weathered Gasoline Fraction<br>GR - Product in Gasoline Range<br>FOF - Fuel Oil Fraction<br>WFOF - Weathered Fuel Oil Fraction<br>FR - Product in Fuel Oil Braction<br>EOF - Lube Oil Fraction<br>LA - Lube Oil Fraction<br>LR - Lube Range<br>UC - Unidentified Compounds<br>NR - No Resemblance<br>NA - Not Applicable |                                                                                                                   |
| Analysis performed at AGAT Halifax (unless marked by *)                                                                                                                                                                                                                                                                                                                              |                                                                                                                   |
|                                                                                                                                                                                                                                                                                                                                                                                      | Certified By:                                                                                                     |

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|                                                  | <b>G</b> ( <b>1</b> )                            | Laboratori          | Se                  | Certificate of Analysis<br>AGAT WORK ORDER: 20X692480<br>PROJECT: 201-11341 First Lakes PS | 11 Morris Drive, Unit 122<br>Dartmouth, Nova Scotia<br>CANADA B3B 1M2<br>TEL (902)468-8718<br>FAX (902)468-8924 |
|--------------------------------------------------|--------------------------------------------------|---------------------|---------------------|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| CLIENT NAME: WSP (                               | SANADA INC.                                      |                     |                     | ATTENTION TO: Jonathan Steev                                                               | Nutp://www.agauabs.com<br>VeS                                                                                   |
| SAMPLING SITE:                                   |                                                  |                     |                     | SAMPLED BY:                                                                                |                                                                                                                 |
|                                                  |                                                  |                     |                     | Moisture                                                                                   |                                                                                                                 |
| DATE RECEIVED: 2020-                             | 12-18                                            |                     |                     | DATE REPO                                                                                  | ORTED: 2020-12-30                                                                                               |
|                                                  |                                                  | SAMPLE DESCRIPTION: | TP-01               | TP-02                                                                                      |                                                                                                                 |
|                                                  |                                                  | SAMPLE TYPE:        | Soil                | Soil                                                                                       |                                                                                                                 |
|                                                  |                                                  | DATE SAMPLED:       | 2020-12-18<br>12:00 | 2020-12-18<br>12:00                                                                        |                                                                                                                 |
| Parameter                                        | Unit                                             | G/S RDL             | 1856134             | 1856136                                                                                    |                                                                                                                 |
| % Moisture                                       | %                                                | 0.0                 | 10                  | 12                                                                                         |                                                                                                                 |
| Comments: KUL - Ke<br>Analysis performed at AGAT | pored Detection Limit,<br>Halifax (unless marked | ы v - сидеше vanc   | ad                  |                                                                                            |                                                                                                                 |
|                                                  |                                                  |                     |                     |                                                                                            |                                                                                                                 |
|                                                  |                                                  |                     |                     |                                                                                            |                                                                                                                 |
|                                                  |                                                  |                     |                     |                                                                                            |                                                                                                                 |
|                                                  |                                                  |                     |                     |                                                                                            |                                                                                                                 |
|                                                  |                                                  |                     |                     |                                                                                            |                                                                                                                 |
|                                                  |                                                  |                     |                     |                                                                                            |                                                                                                                 |
|                                                  |                                                  |                     |                     |                                                                                            |                                                                                                                 |

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**AGAT** CERTIFICATE OF ANALYSIS (V1)

|                           |       |                |       | ບ<br>               | ertificate of Analvsis                                        | 11 Morris Drive, Unit 122<br>Dartmouth, Nova Scotia      |
|---------------------------|-------|----------------|-------|---------------------|---------------------------------------------------------------|----------------------------------------------------------|
|                           |       | Laborat        | ories | AC                  | AT WORK ORDER: 20X692480<br>0.IFCT · 201-11341 First Lakes PS | CANADA B3B 1M2<br>TEL (902)468-8718<br>FAX (902)468-8924 |
| CLIENT NAME: WSP CANADA   | NC.   |                |       |                     | ATTENTION TO: Jonathan Steeves                                | http://www.agatlabs.com                                  |
| SAMPLING SITE:            |       |                |       |                     | SAMPLED BY:                                                   |                                                          |
|                           |       |                | Pol   | ycyclic A           | omatic Hydrocarbons in Soil                                   |                                                          |
| DATE RECEIVED: 2020-12-18 |       |                |       |                     | DATE REPORTED: 2020-1                                         | 12-30                                                    |
|                           | 0     | AMPLE DESCRIPT | TION: | TP-01               | TP-02                                                         |                                                          |
|                           |       | SAMPLE T       | 'YPE: | Soil                | Soil                                                          |                                                          |
|                           |       | DATE SAMP      | LED:  | :020-12-18<br>12:00 | 2020-12-18<br>12:00                                           |                                                          |
| Parameter                 | Unit  | G/S RI         | DL    | 1856134             | 1856136                                                       |                                                          |
| 1-Methylnaphthalene       | mg/kg | 0.             | 05    | <0.01               | <0.01                                                         |                                                          |
| 2-Methylnaphthalene       | mg/kg | 0.             | 01    | <0.01               | <0.01                                                         |                                                          |
| Acenaphthene              | mg/kg | 0.00           | 0671  | <0.00671            | <0.00671                                                      |                                                          |
| Acenaphthylene            | mg/kg | 0.0            | 004   | <0.004              | <0.004                                                        |                                                          |
| Acridine                  | mg/kg | 0.0            | 05    | <0.01               | <0.01                                                         |                                                          |
| Anthracene                | mg/kg | 0.0            | 03    | <0.01               | <0.01                                                         |                                                          |
| Benzo(a)anthracene        | mg/kg | 0.0            | 01    | 0.02                | <0.01                                                         |                                                          |
| Benzo(a)pyrene            | mg/kg | 0.             | 01    | 0.01                | <0.01                                                         |                                                          |
| Benzo(b)fluoranthene      | mg/kg | 0.             | 05    | 0.04                | <0.01                                                         |                                                          |
| Benzo(j+k)fluoranthene    | mg/kg | 0.             | 05    | <0.01               | <0.01                                                         |                                                          |
| Benzo(e)pyrene            | mg/kg | 0.             | 05    | 0.02                | <0.01                                                         |                                                          |
| Benzo(ghi)perylene        | mg/kg | 0.             | 01    | 0.02                | <0.01                                                         |                                                          |
| Chrysene                  | mg/kg | 0.             | 01    | 0.03                | <0.01                                                         |                                                          |
| Dibenzo(a,h)anthracene    | mg/kg | 0.0            | 006   | <0.006              | <0.006                                                        |                                                          |
| Fluoranthene              | mg/kg | 0.             | 05    | 0.04                | <0.01                                                         |                                                          |
| Fluorene                  | mg/kg | 0.             | 01    | <0.01               | <0.01                                                         |                                                          |
| Indeno(1,2,3)pyrene       | mg/kg | .0             | 01    | 0.02                | <0.01                                                         |                                                          |
| Naphthalene               | mg/kg | .0.            | 01    | <0.01               | <0.01                                                         |                                                          |
| Perylene                  | mg/kg | .0             | 05    | 0.01                | <0.01                                                         |                                                          |
| Phenanthrene              | mg/kg | 0.             | 03    | 0.01                | <0.01                                                         |                                                          |
| Pyrene                    | mg/kg | .0             | 05    | 0.04                | <0.01                                                         |                                                          |
| Quinoline                 | mg/kg | 0.             | 05    | <0.01               | <0.01                                                         |                                                          |
| Surrogate                 | Unit  | Acceptable Lin | nits  |                     |                                                               |                                                          |
| Naphthalene-d8            | %     | 50-140         |       | 79                  | 78                                                            |                                                          |
| Terphenyl-d14             | %     | 50-140         |       | 80                  | 78                                                            |                                                          |
| Pyrene-d10 (%)            | %     | 50-140         |       | 78                  | 78                                                            |                                                          |
|                           |       |                |       |                     |                                                               |                                                          |
|                           |       |                |       |                     |                                                               |                                                          |

Results relate only to the items tested. Results apply to samples as received.

**AGAT** CERTIFICATE OF ANALYSIS (V1)

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**AGAT** CERTIFICATE OF ANALYSIS (V1)

Results relate only to the items tested. Results apply to samples as received.



#### **Quality Assurance**

#### CLIENT NAME: WSP CANADA INC.

#### PROJECT: 201-11341 First Lakes PS

SAMPLING SITE:

AGAT WORK ORDER: 20X692480 ATTENTION TO: Jonathan Steeves

#### SAMPLED BY:

|                          |         |        |        | Soi     | l Ana | alysi           | 5        |             |                |          |       |                |          |             |                |
|--------------------------|---------|--------|--------|---------|-------|-----------------|----------|-------------|----------------|----------|-------|----------------|----------|-------------|----------------|
| RPT Date: Dec 30, 2020   |         |        |        | UPLICAT | E     |                 | REFERE   | NCE MA      | TERIAL         | METHOD   | BLAN  |                | MAT      | RIX SPI     | IKE            |
| PARAMETER                | Batch   | Sample | Dup #1 | Dup #2  | RPD   | Method<br>Blank | Measured | Acce<br>Lir | ptable<br>nits | Recovery | Acce  | ptable<br>nits | Recovery | Acce<br>Lir | ptable<br>nits |
|                          |         | Ia     |        |         |       |                 | value    | Lower       | Upper          |          | Lower | Upper          |          | Lower       | Upper          |
| Available Metals in Soil |         |        |        |         |       |                 |          |             |                |          |       |                |          |             |                |
| Aluminum                 | 1835688 |        | 13600  | 16400   | 18.6% | < 10            | 95%      | 80%         | 120%           | 108%     | 80%   | 120%           | NA       | 70%         | 130%           |
| Antimony                 | 1835688 |        | <1     | <1      | NA    | < 1             | 80%      | 80%         | 120%           | 120%     | 80%   | 120%           | NA       | 70%         | 130%           |
| Arsenic                  | 1835688 |        | 7      | 6       | 16.0% | < 1             | 85%      | 80%         | 120%           | 97%      | 80%   | 120%           | NA       | 70%         | 130%           |
| Barium                   | 1835688 |        | 38     | 29      | 24.2% | < 5             | 85%      | 80%         | 120%           | 96%      | 80%   | 120%           | NA       | 70%         | 130%           |
| Beryllium                | 1835688 |        | <2     | <2      | NA    | < 2             | 84%      | 80%         | 120%           | 105%     | 80%   | 120%           | 95%      | 70%         | 130%           |
| Boron                    | 1835688 |        | 4      | 3       | NA    | < 2             | 88%      | 80%         | 120%           | 105%     | 80%   | 120%           | 83%      | 70%         | 130%           |
| Cadmium                  | 1835688 |        | <0.3   | <0.3    | NA    | < 0.3           | 86%      | 80%         | 120%           | 97%      | 80%   | 120%           | 94%      | 70%         | 130%           |
| Chromium                 | 1835688 |        | 23     | 19      | 18.2% | < 2             | 84%      | 80%         | 120%           | 96%      | 80%   | 120%           | NA       | 70%         | 130%           |
| Cobalt                   | 1835688 |        | 18     | 15      | 17.7% | < 1             | 85%      | 80%         | 120%           | 97%      | 80%   | 120%           | NA       | 70%         | 130%           |
| Copper                   | 1835688 |        | 10     | 9       | NA    | < 2             | 88%      | 80%         | 120%           | 100%     | 80%   | 120%           | 111%     | 70%         | 130%           |
| Iron                     | 1835688 |        | 22700  | 26600   | 16.0% | < 50            | 93%      | 80%         | 120%           | 96%      | 80%   | 120%           | NA       | 70%         | 130%           |
| Lead                     | 1835688 |        | 6.9    | 5.8     | 17.2% | < 0.5           | 92%      | 80%         | 120%           | 102%     | 80%   | 120%           | 91%      | 70%         | 130%           |
| Lithium                  | 1835688 |        | 24     | 20      | NA    | < 5             | 85%      | 70%         | 130%           | 103%     | 70%   | 130%           | NA       | 70%         | 130%           |
| Manganese                | 1835688 |        | 1450   | 1630    | 11.5% | < 2             | 85%      | 80%         | 120%           | 95%      | 80%   | 120%           | NA       | 70%         | 130%           |
| Molybdenum               | 1835688 |        | <2     | <2      | NA    | < 2             | 82%      | 80%         | 120%           | 95%      | 80%   | 120%           | 93%      | 70%         | 130%           |
| Nickel                   | 1835688 |        | 14     | 11      | 24.7% | < 2             | 87%      | 80%         | 120%           | 100%     | 80%   | 120%           | NA       | 70%         | 130%           |
| Selenium                 | 1835688 |        | <1     | <1      | NA    | < 1             | 96%      | 80%         | 120%           | 97%      | 80%   | 120%           | 76%      | 70%         | 130%           |
| Silver                   | 1835688 |        | <0.5   | <0.5    | NA    | < 0.5           | 88%      | 80%         | 120%           | 96%      | 80%   | 120%           | 99%      | 70%         | 130%           |
| Strontium                | 1835688 |        | 5      | <5      | NA    | < 5             | 86%      | 80%         | 120%           | 101%     | 80%   | 120%           | 128%     | 70%         | 130%           |
| Thallium                 | 1835688 |        | <0.1   | <0.1    | NA    | < 0.1           | 90%      | 80%         | 120%           | 100%     | 80%   | 120%           | NA       | 70%         | 130%           |
| Tin                      | 1835688 |        | 4      | 3       | NA    | < 2             | 83%      | 80%         | 120%           | 100%     | 80%   | 120%           | 87%      | 70%         | 130%           |
| Uranium                  | 1835688 |        | 0.5    | 0.5     | NA    | < 0.1           | 85%      | 80%         | 120%           | 96%      | 80%   | 120%           | 97%      | 70%         | 130%           |
| Vanadium                 | 1835688 |        | 36     | 31      | 15.9% | < 2             | 83%      | 80%         | 120%           | 95%      | 80%   | 120%           | NA       | 70%         | 130%           |
| Zinc                     | 1835688 |        | 31     | 25      | 19.3% | < 5             | 86%      | 80%         | 120%           | 98%      | 80%   | 120%           | 99%      | 70%         | 130%           |

Certified By:

Marta Manta

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#### **AGAT** QUALITY ASSURANCE REPORT (V1)

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation. RPDs calculated using raw data. The RPD may not be reflective of duplicate values shown, due to rounding of final results.



#### **Quality Assurance**

#### CLIENT NAME: WSP CANADA INC.

#### PROJECT: 201-11341 First Lakes PS

#### SAMPLING SITE:

AGAT WORK ORDER: 20X692480 ATTENTION TO: Jonathan Steeves SAMPLED BY:

#### **Trace Organics Analysis**

| RPT Date: Dec 30, 2020           |            |            | C           | UPLICAT  | E     |                 | REFEREN  | NCE MA      | TERIAL         | METHOD   | BLANK       | SPIKE          | MAT      | RIX SPI     | KE             |
|----------------------------------|------------|------------|-------------|----------|-------|-----------------|----------|-------------|----------------|----------|-------------|----------------|----------|-------------|----------------|
| PARAMETER                        | Batch      | Sample     | Dup #1      | Dup #2   | RPD   | Method<br>Blank | Measured | Acce<br>Lir | ptable<br>nits | Recoverv | Acce<br>Lir | ptable<br>nits | Recoverv | Acce<br>Lir | ptable<br>nits |
|                                  |            | Id         |             |          |       |                 | value    | Lower       | Upper          |          | Lower       | Upper          |          | Lower       | Upper          |
| Atlantic RBCA Tier 1 Hydrocarbor | ns in Soil | (Version 3 | .1) - Field | Preserve | d     |                 |          |             |                |          |             |                |          |             |                |
| Benzene                          | 1          | 1825609    | < 0.03      | < 0.03   | NA    | < 0.03          | 92%      | 60%         | 140%           | 94%      | 60%         | 140%           |          |             |                |
| Toluene                          | 1          | 1825609    | 0.190       | 0.210    | NA    | < 0.04          | 94%      | 60%         | 140%           | 96%      | 60%         | 140%           |          |             |                |
| Ethylbenzene                     | 1          | 1825609    | 0.10        | 0.12     | NA    | < 0.03          | 94%      | 60%         | 140%           | 95%      | 60%         | 140%           |          |             |                |
| Xylene (Total)                   | 1          | 1825609    | 0.61        | 0.68     | 10.9% | < 0.05          | 91%      | 60%         | 140%           | 91%      | 60%         | 140%           |          |             |                |
| C6-C10 (less BTEX)               | 1          | 1825609    | 7.3         | 7.4      | NA    | < 3             | 119%     | 60%         | 140%           | 85%      | 60%         | 140%           | NA       | 30%         | 130%           |
| >C10-C16 Hydrocarbons            | 1          | 1856134    | < 15        | < 15     | NA    | < 15            | 93%      | 60%         | 140%           | 100%     | 60%         | 140%           | 102%     | 30%         | 130%           |
| >C16-C21 Hydrocarbons            | 1          | 1856134    | < 15        | < 15     | NA    | < 15            | 95%      | 60%         | 140%           | 100%     | 60%         | 140%           | 102%     | 30%         | 130%           |
| >C21-C32 Hydrocarbons            | 1          | 1856134    | < 15        | < 15     | NA    | < 15            | 107%     | 60%         | 140%           | 100%     | 60%         | 140%           | 102%     | 30%         | 130%           |

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution. If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

#### Polycyclic Aromatic Hydrocarbons in Soil

| 1-Methylnaphthalene    | 1 | 1856134 | < 0.05    | < 0.05    | NA | < 0.05    | 128% | 50% | 140% | 78%  | 50% | 140% | 90%  | 50% | 140% |
|------------------------|---|---------|-----------|-----------|----|-----------|------|-----|------|------|-----|------|------|-----|------|
| 2-Methylnaphthalene    | 1 | 1856134 | < 0.01    | < 0.01    | NA | < 0.01    | 135% | 50% | 140% | 91%  | 50% | 140% | 113% | 50% | 140% |
| Acenaphthene           | 1 | 1856134 | < 0.00671 | < 0.00671 | NA | < 0.00671 | 137% | 50% | 140% | 101% | 50% | 140% | 95%  | 50% | 140% |
| Acenaphthylene         | 1 | 1856134 | < 0.004   | < 0.004   | NA | < 0.004   | 125% | 50% | 140% | 83%  | 50% | 140% | 80%  | 50% | 140% |
| Acridine               | 1 | 1856134 | < 0.05    | < 0.05    | NA | < 0.05    | 88%  | 50% | 140% | 77%  | 50% | 140% | 110% | 50% | 140% |
| Anthracene             | 1 | 1856134 | < 0.03    | < 0.03    | NA | < 0.03    | 122% | 50% | 140% | 72%  | 50% | 140% | 71%  | 50% | 140% |
| Benzo(a)anthracene     | 1 | 1856134 | 0.02      | 0.02      | NA | < 0.01    | 128% | 50% | 140% | 82%  | 50% | 140% | 93%  | 50% | 140% |
| Benzo(a)pyrene         | 1 | 1856134 | 0.01      | 0.01      | NA | < 0.01    | 123% | 50% | 140% | 82%  | 50% | 140% | 85%  | 50% | 140% |
| Benzo(b)fluoranthene   | 1 | 1856134 | 0.04      | 0.05      | NA | < 0.05    | 118% | 50% | 140% | 109% | 50% | 140% | 85%  | 50% | 140% |
| Benzo(j+k)fluoranthene | 1 | 1856134 | < 0.05    | < 0.05    | NA | < 0.05    | 102% | 50% | 140% | 83%  | 50% | 140% | 95%  | 50% | 140% |
| Benzo(e)pyrene         | 1 | 1856134 | 0.02      | 0.02      | NA | < 0.05    | 122% | 50% | 140% | 93%  | 50% | 140% | 99%  | 50% | 140% |
| Benzo(ghi)perylene     | 1 | 1856134 | 0.02      | 0.02      | NA | < 0.01    | 109% | 50% | 140% | 81%  | 50% | 140% | 91%  | 50% | 140% |
| Chrysene               | 1 | 1856134 | 0.03      | 0.03      | NA | < 0.01    | 134% | 50% | 140% | 101% | 50% | 140% | 102% | 50% | 140% |
| Dibenzo(a,h)anthracene | 1 | 1856134 | < 0.006   | < 0.006   | NA | < 0.006   | 126% | 50% | 140% | 91%  | 50% | 140% | 97%  | 50% | 140% |
| Fluoranthene           | 1 | 1856134 | 0.04      | 0.04      | NA | < 0.05    | 130% | 50% | 140% | 92%  | 50% | 140% | 102% | 50% | 140% |
| Fluorene               | 1 | 1856134 | < 0.01    | < 0.01    | NA | < 0.01    | 126% | 50% | 140% | 93%  | 50% | 140% | 88%  | 50% | 140% |
| Indeno(1,2,3)pyrene    | 1 | 1856134 | 0.02      | 0.02      | NA | < 0.01    | 109% | 50% | 140% | 107% | 50% | 140% | 105% | 50% | 140% |
| Naphthalene            | 1 | 1856134 | < 0.01    | < 0.01    | NA | < 0.01    | 138% | 50% | 140% | 97%  | 50% | 140% | 91%  | 50% | 140% |
| Perylene               | 1 | 1856134 | 0.01      | <0.01     | NA | < 0.05    | 134% | 50% | 140% | 100% | 50% | 140% | 86%  | 50% | 140% |
| Phenanthrene           | 1 | 1856134 | 0.01      | 0.01      | NA | < 0.03    | 112% | 50% | 140% | 97%  | 50% | 140% | 94%  | 50% | 140% |
| Pyrene                 | 1 | 1856134 | 0.04      | 0.03      | NA | < 0.05    | 129% | 50% | 140% | 93%  | 50% | 140% | 97%  | 50% | 140% |
| Quinoline              | 1 | 1856134 | < 0.05    | < 0.05    | NA | < 0.05    | 96%  | 50% | 140% | 92%  | 50% | 140% | 110% | 50% | 140% |

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution. If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

#### AGAT QUALITY ASSURANCE REPORT (V1)

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AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific tests tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation. RPDs calculated using raw data. The RPD may not be reflective of duplicate values shown, due to rounding of final results.



#### **Quality Assurance**

#### CLIENT NAME: WSP CANADA INC.

#### PROJECT: 201-11341 First Lakes PS

SAMPLING SITE:

AGAT WORK ORDER: 20X692480

**ATTENTION TO: Jonathan Steeves** 

SAMPLED BY:

#### **Trace Organics Analysis (Continued)**

|                        |       |        | -      |         |     | -               | -        |        |                | •        |             |                |          |             |                |
|------------------------|-------|--------|--------|---------|-----|-----------------|----------|--------|----------------|----------|-------------|----------------|----------|-------------|----------------|
| RPT Date: Dec 30, 2020 |       |        | 0      | UPLICAT | E   |                 | REFEREN  | ICE MA | TERIAL         | METHOD   | BLANK       | SPIKE          | MAT      | RIX SPI     | KE             |
| PARAMETER              | Batch | Sample | Dup #1 | Dup #2  | RPD | Method<br>Blank | Measured | Acce   | ptable<br>nits | Recoverv | Acce<br>Lir | ptable<br>nits | Recoverv | Acce<br>Lir | ptable<br>nits |
|                        |       | Id     |        |         |     |                 | value    | Lower  | Upper          |          | Lower       | Upper          |          | Lower       | Upper          |

Certified By:

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**AGAT** QUALITY ASSURANCE REPORT (V1)

Page 10 of 14

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#### **Method Summary**

#### CLIENT NAME: WSP CANADA INC. PROJECT: 201-11341 First Lakes PS

#### AGAT WORK ORDER: 20X692480

**ATTENTION TO: Jonathan Steeves** 

| SAMPLING SITE: |                                | SAMPLED BY:                         |                      |
|----------------|--------------------------------|-------------------------------------|----------------------|
| PARAMETER      | AGAT S.O.P                     | LITERATURE REFERENCE                | ANALYTICAL TECHNIQUE |
| Soil Analysis  | ł                              | 1                                   |                      |
| Aluminum       | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP/MS               |
| Antimony       | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP/MS               |
| Arsenic        | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP/MS               |
| Barium         | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP/MS               |
| Beryllium      | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP/MS               |
| Boron          | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP/MS               |
| Cadmium        | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP/MS               |
| Chromium       | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP/MS               |
| Cobalt         | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP/MS               |
| Copper         | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP/MS               |
| Iron           | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP/MS               |
| Lead           | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP-MS               |
| Lithium        | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP-MS               |
| Manganese      | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP/MS               |
| Molybdenum     | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP/MS               |
| Nickel         | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP/MS               |
| Selenium       | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP/MS               |
| Silver         | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP/MS               |
| Strontium      | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP/MS               |
| Thallium       | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP/MS               |
| Tin            | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP/MS               |
| Uranium        | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP/MS               |
| Vanadium       | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP/MS               |
| Zinc           | MET-121-6105 &<br>MET-121-6103 | EPA SW 846 6020A/3050B & SM<br>3125 | ICP/MS               |



#### **Method Summary**

#### CLIENT NAME: WSP CANADA INC. PROJECT: 201-11341 First Lakes PS

AGAT WORK ORDER: 20X692480

ATTENTION TO: Jonathan Steeves SAMPLED BY:

| SAMPLING SITE:            |              | SAMPLED BY:                                         |                      |
|---------------------------|--------------|-----------------------------------------------------|----------------------|
| PARAMETER                 | AGAT S.O.P   | LITERATURE REFERENCE                                | ANALYTICAL TECHNIQUE |
| Trace Organics Analysis   |              |                                                     |                      |
| Benzene                   | VOL-120-5013 | Atlantic RBCA Guidelines for<br>Laboratories Tier 1 | GC/MS                |
| Toluene                   | VOL-120-5013 | Atlantic RBCA Guidelines for<br>Laboratories Tier 1 | GC/MS                |
| Ethylbenzene              | VOL-120-5013 | Atlantic RBCA Guidelines for<br>Laboratories Tier 1 | GC/MS                |
| Xylene (Total)            | VOL-120-5013 | Atlantic RBCA Guidelines for<br>Laboratories Tier 1 | GC/MS                |
| C6-C10 (less BTEX)        | VOL-120-5013 | Atlantic RBCA Guidelines for<br>Laboratories Tier 1 | GC/MS/FID            |
| >C10-C16 Hydrocarbons     | ORG-120-5101 | Atlantic RBCA Guidelines for<br>Laboratories Tier 1 | GC/FID               |
| >C16-C21 Hydrocarbons     | ORG-120-5101 | Atlantic RBCA Guidelines for<br>Laboratories Tier 1 | GC/FID               |
| >C21-C32 Hydrocarbons     | ORG-120-5101 | Atlantic RBCA Guidelines for<br>Laboratories Tier 1 | GC/FID               |
| Modified TPH (Tier 1)     | ORG-120-5101 | Atlantic RBCA Guidelines for<br>Laboratories Tier 1 | CALCULATION          |
| Resemblance Comment       | ORG-120-5101 | Atlantic RBCA Guidelines for<br>Laboratories Tier 1 | GC/MS/FID            |
| Return to Baseline at C32 | ORG-120-5101 | Atlantic RBCA Guidelines for<br>Laboratories Tier 1 | GC/FID               |
| Isobutylbenzene - EPH     | ORG-120-5101 | Atlantic RBCA Guidelines for<br>Laboratories Tier 1 | GC/FID               |
| Isobutylbenzene - VPH     | VOL-120-5013 | Atlantic RBCA Guidelines for<br>Laboratories Tier 1 | GC/MS                |
| n-Dotriacontane - EPH     | ORG-120-5101 | Atlantic RBCA Guidelines for<br>Laboratories Tier 1 | GC/FID               |
| % Moisture                |              | Calculation                                         | GRAVIMETRIC          |
| 1-Methylnaphthalene       | ORG-120-5104 | EPA SW846/3541/3510/8270C                           | GC/MS                |
| 2-Methylnaphthalene       | ORG-120-5104 | EPA SW846/3541/3510/8270C                           | GC/MS                |
| Acenaphthene              | ORG-120-5104 | EPA SW846/3541/3510/8270C                           | GC/MS                |
| Acenaphthylene            | ORG-120-5104 | EPA SW846/3541/3510/8270C                           | GC/MS                |
| Acridine                  | ORG-120-5104 | EPA SW846/3541/3510/8270C                           | GC/MS                |
| Anthracene                | ORG-120-5104 | EPA SW846/3541/3510/8270C                           | GC/MS                |
| Benzo(a)anthracene        | ORG-120-5104 | EPA SW846/3541/3510/8270C                           | GC/MS                |
| Benzo(a)pyrene            | ORG-120-5104 | EPA SW846/3541/3510/8270C                           | GC/MS                |
| Benzo(b)fluoranthene      | ORG-120-5104 | EPA SW846/3541/3510/8270C                           | GC/MS                |
| Benzo(j+k)fluoranthene    | ORG-120-5119 | EPA SW846/3541/3510/8270C                           | GC/MS                |
| Benzo(e)pyrene            | ORG-120-5104 | EPA SW846/3541/3510/8270C                           | GC/MS                |
| Benzo(ghi)perylene        | ORG-120-5104 | EPA SW846/3541/3510/8270C                           | GC/MS                |
| Chrysene                  | ORG-120-5104 | EPA SW846/3541/3510/8270C                           | GC/MS                |
| Dibenzo(a,h)anthracene    | ORG-120-5104 | EPA SW846/3541/3510/8270C                           | GC/MS                |
| Fluoranthene              | ORG-120-5104 | EPA SW846/3541/3510/8270C                           | GC/MS                |
| Fluorene                  | ORG-120-5104 | EPA SW846/3541/3510/8270C                           | GC/MS                |
| Indeno(1,2,3)pyrene       | ORG-120-5104 | EPA SW846/3541/3510/8270C                           | GC/MS                |
| Naphthalene               | ORG-120-5104 | EPA SW846/3541/3510/8270C                           | GC/MS                |
| Perylene                  | ORG-120-5104 | EPA SW846/3541/3510/8270C                           | GC/MS                |
| Phenanthrene              | ORG-120-5104 | EPA SW846/3541/3510/8270C                           | GC/MS                |
| Pyrene                    | ORG-120-5104 | EPA SW846/3541/3510/8270C                           | GC/MS                |
| Quinoline                 | ORG-120-5104 | EPA SW846/3541/3510/8270C                           | GC/MS                |
| Naphthalene-d8            | ORG-120-5104 | EPA SW846/3541/3510/8270C                           | GC/MS                |



#### **Method Summary**

#### CLIENT NAME: WSP CANADA INC.

#### PROJECT: 201-11341 First Lakes PS

#### SAMPLING SITE

#### AGAT WORK ORDER: 20X692480 ATTENTION TO: Jonathan Steeves

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|                |              | URANI LED DI.             |                      |
|----------------|--------------|---------------------------|----------------------|
| PARAMETER      | AGAT S.O.P   | LITERATURE REFERENCE      | ANALYTICAL TECHNIQUE |
| Terphenyl-d14  | ORG-120-5104 | EPA SW846/3541/3510/8270C | GC/MS                |
| Pyrene-d10 (%) | ORG-120-5119 | EPA SW846/3510/8270C      | GC/MS                |





#### LIMITATIONS

#### Limited use

This Report was prepared for Halifax Water solely for their exclusive use to provide an Assessment of current environmental conditions in association with the Site. WSP will not be responsible for any use of this report by any other party, for any decisions to be made based on it, or for the consequences thereof, unless written reliance is granted by WSP. Unless otherwise agreed in writing by WSP, it shall not be used to express or imply warranty as to the suitability of the property for a particular purpose. WSP disclaims responsibility of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs.

#### **Excerpts**

The Report is intended to be used in its entirety. No excerpts may be taken to be representative of the findings in the assessment.

#### Information from others

In evaluating the Site, WSP has relied in good faith on information provided by others, as noted in the Report. WSP has assumed that the information provided is correct and WSP assumes no responsibility for the accuracy, completeness or workmanship of any such information.

#### Standard of care

This project has been carried out using investigation techniques and engineering analysis methods consistent with those ordinarily exercised by WSP and other engineering/scientific practitioners, working under similar conditions and subject to the time, financial and physical constraints applicable to this project. The conclusions presented in this Report are based on Work undertaken by trained professional and technical staff and the reasonable and professional interpretation using accepted engineering and scientific practices current at the time the work was performed. Conclusions presented in this report should not be construed as legal advice. WSP makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in the Report, including, but not limited to, ownership of any property, or the application of any law to the findings of the Assessment.

#### Limited scope

The Report summarizes WSP's review of available data in accordance with the principal components of the stated regulations, standards and guidelines and the scope, terms and conditions of the contract or proposal to which the Assignment was conducted. No other warranties are either expressed or implied with respect to the professional services provided under the terms of the contract or proposal and represented in this Report. Conditions may exist which were not detected given the nature of the inquiry WSP was retained to undertake with respect to the Site. Additional environmental studies and actions may be recommended.

1 Spectacle Lake Drive Dartmouth, NS Canada B3B 1X7

T: +1 902-835-9955 F: +1 902-835-1645 wsp.com



#### Changes over time

The Report is based on data and information collected at the time of this Assessment, as stated in the Report. Site use or conditions change and the information and conclusions in the Report may no longer apply following the date of this Report. If any conditions become apparent that differ significantly from that presented in this Report, we request that we be notified to reassess the conclusions and recommendations provided herein. WSP disclaims any obligation to update this Report for conditions that may be identified after the date of this Report; however, WSP reserves the right to amend or supplement this report based on additional information, documentation or evidence.

#### Variability between test locations

Conclusions are based on the Site conditions observed by WSP at the time the work was performed and may include information obtained at specific testing and/or sampling locations. It is recognized that overall conditions can only be extrapolated to an undefined limited area around these testing and sampling locations. The conditions that WSP interprets to exist between testing and sampling points may differ from those that actually exist. The accuracy of any extrapolation and interpretation beyond the sampling locations will depend on natural conditions, the history of Site development and changes through construction and other activities. In addition, analysis has been carried out for the identified chemical and physical parameters only, and it should not be inferred that other chemical species or physical conditions are not present. WSP cannot warrant against undiscovered environmental liabilities or adverse impacts off-Site.

#### Surveying

Benchmark and elevations used in this report are primarily to establish relative elevation differences between the specific testing and/or sampling locations and should not be used for other purposes, such as grading, excavating, construction, planning, development, etc.

#### Use for design and construction

Design recommendations given in this report are applicable only to the project and areas as described in the text and then only if constructed in accordance with the details stated in this report. The comments made in this report on potential construction issues and possible methods are intended only for the guidance of the designer. The number of testing and/or sampling locations may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. Contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.

# FINAL DESIGN REPORT APPENDIX

# B HYDRAULIC TRANSIENT ANALYSIS

#### HALIFAX WATER

### FIRST LAKE WASTEWATER PUMPING STATION HYDRAULIC TRANSIENT ANALYSIS







#### FIRST LAKE WASTEWATER PUMPING STATION

#### HYDRAULIC TRANSIENT ANALYSIS HALIFAX WATER

ENGINEERING REPORT VERSION 1.0

WSP PROJECT NO.: 201-11341-00 MAR 2021

WSP CANADA INC. 100 Commerce Valley Drive West Thornhill, ON Canada L3T 0A1

T: +1 905 882-1100 F: +1 905 882-0055

WSP.COM



March 2, 2021

Mr. Brad Baxter, Project Engineer Halifax Water, Nova Scotia, Canada

**Subject:** Hydraulic Transient Analysis Report for First Lake Wastewater Pumping Station (PS) and Forcemain

Dear Brad,

WSP Canada Inc.'s Hydraulics group is pleased to present the report documenting the results of its transient analysis for First Lake PS in the Halifax Regional Municipality (HRM).

To analyse the system, WSP used Bentley HAMMER to simulate a global power failure (or emergency stop) resulting in a rapid pump spin-down of five (3+2) pumps, the most critical scenario. WSP also simulated an emergency stop of the three (3) pumps at wet-well #1 while the other two (2) pumps at wet-well #2 (and overflow) inactive or abandoned.

This report describes the result of hydraulic transient analysis of adding another pump in Wet-Well #1 for the conditions described above and the adequacy of the existing PVC 300mm forcemain to convey wastewater from the PS up to discharge Maintenance Hole (MH), located just East of Glendale Drive and Riverside Drive intersection.

This report includes the recommended air-valve to protect both Wet-Well #1 and Wet-Well #2 systems at the First Lake PS against transient conditions. The same equipment can be used when the overflow wet-well is inactive or abandoned.

We take this opportunity to thank Halifax Water for providing information at various stages. If you have any questions, please do not hesitate to contact the undersigned.

Respectfully Submitted,

WSP Canada Inc.

Alan- Luc Daria

Jean-Luc Daviau, M.A.Sc., P.Eng. Sr. Fluid Dynamic & Transient Specialist

Spin Coulo

Abhishek Kumar, M.Sc., P.Eng., PMP <sup>®</sup> Project Manager, Hydraulics

100 Commerce Valley Drive West Thornhill, ON Canada L3T 0A1

T: +1 905 882-1100 F: +1 905 882-0055 This page is intentionally left blank.

#### REVISION HISTORY

| VERSION | DATE        | DESCRIPTION        |
|---------|-------------|--------------------|
| 0.      | March, 2021 | Initial Submission |
| 1.      |             |                    |
| 2.      |             |                    |

#### SIGNATURES

#### PREPARED BY

Hin Louillon

Abhishek Kumar, M.Sc., P.Eng., PMP ® Project Manager/Engineer

CHECKED FOR DESIGN CONSISTENCY BY

Adib Eider, M.A.Sc., P.Eng. Senior Hydraulics Engineer

**REVIEWED BY** 

Jean-Luc Daviau, M.A.Sc., P.Eng. Sr. Fluid Dynamic & Transient Specialist

#### PRODUCTION TEAM

#### CLIENT

Brad Baxter, P.Eng. (Halifax Water) **Project Manager** WSP Project Manager Pat Lewis, P.Eng. Task Manager/Engineer Abhishek Kumar, M.Sc., PMP<sup>®</sup>, P.Eng. CAD/Data Plots Helena Chiu (Database Specialist) Quality Control Adib Eider, M.A.Sc., P.Eng. (Sr. Engineer) **Quality Analyst** Jean-Luc Daviau, M.A.Sc., P.Eng. (Departmental Manager)

#### EXECUTIVE SUMMARY

Halifax Water (HW; Client) retained WSP Canada Inc. (WSP) to conduct a hydraulic transient analysis to facilitate addition of the third pump in Wet-Well #1 of the First Lake Wastewater Pumping Station (PS). Located South of Kingfisher Way and Metropolitan Ave intersection, the First Lake PS has two wet wells: #1 (main) and #2 (overflow). Wet-Well #1 was designed to accommodate three (3) pumps of model, Flygt 3152.181, while only two were initially installed (i.e, existing condition) and through this project HW proposes to add the remaining envisioned third pump, leaving everything else as-is. It should also be noted that, Wet-Well #2, has two pumps of the model: Flygt 3152.120 in the existing condition. HW may or may not decommision/abandon Wet-Well #2.

To perform the analysis, WSP built an all-pipe HAMMER<sup>®</sup> model of the PS and forcemain. In order to check the adequacy of proposed (3+2 pumps) system with and without protection, WSP modeled all five (5) pumps experiencing a global power failure (sudden shut-off) and conveying flow downstream only via one (1) 300mm forcemain to reflect the most critical transient event at the maximum water level in the wet well for conservative results. WSP also modelled a scenario with only the three (3) pumps at Wet-Well #1 (main) operational while the other two (2) pumps at Wet-Well #2 were kept inactive (representing abandoned Wet-Well #2). Scenarios simulated can be summarised as follows:

- Scenario 1: Five (3 + 2) Pumps <u>without</u> Protection. Both Wet-Well #1 and Wet-Well #2 are <u>active</u>.
- Scenario 2: Five (3 +2) Pumps <u>with Protection</u>. Both Wet-Well #1 and Wet-Well #2 are <u>active</u>
- Scenario 3: Three (3) Pumps <u>without</u> Protection. Wet-Well #1 is <u>active</u> while Wet-Well #2 is <u>inactive</u> (abandoned/decommisioned).
- Scenario 4: Three (3) Pumps <u>with</u> Protection. Wet-Well #1 is <u>active</u> while Wet-Well #2 is <u>inactive</u> (abandoned/decommisioned).

The simulation results predict the maximum and minimum transient pressure envelopes expected within the PS and along the forcemain are improved with an air valve (one for each of the two common discharge headers). The sewage combination air valves will primarily improve air-handling by expelling air from pipes normally and letting air into the line upon power failure to minimise the duration of minimum sub-atmospheric pressures in the forcemain. Accordingly, the selected DR 18 pipe's sub-atmospheric and also its high pressure tolerance will be able to withstand both "negative" and subsequent positive pressures during an emergency pump stop or power failure with 3 or 5 pumps initially operating.

WSP has used best efforts and knowledge to quantify the expected performance of the pump station and forcemain system; however, care must be exercised during commissioning to confirm key factors such as forcemain profile, air valve function, etc. Preventive maintenance and regular inspections are required to ensure air valve remains operable over the life of the infrastructure and can contribute to optimal system performance.

#### PURPOSE OF MODEL

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#### 1 INTRODUCTION AND OBJECTIVE

WSP Canada Inc. (WSP) conducted transient analysis for the First Lake wastewater PS, in the HRM. Background information for the analysis, includes key drawings and specifications, as referenced in this document. As per the Client's requirements, the purpose of the hydraulic transient computer simulations is to:

- 1. Evaluate the static, steady-state and transient pressures against pipe burst (or collapse) limits;
- 2. Evaluate the need for and location/make/model/size of check, air valves; and,
- 3. Evaluate the performance of proposed air valve for a global power failure.

WSP has modeled the system with four (4) Scenarios: Scenarios 1 and 3 are without protection, and Scenarios 2 and 4 are with protection. Scenarios 1 and 2 represent condition with five (5) pumps operational (i.e., all pumps in main and overflow wet-wells are operational) while Scenarios 3 and 4 represent only three (3) pumps as operational (i.e., main wet-well will have three (3) pumps operational while the overflow wet-well is abandoned).

The overall objective is to recommend cost effective solutions to reduce the risk of pipeline failure or excessive wear-and-tear while also enhancing operational flexibility by recommending the fastest safe pump sequences; in combination with effective operation and maintenance practices. This analysis considered pipe class and air valve protection for the system.

#### 2.1 LOCATION AND SYSTEM DESCRIPTION

First Lake Wastewater Pumping Station (PS) is located along King Fisher Way and East of Metropolitan Ave. in the HRM as shown in Figure 2-1. The PS has two wet-wells: Wet-Well#1 and Wet-Well #2 both currently containing two pumps; HW plans to add one more pump to Wet-Well#1 via this project. The pumps on Wet-Well #1 and Wet-Well #2 are Flygt 3152.181 and Flygt 3152.120, respectively.





#### 2.1.1 WET-WELLS, PUMPS AND WASTEWATER PS PIPING

**Figure 2-5** and **Figure 2-4** show the wet well containing the pumps. The station pumps wastewater and discharges it to an existing Maintenance Hole (MH) located approximately 0.6km north-west of the PS just along Glendale Dr (see Figure 2-3).

The PS is proposed with one (1) new Flygt 3152.181 pump (rated for 76L/s @11.5m TDH) to make a total of 3 pumps in Wet-Well #1 (main). The pumps on the Wet-Well #2 (overflow) are both Flygt 3152.120 (submersible pump rated for 63L/s @14m TDH). Pump curves corresponding to both of these pumps are kept under **Appendix A**.

Flygt 3152.181 and Flygt 3152.120 pump models have a rated speed of 1750rpm. An arrangement of five (5) pumps working simultaneously is simulated for the most critical hydraulic transient. WSP has modeled and presented the results for Wet-Well #2 abandoned condition while three (i.e., 1 new + 2 existing) pumps at Wet-Well #1 are considered simultaneously operational.

The piping at the PS is made of DI with nominal diameters ranging of 150mm and 300mm while the forcemain is 300mm DR18 PVC. Internal diameters were used to model for better accuracy.

Figure **2-2**, Figure **2-3**, Figure **2-5** and Figure **2-4** show the PS, forcemain for station in plan and profile views, respectively. Full size Figure **2-5** and Figure **2-4** are provided in the appendix.


Figure 2-2: First Lake Proposed Forcemain Layout (Plan View).



Figure 2-3: First Lake Wastewater PS – Proposed Piping Layout (Profile View)- Five Pumps Operational.



Figure 2-4: Main Wet-Well (Plan and Section Views) with Flow Direction.



Figure 2-5: Overflow Wet-Well (Plan and Section Views) with Flow Direction.

WSP accounted for the minor losses during the analysis and a roughness (C-factor) of 130. A rather "smooth" forcemain is conservative from the point of view of hydraulic transient pressure simulations. (Keeping in mind the forcemains are more than five years old.)

Table **1** shows the pipe characteristics used in the hydraulic analysis. Internal Diameters and C-Factors of the pipes were used to the model the pipes inside the PS (DI) and forcemain (PVC).

| Material:                              | Ductile Iron (PS)                      | Ductile Iron (PS)                      | PVC (Forcemain)   |  |
|----------------------------------------|----------------------------------------|----------------------------------------|-------------------|--|
| Class                                  | Class 350                              | Class 350                              | DR 18 (Class 235) |  |
| Nominal Diameter                       | 150mm                                  | 300mm                                  | 300mm             |  |
| Wall Thickness                         | Vall Thickness 6.4mm                   |                                        | 19mm              |  |
| Inside Diameter                        | 162.6mm                                | 321                                    | 297mm             |  |
| Roughness, C                           | 130                                    | 130                                    | 130               |  |
| Max. Pressure Rating                   | 350psi (+100psi of<br>Surge Allowance) | 350psi (+100psi of<br>Surge Allowance) | 235psi            |  |
| Vacuum Tolerant (-14psi<br>or -100kPa) | Yes                                    | Yes                                    | Yes               |  |

Table 1: First Lake Wastewater PS Piping and Forcemain Properties

#### 2.1.2 WASTEWATER FORCEMAIN TO DISCHARGE MH

First Lake discharge pipe exits the pump station at elevation 46.1m and is connected to an existing 300mm DR18 PVC pipe. The existing forcemain then goes along Metropolitan Ave. and Glendale Drive for approximately 0.6km until it discharges to an existing MH at an elevation of 54.14m.

WSP used AECOM's report provided by Halifax Water in the RFP to build a Bentley HAMMER <sup>®</sup> model.

#### 2.2 STATIC PRESSURE

**Table 2-3** and **Table 2-3** show to keep results conservative, the maximum water level in the wet wells is considered to be 48.9m and 48.4m for wet well #1 and #2, respectively. Due to the profile of the existing forcemain, the pipeline remains full between pump cycles (see Figure 2-3).

Table 2-3 and Table 2-3 show the key elevations, pressure and head along the pipeline profile while

**Table** 2-4 tabulates these parameters for the proposed Wet-Well #2 abandoned condition (Scenarios 3 and 4, as explained in Section 2.4).

| Distance and Station |       | Elevation | Steady Head and Pressure<br>(Three Pumps ON) |        | ressure<br>ON) | Comment                     |
|----------------------|-------|-----------|----------------------------------------------|--------|----------------|-----------------------------|
| (m)                  | (km)  | (m)       | HGL (m)                                      | (kPa)  | (psi)          |                             |
| 0                    | 0+000 | 42.61     | 48.83                                        | 60.91  | 8.83           | Pump Suction (Wet-Well #2)  |
| 0                    | 0+000 | 42.61     | 68.97                                        | 258.00 | 37.42          | Pump Discharge(Wet-Well #2) |

Table 2-2: Points of Interest for First Lake System: Overflow Wet-Well with 5 pumps on

| Distance and Station Ele |       | Elevation | Steady Head and Pressure<br>(Three Pumps ON) |        |       | Comment                          |
|--------------------------|-------|-----------|----------------------------------------------|--------|-------|----------------------------------|
| (m)                      | (km)  | (m)       | HGL (m)                                      | (kPa)  | (psi) |                                  |
| 1                        | 0+001 | 46.10     | 68.74                                        | 221.66 | 32.15 | Top of the riser (wet-well exit) |

#### Table 2-3: Points of Interest for First Lake System: Main Wet-Well with 5 pumps on

| Distance and Station |        | Elevation | Steady Head and Pressure<br>(Three Pumps ON) |        |       | Comment                                    |  |
|----------------------|--------|-----------|----------------------------------------------|--------|-------|--------------------------------------------|--|
| (m)                  | (km)   | (m)       | HGL (m)                                      | (kPa)  | (psi) |                                            |  |
| 0                    | 0+000  | 48.77     | 48.34                                        | 59.76  | 8.67  | Pump Suction (Wet-Well #1)                 |  |
| 0                    | 0+000  | 42.24     | 68.76                                        | 259.56 | 37.65 | Pump Discharge(Wet-Well #1)                |  |
| 1                    | 0+001  | 46.08     | 68.56                                        | 220.09 | 31.92 | Top of the riser (wet-well exit)           |  |
| 13.7                 | 0+0137 | 46.67     | 68.01                                        | 208.86 | 30.29 | Air-Valve                                  |  |
| 15.5                 | 0+0155 | 46.17     | 67.98                                        | 213.49 | 30.96 | PS Exit (300mm Common<br>Discharge Header) |  |
| 551.1                | 0+551  | 53.75     | 54.14                                        | 0.00   | 0.00  | Discharge MH                               |  |

| Distance and Station |        | Elevation | Steady Head and Pressure<br>(Three Pumps ON) |        |       | Comment                                    |  |
|----------------------|--------|-----------|----------------------------------------------|--------|-------|--------------------------------------------|--|
| (m)                  | (km)   | (m)       | HGL (m)                                      | (kPa)  | (psi) |                                            |  |
| 0                    | 0+000  | 48.77     | 48.29                                        | 59.27  | 8.60  | Pump Suction (Wet-Well #1)                 |  |
| 0                    | 0+000  | 42.24     | 65.13                                        | 224.05 | 32.50 | Pump Discharge(Wet-Well #1)                |  |
| 1                    | 0+001  | 46.08     | 64.76                                        | 182.84 | 26.52 | Top of the riser (wet-well exit)           |  |
| 13.7                 | 0+0137 | 46.67     | 63.81                                        | 167.79 | 24.34 | Air-Valve                                  |  |
| 15.5                 | 0+0155 | 46.17     | 63.80                                        | 172.50 | 25.02 | PS Exit (300mm Common<br>Discharge Header) |  |
| 551.1                | 0+551  | 53.75     | 54.14                                        | 0.00   | 0.00  | Discharge MH                               |  |

Note: air-valve, discharge header and discharge manhole are common to both wet-wells.

#### 2.3 STEADY-STATE OPERATION

Using the detailed hydraulic model of the PS and forcemain system, the simulated steady-state operation result for the two conditions:

- 1. Five Pumps Operational
  - Three (3) Flygt 3152.181 60Hz with total flow 155L/s with velocities around 1.72m/s in the PS at the riser,
  - Two (2) Flygt 3152.120 60Hz with total flow 42L/s with velocities around 1.92m/s in the PS at the riser,
  - Velocity in 300mm PVC DR18 forcemain (one forcemain operational) is around 2.81m/s.
- 2. Three Pumps Operational at Wet-Well #1 (main) and Wet-Well #2 (Overflow) Inactive
  - Three (3) Flygt 3152.181 60Hz with total flow 158L/s with velocities around 2.45m/s in the PS at the riser,
  - Velocity in 300mm PVC DR18 forcemain (one forcemain operational) is around 2.28m/s.

#### 2.4 TRANSIENT SIMULATIONS

The most severe transient phenomenon is typically due to a sudden pump stoppage. Stopping a pump can cause a rapid initial drop in pressure (downsurge) followed by an often-chaotic rise in pressure (upsurge) upon return of the water column towards the pumps, occurring as these are slowing to a stop and as the check valves close.

In order to analyze the possibility of a water hammer within the system, WSP simulated the following transient scenarios:

- Scenario 1 (SCN1): Three (3) pumps in Wet Well #1 and two (2) pumps in Wet-Well #2 are simulated to be in operation, i.e., the proposed system but <u>without</u> protection (no air valve).
- Scenario 2 (SCN2): Three (3) pumps in Wet Well #1 and two (2) pumps in Wet-Well #2 are simulated to be in operation, i.e., the proposed system but <u>with</u> protection\*.
- Scenario 3 (SCN3): Three (3) pumps in Wet Well #1 and no pumps in Wet-Well #2 are simulated to be in operation, i.e., the proposed system but <u>without</u> protection (no air valve). This reflects the proposed condition, Wet-Well #2 will be abandoned and Wet-Well #1 will have one new pump.
- Scenario 4 (SCN4): Three (3) pumps in Wet Well #1 and no pumps in Wet-Well #2 are simulated to be in operation, i.e., the proposed system but <u>with</u> protection\*. This reflects the proposed condition, Wet-Well #2 will be abandoned and Wet-Well #1 will have one new pump.

\*one (1) wastewater combination air valve (per forcemain) with a 50mm (2") nominal diameter air inlet, 50mm (2") large air outlet and with 3.57mm (9/64") small air release outlet (orifice) or equivalent. WSP has used Valmatic 802A, a widely available air-valve, for the transient simulations. HW may suggest their approved equal make/model.

Based on the material properties and the pipe class, WSP used for the pipes the pressure wave speed of approximately 1200 m/s-1300m/s and 490 m/s for DI and PVC, respectively. The pipe diameters used in

the hydraulic model reflect the actual Internal Diameter (ID). The minor loss values used were selected from the built-in parameter library of Bentley HAMMER software.

**Figure 2-6** shows the maximum and minimum transient envelopes under Scenario 1. The magnitude of the maximum HGL is just under 70m (pressure is 270kPa).

**Figure 2-7**, shows negative pressures can be mitigated by using an air-valve. A significant portion of the forcemain has low pressures averaging approximately up to -100kPa; and the pressure in the system ranges between -100kPa to 270kPa during a power failure where five pumps shut down in the no-protection scenario (Scenario 1). Without protection prolonged negative pressures may lead to collapse of the pipe. However, PVC DR18 pipe is known to be vacuum tolerant, but it is still advised to provide air-valve at the PS both for air-management purpose and for transient conditions.

**Figure 2-8** shows with protection (Scenario 2), the maximum HGL envelope remained almost the same as the initial steady-state thanks to the air-valve that controls air outflow and gradually expels energy. The air intake shortly after the power failure limits the duration and magnitude of sub-atmospheric pressures along the entire forcemain as shown. The result is that full vacuum does not occur.



The maximum and minimum transient pressures are tolerable for PVC DR18.

Figure 2-6: Transient HGL Envelopes without Surge Protection (5 Pumps, Scenario 1)



Figure 2-7: Transient Pressure Envelopes upon Power Failure (5 Pumps, Scenarios 1 and 2)



Figure 2-8: Transient HGL Envelopes upon Power Failure with Surge Protection (5 Pumps, Scenario 2)

For Scenarios 3 and 4, with only three (3) pumps initially operational instead of five (5), the system conveys lower flows, and magnitude of both transient pressure both maximum and minimum pressures are lower than the corresponding values in Scenarios 1 and 2. Both the maximum and minimum pressures are tolerable since they are within the pressure rating of PVC DR18 pipe. **Figure 2-9** to **Figure 2-11** show the pressure and HGL modeling results for Scenarios 3 and 4.



Figure 2-9: Transient HGL Envelopes upon Power Failure without Surge Protection (3 Pumps, Scenario 3)



Figure 2-10: Transient Pressure Envelopes upon Power Failure (3 Pumps, Scenarios 3 and 4)



Figure 2-11: Transient HGL Envelopes upon Power Failure with Protection (3 Pumps, Scenario 4)

#### 2.5 FIRST LAKE WASTEWATER PS RECOMMENDATIONS

Based on the results of the transient analysis for First Lake Wastewater Pumping Station (PS) described in this report (for operation of 5 or 3 pumps and one forcemain), WSP Hydraulics concludes as follows:

- 1 The First Lake PS has approximately 0.6km long forcemain. Vertically the forcemain has a rising profile with the PS elevation of 48.4m (wet-well #1) and 48.9m (wet-well #1) and a discharge location elevation of 54.14m.
- 2 The majority of the head-loss occurs along the forcemain and flows can potentially reverse to the station at a final velocity equivalent to the initial steady-state velocity. However, check valves should prevent the reversing flow from dropping back to the wet-well from the common discharge header.
- 3 In terms of flows:
  - a For PVC and DI pipes have a roughness of C=130, the First Lake PS with five (5) pumps ON can convey up to 155L/s and 42L/s for the 3 pumps at wet-well #1 and the 2 pumps at wet-well #2, respectively. The result is a total flow of approximately 200L/s.
  - b For PVC and DI pipes have a roughness of C=130, the First Lake PS with three (3) pumps ON (Scenarios 3 and 4) can convey up to 158L/s from wet-well #1; with wet-well#2 decommisioned or abandoned.
- 4 The velocity in the forcemain ranges between 2.30m/s and 2.85m/s.
- 5 Wet well #2 and its overflow provide a measure of redundancy in storage that can reduce the frequency of pump starts/stops and reduce pressure cycling: this should be considered in design.
- **6** The all-pipe HAMMER model represents the mass and length characteristics of the system accurately and can be relied upon to predict transient pressures upon pump shut-down.

Based on the computer simulations completed, WSP recommends:

- 1 For First Lake PS with sewage combination air valves are required on each forcemain to protect against short-lived sub-atmospheric pressure conditions (Scenarios 2 and 4). Each SCAV or wastewater combination air valve (one per forcemain) will have a 50mm (2") nominal diameter air inlet and a 50mm (2") large air outlet with a 3.57mm (9/64") air release orifice. WSP simulated a Valmatic 802A for the transient protection but HRM may suggest a different make/model provided it has equivalent inlet/outlet port and orifice diameters.
- 2 The pipes and joints inside the pump station will require thrust restraints due to the flows and low pressures anticipated. Supports at elbows can be used to minimise movement or reduce pipe vibration, if any.

If any of the parameters mentioned in this report is changed by the City, WSP requests a prior consultation to ascertain its design implications.









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### Engineering & Technical Data R-6

## Thickness Design of Ductile Iron Pipe

#### Nominal Thicknesses for Standard "Pressure Classes" of Ductile Iron Pipe

| NOMINAL   | OUTSIDE  |      | PRESSURE CLASS |               |          |       |  |  |  |
|-----------|----------|------|----------------|---------------|----------|-------|--|--|--|
| PIPE SIZE | DIAMETER | 150  | 200            | 250           | 300      | 350   |  |  |  |
| (inches)  | (inches) |      | NOMIN          | IAL THICKNESS | (inches) |       |  |  |  |
| 3"        | 3.96     | —    | —              | _             | —        | 0.25* |  |  |  |
| 4"        | 4.80     | _    | _              | _             | _        | 0.25* |  |  |  |
| 6"        | 6.90     | —    |                | —             |          | 0.25* |  |  |  |
| 8"        | 9.05     | _    | —              | —             | —        | 0.25* |  |  |  |
| 10"       | 11.10    | _    | _              | _             | _        | 0.26  |  |  |  |
| 12"       | 13.20    | —    | —              | —             | —        | 0.28  |  |  |  |
| 14"       | 15.30    | —    | —              | 0.28          | 0.30     | 0.31  |  |  |  |
| 16"       | 17.40    | _    | _              | 0.30          | 0.32     | 0.34  |  |  |  |
| 18"       | 19.50    | _    | _              | 0.31          | 0.34     | 0.36  |  |  |  |
| 20"       | 21.60    | _    | _              | 0.33          | 0.36     | 0.38  |  |  |  |
| 24"       | 25.80    | _    | 0.33           | 0.37          | 0.40     | 0.43  |  |  |  |
| 30"       | 32.00    | 0.34 | 0.38           | 0.42          | 0.45     | 0.49  |  |  |  |
| 36"       | 38.30    | 0.38 | 0.42           | 0.47          | 0.51     | 0.56  |  |  |  |
| 42"       | 44.50    | 0.41 | 0.47           | 0.52          | 0.57     | 0.63  |  |  |  |
| 48"       | 50.80    | 0.46 | 0.52           | 0.58          | 0.64     | 0.70  |  |  |  |
| 54"       | 57.56    | 0.51 | 0.58           | 0.65          | 0.72     | 0.79  |  |  |  |
| 60"       | 61.61    | 0.54 | 0.61           | 0.68          | 0.76     | 0.83  |  |  |  |
| 64"       | 65.67    | 0.56 | 0.64           | 0.72          | 0.80     | 0.87  |  |  |  |

\* Calculated thicknesses for these sizes and pressure ratings are less than those shown above. Presently these are the lowest nominal thicknesses available in these sizes.

- "Pressure Classes" are defined as the rated water working pressure of the pipe in pounds per square inch (psi). The thicknesses shown are adequate for the rated water working pressure plus a surge allowance of 100 psi.
- Ductile Iron Pipe is available for water working pressures greater than 350 psi.
- Ductile Iron Pipe is also available with thicknesses greater than Pressure Class 350; see table below.†
- All information is from AWWA/ANSI C150/A21.50-91 Standards, tables 50.5 and 50.15.

#### Special "Thickness Classes" of Ductile Iron Pipe†

| NOMINAL   | OUTSIDE  |      | THI    |            |             |      |      |      |
|-----------|----------|------|--------|------------|-------------|------|------|------|
| PIPE SIZE | DIAMETER | 50   | 51     | 52         | 53          | 54   | 55   | 56   |
| (inches)  | (inches) |      | NOMINA | L THICKNES | SS (inches) |      |      |      |
| 3"        | 3.96     | —    | 0.25   | 0.28       | 0.31        | 0.34 | 0.37 | 0.40 |
| 4"        | 4.80     |      | 0.26   | 0.29       | 0.32        | 0.35 | 0.38 | 0.41 |
| 6"        | 6.90     | 0.25 | 0.28   | 0.31       | 0.34        | 0.37 | 0.40 | 0.43 |
| 8"        | 9.05     | 0.27 | 0.30   | 0.33       | 0.36        | 0.39 | 0.42 | 0.45 |
| 10"       | 11.10    | 0.29 | 0.32   | 0.35       | 0.38        | 0.41 | 0.44 | 0.47 |
| 12"       | 13.20    | 0.31 | 0.34   | 0.37       | 0.40        | 0.43 | 0.46 | 0.49 |
| 14"       | 15.30    | 0.33 | 0.36   | 0.39       | 0.42        | 0.45 | 0.48 | 0.51 |
| 16"       | 17.40    | 0.34 | 0.37   | 0.40       | 0.43        | 0.46 | 0.49 | 0.52 |
| 18"       | 19.50    | 0.35 | 0.38   | 0.41       | 0.44        | 0.47 | 0.50 | 0.53 |
| 20"       | 21.60    | 0.36 | 0.39   | 0.42       | 0.45        | 0.48 | .051 | 0.54 |
| 24"       | 25.80    | 0.38 | 0.41   | 0.44       | 0.47        | 0.50 | 0.53 | 0.56 |
| 30"       | 32.00    | 0.39 | 0.43   | 0.48       | 0.51        | 0.55 | 0.59 | 0.63 |
| 36"       | 38.30    | 0.43 | 0.47   | 0.53       | 0.58        | 0.63 | 0.68 | 0.73 |
| 42"       | 44.50    | 0.47 | 0.53   | 0.59       | 0.65        | 0.71 | 0.77 | 0.83 |
| 48"       | 50.80    | 0.51 | 0.58   | 0.65       | 0.72        | 0.79 | 0.86 | 0.93 |
| 54"       | 57.56    | 0.57 | 0.65   | 0.73       | 0.81        | 0.89 | 0.97 | 1.05 |

†These special thickness classes were designated standard thickness classes by AWWA/ANSI Standard C150/A21.50-81.



| Dimens          | ions in M               | lillimetr              | es                       | Dimens          | sions in In             | ches                   |                          |
|-----------------|-------------------------|------------------------|--------------------------|-----------------|-------------------------|------------------------|--------------------------|
| Nominal<br>Size | Avg. Inside<br>Diameter | Min. Wall<br>Thickness | Avg. Outside<br>Diameter | Nominal<br>Size | Avg. Inside<br>Diameter | Min. Wall<br>Thickness | Avg. Outside<br>Diameter |
| Class 16        | 65 (DR25)               |                        |                          | Class 1         | 65 (DR25)               |                        |                          |
| 100             | 112                     | 5                      | 122                      | 4               | 4.42                    | .192                   | 4.80                     |
| 150             | 161                     | 7                      | 175                      | 6               | 6.35                    | .276                   | 6.90                     |
| 200             | 212                     | 9                      | 230                      | 8               | 8.33                    | .362                   | 9.05                     |
| 250             | 260                     | 11                     | 282                      | 10              | 10.21                   | .444                   | 11.10                    |
| 300             | 309                     | 13                     | 335                      | 12              | 12.15                   | .527                   | 13.20                    |
| Class 23        | 35 (DR18)               |                        |                          | Class 2         | 35 (DR18)               |                        |                          |
| 100             | 108                     | 7                      | 122                      | 4               | 4.27                    | .267                   | 4.80                     |
| 150             | 155                     | 10                     | 175                      | 6               | 6.13                    | .383                   | 6.90                     |
| 200             | 204                     | 13                     | 230                      | 8               | 8.05                    | .502                   | 9.05                     |
| 250             | 250                     | 16                     | 282                      | 10              | 9.87                    | .616                   | 11.10                    |
| 300             | 297                     | 19                     | 335                      | 12              | 11.73                   | .733                   | 13.20                    |
| Class 30        | )5 (DR14)               |                        |                          | Class 3         | 05 (DR14)               |                        |                          |
| 100             | 104                     | 9                      | 122                      | 4               | 4.11                    | .343                   | 4.80                     |
| 150             | 149                     | 13                     | 175                      | 6               | 5.91                    | .493                   | 6.90                     |
| 200             | 198                     | 16                     | 230                      | 8               | 7.76                    | .646                   | 9.05                     |
| 250             | 242                     | 20                     | 282                      | 10              | 9.51                    | .793                   | 11.10                    |
| 300             | 287                     | 24                     | 335                      | 12              | 11.31                   | .943                   | 13.20                    |

Dimension Ratio (DR) is the outside diameter of the pipe divided by the minimum wall thickness.



### **Combination Air Valves**

| WATER COMBINATION AIR VALVES (SINGLE BODY) |        |         |     |              |           |            |  |  |
|--------------------------------------------|--------|---------|-----|--------------|-----------|------------|--|--|
| Inlet                                      | Outlet | Model   | CWP | Orifico Sizo | Dimension | is (Inches |  |  |
| Size                                       | Size   | Number* | PSI | Office Size  | Α         | В          |  |  |
| 1" NPT                                     | 1" NPT | 2010.2  | 300 | 5/64"        | 11.38     | 10.50      |  |  |
| 2" NPT                                     | 2" NPT | 202C.2  | 300 | 3/32"        | 14.00     | 13.00      |  |  |
| 3" NPT                                     | 3" NPT | 203C.2  | 300 | 3/32"        | 16.00     | 15.00      |  |  |
| 3" <b>12</b> 5lb Flg                       | 3" NPT | 2030.14 | 150 | 3/32"        | 16.00     | 16.75      |  |  |
| 3" 250lb Flg                               | 3" NPT | 2030.15 | 300 | 3/32"        | 16.00     | 17.25      |  |  |
| 4" 125lb Flg                               | 4" NPT | 204C.14 | 150 | 3/32"        | 18.50     | 19.00      |  |  |
| 4" 250lb Flg                               | 4" NPT | 204C.15 | 300 | 3/32"        | 18.50     | 20.25      |  |  |
| 6" 125lb Flg                               | 6" NPT | 206C    | 150 | 3/8"         | 21.00     | 20.25      |  |  |
| 6" 250lb Flg                               | 6" NPT | 256C    | 300 | 7/32"        | 21.00     | 20.25      |  |  |
| 8" 125lb Flg                               | 8" NPT | 208C    | 150 | 3/8"         | 25.00     | 23.50      |  |  |
| 8" 250lb Flg                               | 8" NPT | 258C    | 300 | 7/32"        | 25.00     | 23.50      |  |  |



201C.2 - 204C.15 Single Body Combination Air Valves



206C - 258C Single Body Combination Air Valves

\*NSF 61 & 372 Certified

| WASTEWATER COMBINATION AIR VALVES (SINGLE BODY) |                  |        |        |              |                     |       |       |  |
|-------------------------------------------------|------------------|--------|--------|--------------|---------------------|-------|-------|--|
|                                                 | Inlet Outlet Mod | Model  | CWP    | Orifica Siza | Dimensions (Inches) |       |       |  |
|                                                 | Size             | Size   | Number | PSI          | Office Size         | Α     | В     |  |
|                                                 | 2" NPT           | 1" NPT | 801A   | 150          | 1/8"                | 7.00  | 14.94 |  |
|                                                 | 2" NPT           | 2" NPT | 802A   | 150          | 9/64"               | 9.50  | 18.06 |  |
|                                                 | 3" NPT           | 3" NPT | 803A   | 150          | 11/64"              | 11.00 | 19.20 |  |
|                                                 | 4" NPT           | 4" NPT | 804    | 150          | 11/64"              | 11.00 | 23.50 |  |



Single Body Combination Air Valve



Single Body Combination Air Valve with FloodSafe<sup>®</sup> Inflow Preventer



# **B** MODELLING RESULTS



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## FINAL DESIGN REPORT APPENDIX

## C HAZARDOUS MATERIAL SURVEY

### REGULATED MATERIALS SURVEY

## FIRST LAKE PUMPING STATION, 1A KINGFISHER WAY, LOWER SACKVILLE, NOVA SCOTIA

HALIFAX WATER

FEBRUARY 12, 2021

wsp


## REGULATED MATERIALS SURVEY

FIRST LAKE PUMPING STATION, 1A KINGFISHER WAY, LOWER SACKVILLE, NOVA SCOTIA

HALIFAX WATER

FINAL REPORT WSP PROJECT NO.: 201-11341 CLIENT PROJECT NO.: P21.2020 DATE: FEBRUARY 12, 2021

WSP 1 SPECTACLE LAKE DRIVE DARTMOUTH, NS, CANADA B3B 1X7

T +1 902-935-9955 F +1 902-835-1645 WSP.COM



February 12, 2021

Halifax Water Halifax Regional Water Commission 450 Cowie Hill Road P.O. Box 8388 RPO CSC Halifax, NS, B3K 5M1

#### Attention: Ray Rice

#### Subject: Limited Regulated Materials Survey, Control Building - First Lake Pumping Station, 1A Kingfisher Way, Sackville, NS

WSP Canada Inc. (WSP) is pleased to present the results of the Limited Regulated Materials Survey (RMS) conducted for the Control Building of the First Lake Pumping Station, located at 1A Kingfisher Way in Sackville, Nova Scotia. We trust that this information meets your current requirements. If you have any questions, please do not hesitate to contact us.

Yours sincerely,

Kallyn DeGrace Environmental Engineering Technologist - Atlantic Environment

Lee Hyne

Lee Hynes, P.Eng., M.A.Sc. Project Manager – Atlantic Environment

WSP ref.: 201-11341

This report was prepared by WSP Canada Inc. for the account of HALIFAX WATER, in accordance with the professional services agreement. The disclosure of any information contained in this report is the sole responsibility of the intended recipient. The material in it reflects WSP's best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This limitations statement is considered part of this report.

The original of the technology-based document sent herewith has been authenticated and will be retained by WSP for a minimum of ten years. Since the file transmitted is now out of WSP's control and its integrity can no longer be ensured, no guarantee may be given with regards to any modifications made to this document.

1 Spectacle Lake Drive Dartmouth, NS, Canada B3B 1X7

T: +1 902-835-9955 F: +1 902-835-1645 wsp.com

### EXECUTIVE SUMMARY

WSP Canada Inc. (WSP) was retained by Halifax Water to complete a Limited Regulated Materials Survey for the Control Building of the First Lake Pumping Station, located at 1A Kingfisher Way in Sackville, Nova Scotia.

The purpose of this survey was to complete a sampling program in the Site Building to determine the types and quantities of regulated materials that may be encountered during building demolition associated with upcoming upgrades to the pumping station facility.

A total of twelve (12) asbestos samples, three (3) lead paint samples and one (1) lead paint leachate sample were collected from the Site and sent to EMSL for laboratory analysis. A summary of the results of WSP's sampling program is presented below:

#### ASBESTOS

Asbestos was not identified in any of the four building materials tested during the survey.

#### LEAD

#### Low-Level Lead Paint:

Lead concentrations exceeding the *Surface Coating Materials Regulations* (90 ppm) criteria but below 1,000 ppm were reported in the sample listed below. This paint is considered 'low-level lead paint' and is considered a potential health risk if disturbed. This paint does not require specialized disposal.

• LP1: Beige paint applied to interior cinderblock walls.

#### Lead-Containing Paint:

The Code of Practice defines a "Lead-Containing Material" as a material containing an inorganic lead concentration exceeding 0.1% (1,000 ppm). None of the paint samples reported lead concentrations exceeding the 1,000 ppm criteria.

Lead-containing materials can be disposed of at Nova Scotia Landfills if the total bulk concentrations and the leachate concentrations do not exceed 1,000 ppm and 5 mg/L.

#### **RECOMMENDATIONS**

#### GENERAL

- Provide a copy of this report to all contractors who will bid on future renovation work for the areas investigated as part of this assessment.
- Retain qualified contractors to remove and dispose of identified, presumed, and potentially hazardous materials as per provincial and federal acts, regulations and codes of practice.
- Require all employees and contractors who may disturb hazardous materials wear appropriate Personal Protective Equipment.
- Require that contractors follow procedures to minimize the generation of dust which may contain asbestos, lead or other hazardous substances.

#### LEAD

• If 'low-level lead-containing materials' are disturbed in a non-aggressive manner (i.e. no abrasive blasting, grinding, welding, heating, etc.), it is recommended that dust suppression and general construction health & safety measures be utilized; these include but are not limited to: not smoking, eating, drinking and chewing gum in the work area, dust suppression techniques being implemented, and facilities being made available for workers to wash hands and face.

The statements in this Executive Summary are subject to the limitations included in Appendix D of this report and are to be read in conjunction with the remainder of the report.

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## wsp

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## 1 INTRODUCTION

#### 1.1 BACKGROUND

WSP Canada Inc. (WSP) was retained by Halifax Water to complete a Limited Regulated Materials Survey for the Control Building of the First Lake Pumping Station, located at 1A Kingfisher Way in Sackville, Nova Scotia.

The purpose of this survey was to complete a sampling program in the Site Building to determine the types and quantities of regulated materials that may be encountered during building demolition associated with upcoming upgrades to the pumping station facility.

#### 1.2 SURVEY OBJECTIVES

The objectives of the Limited Regulated Materials Survey were to:

- Complete a sampling program in the Site Building to determine types and quantities of regulated materials that may be present in advance of building demolition.
- Following the completion of the survey, complete temporary repairs to sample locations (where required) to protect staff and general public from potential exposure to regulated materials.

#### 1.3 SCOPE OF WORK

The scope of work for this Limited Regulated Materials Survey entailed:

- Preparation of a site-specific Health and Safety Plan.
- Collection of twelve (12) samples of selected for asbestos analysis.
- Collection of three (3) paint samples for total lead analysis.
- Collection of one (1) paint sample for lead leachate analysis.

The survey involved limited destructive sampling (i.e. brick mortars, wall paint, insulation) for identification of potential friable and non-friable asbestos-containing materials as well as lead in paint. Asbestos means any of the following fibrous silicates: actinolite, amosite, anthophyllite, chrysotile, crocidolite or tremolite. The term 'friable material' is applied to a material that when dry, can be crumbled, pulverized or powdered with moderate hand pressure. Asbestos materials that are friable have a greater potential to release airborne asbestos fibres when disturbed. Common friable asbestos-containing buildings materials used in the past include sprayed fireproofing, stucco texture coat, and thermal pipe and jacket insulation. Common non-friable asbestos containing materials include vinyl floor tiles, gasket materials, asbestos cement (Transite<sup>TM</sup>) pipe, Transite<sup>TM</sup> board and asbestos textiles. These materials can however release fine dust due to deterioration or during removal that is considered friable.

## 2 METHODOLOGY

#### 2.1 GENERAL SURVEY METHODOLOGY

WSP's survey sought to identify those substances defined as Dangerous Goods under the *Dangerous Good Management Regulations* under section 84 of the *Environment Act (1995)*, including: asbestos (friable and nonfriable) and lead. Building materials containing substances outlined in the *Dangerous Good Management Regulations* are often referred to as Regulated Materials for the purposes of assessment and documentation of such materials; this terminology is used throughout this report.

WSP's surveyors performed a systematic survey of the site for the purposes of identifying Regulated Materials and documenting observations made about their locations, estimated quantities and respective conditions. These observations form the basis for developing the recommendations provided within this report.

In situations where asbestos-containing materials or other Regulated Materials (lead paint) are confirmed, and the material extends into a non-accessible area such as the exterior of the second level windows, it is assumed that the asbestos-containing materials are also present in these areas and will be reported as such.

#### 2.2 ASBESTOS SURVEY METHODOLOGY

The surveyors inspected interior mortar and insulation, and exterior mortar and shingles for the presence of friable and non-friable asbestos-containing materials (ACM). Bulk samples were collected from suspect materials (i.e. materials known as having the potential to be asbestos-containing) and analyzed to identify or confirm the presence/absence of asbestos. Asbestos samples are collected by taking a small volume of material (approximately two square centimeters in size) from either intact material or preferably from a damaged section. Three individual samples are collected to represent one homogenous material, with sample IDs referring to the number of the homogenous material being sampled followed by A, B or C to represent the individual samples from different locations (e.g. AS1-A is the first homogenous material being sampled for asbestos [AS1], and this sample is the first of 3 to be collected of this material [-A]). The collected samples were placed in zipper storage plastic bags and labelled accordingly.

The bulk samples were then submitted to an accredited, independent laboratory for analysis of asbestos content (accompanied by a chain of custody form) via United States Environmental Protection Agency (US EPA) Method EPA/600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials. For this assessment, the laboratory utilized was EMSL Analytical Inc., located at 2756 Slough Street in Mississauga, Ontario. EMSL is accredited to AIHA-LAP, LLC IHLAP 196142 by the Canadian Association for Laboratory Accreditation (CALA) and the Standards Council of Canada (SCC).

The number of bulk samples required, in order to establish whether a material is asbestos-containing according to the *Nova Scotia Occupational Health and Safety Act* code of practice, *Asbestos in the Workplace: A Guide to Assessment & Management of Asbestos in the Workplace* summarized in Table 2-1, below.

#### Table 2-1: Asbestos Bulk Material Sample Requirements

| TYPE OF MATERIAL                                                                                         | SIZE OF HOMOGENEOUS MATERIAL                          | MINIMUM # OF BULK<br>SAMPLES |
|----------------------------------------------------------------------------------------------------------|-------------------------------------------------------|------------------------------|
| Surfacing material, including without limitation<br>material that is applied to surfaces by spraying, by | Less than 90m <sup>2</sup>                            | 3                            |
| troweling or otherwise, such as acoustical plaster<br>on ceilings, fireproofing materials on structural  | $90\text{m}^2$ or more, but less than $450\text{m}^2$ | 5                            |
| members and plaster                                                                                      | 450m <sup>2</sup> or more                             | 7                            |
| Thermal insulation, except as described below                                                            | Any size                                              | 3                            |
| Thermal insulation patch                                                                                 | Less than 2m or 0.5m <sup>2</sup>                     | 1                            |
| Other material                                                                                           | Any size                                              | 3                            |

In accordance with the analysis techniques required by the Nova Scotia Occupational Health and Safety Act, where layered materials are present, subsamples are taken from each individual or discrete layer and each subsample is then treated as a discrete sample.

A total of twelve (12) samples were collected from four (4) homogenous materials and submitted for asbestos analysis as part of this survey.

#### 2.3 LEAD SURVEY METHODOLOGY

Bulk paint samples (paint chips) were collected from interior walls and floors, as well as the exterior door. Samples were collected with the aid of a thin-bladed knife and a paint scraper, each of which were cleaned prior to each sampling event. WSP's surveyors selected sample locations where it appeared that the paint application was most representative of all areas on which it was applied. Each paint chip sample was placed in a clear bag with a tight closure, uniquely labelled and then placed in a second, similar bag. A chain of custody form was completed and accompanied the bulk samples to EMSL Analytical Inc. for analysis of lead content. Lead analysis was performed following ASTM Method, ASTM D3335-85A "*Standard Method to Test for Low Concentrations of Lead in Paint by Atomic Absorption Spectrophotometry*".

A total of three (3) lead paint samples and one (1) lead leachate sample were collected for analysis.

### **3 SITE OVERVIEW**

#### 3.1 SITE DESCRIPTION

The subject Site is located at 1A Kingfisher Way in Lower Sackville, Nova Scotia. The Site is occupied by a onestorey stone building with pumps located underground beside the building. The building contains a several electric heaters with built in thermostats, two fluorescent light fixtures, a generator, and a fuel tank.

The walls within the building consisted of painted cinderblock and the floor was constructed of concrete. The ceiling was composed of drywall with a layer of pink insulation laid over top. The exterior of the building was finished with stone and a single metal door is installed on the south-west side of the building. Metal trim and gutters surround the shingled roof.

#### 3.2 SITE INSPECTION

The building was inspected by WSP representative Kallyn DeGrace on December 16, 2020. A total of twelve (12) asbestos samples, three (3) lead paint samples and one (1) lead leachate sample were collected from the Site and sent to EMSL for laboratory analysis. Photos of each sampling location can be found in Appendix A.

### 4 REGULATORY CONTEXT

The survey was conducted according to the requirements of the applicable provincial and federal acts, regulations and policies. Specific regulations related to asbestos and lead in paint are summarized below, in addition to other relevant provincial and federal regulations, guidelines and reference documents.

#### 4.1 ASBESTOS

Asbestos is a component of a variety of building materials manufactured before 1984 including mechanical insulation, floor tiles, ceiling tiles, caulking, plaster, wiring, etc. Workers and building occupants may be exposed during demolition/renovation activities. Exposure to asbestos can cause cancer and lung disease. The route of exposure is primarily by inhalation.

In Nova Scotia, an asbestos-containing material (ACM) is defined as any material that contains at least 0.5% asbestos by volume according to the NS Department of Labour and Advanced Education document entitled *Asbestos in the Workplace: A Guide to Removal of Friable Asbestos Containing Material*. ACMs are placed into two general classes, "friable" and "non-friable" ACMs. Friable ACMs are those materials that when dry can be crumbled, pulverized and reduced to powder by hand pressure.

The disposal of asbestos waste must follow the guidelines set out in the Asbestos Waste Management Regulations and Asbestos in the Workplace: A Guide to Removal of Friable Asbestos Containing Material documents. According to the Asbestos Waste Management Regulations, asbestos waste is defined as friable waste material containing asbestos fibre or asbestos dust in a concentration greater than 1% by weight.

#### 4.2 LEAD

Lead may be present in paint, solder used on copper pipes, caulking on cast iron water pipes, glazing on ceramic tiles, electrical wires and fixtures. Workers and building occupants may be exposed during demolition/renovation activities. Primary routes of exposure include inhalation, absorption through the skin and ingestion. Overexposure can affect the blood, kidneys, gastro-intestinal system, nervous system and reproductive system.

The following guidelines and codes of practice have been developed by the Nova Scotia Department of Labour and Advanced Education and the Nova Scotia Department of Environment to govern the management of lead in Nova Scotia:

- Lead in the Workplace: A Guide to Working with Lead (2015), which is based on and supported by the following previously published guidelines/codes of practice:
  - Working with Inorganic Lead: Code of Practice (2010);
  - Working with Inorganic Lead An Information Package; and,
  - o Guidelines for Disposal of Contaminated Solids in Landfills (2012).

The Code of Practice defines a "Lead-Containing Material" as a material containing an inorganic lead concentration exceeding 0.1% (1,000 ppm).

The maximum acceptable concentrations for disposal of lead-containing substances is defined by the Nova Scotia Guidelines for Disposal of Contaminated Solids in Landfills and is summarized in the following table. Lead-containing materials can be disposed of at Nova Scotia Landfills if the total concentrations and the leachate concentrations do not exceed the listed values.

#### Table 4-1: Maximum Acceptable Concentrations of Lead-Containing Substances for Landfill Disposal

| MATERIAL | TOTAL CONCENTRATION MAXIMUM<br>LIMIT (PPM) | LEACHATE CONCENTRATION MAXIMUM<br>LIMIT (MG/L) |
|----------|--------------------------------------------|------------------------------------------------|
| Lead     | 1,000                                      | 5                                              |

The Surface Coating Materials Regulation (SOR/2016-193) made under the federal Hazardous Products Act (HPA) prescribes an acceptable level of 0.009% (90 mg/kg) lead by dry weight or less, as determined by bulk chemical analysis in accordance with good laboratory practises. Under the Surface Coating Materials Regulation (SOR/2005-109) Section 4.2, the following paints and surface coatings are excluded from the above noted acceptable lead level:

- as an anti-corrosive or an anti-weathering coating applied on the interior or exterior surface of any building or equipment that is used for an agricultural or industrial purpose;
- as an anti-corrosive or an anti-weathering coating applied on any structure other than a building, that is used for an agricultural, industrial or public purpose;
- as a touch-up coating for metal surfaces;
- on traffic signs;
- for graphic art on billboards or similar displays;
- for identification marks in industrial buildings; or
- as materials for the purposes of arts, crafts or hobbies, other than material for use by children.

For the purposes of this report, WSP has classified anything between 90 ppm and 1000 ppm as 'low-level lead-containing paint'.

#### 4.3 OTHER APPLICABLE REGULATIONS AND GUIDELINES

Additional provincial and federal regulations, relevant guidelines and reference documents are as follows:

- Hazardous Products Act, R.S.C., c.H-3 (amended 2018)
- Occupational Health and Safety Act, S.N.S. 1996 (amended 2016)
- Environmental Emergency Regulations, N.S.Reg.16/2013
- Dangerous Goods Management Regulations, N.S. Reg. 57/2016
- Dangerous Goods Transportation Act, N.S. Reg. 105//2002
- PCB Regulations, SOR/2008-273 (amended 2015)
- Identification of Lamp Ballasts Containing PCBs, Environment Canada Report EPA 2/CC/2, revised 1991
- Guidelines for Management of Wastes Containing PCBs, Environment Canada, 1989
- Handbook on PCBs in Electrical Equipment, 3rd ed. Environment Canada, 1988
- Canada Wide Standard for Mercury Containing Lamps (Canadian Council of Ministers of the Environment [CCME], 2001)

- Canada Wide Standard for Mercury Emissions (CCME, 2000)
- Mould Guidelines for the Canadian Construction Industry (Canadian Centre for Architecture [CCA], 2004)
- Fungal Contamination in Public Buildings: A Guide to Recognition and Management, Federal- Provincial Committee on Environmental and Occupational Health, 2004
- Environmental Abatement Council of Ontario (EACO) Mould Abatement Guidelines, 3<sup>rd</sup> Edition (2015)
- Ozone Layer Protection Regulations, N.S. Reg. 54/95
- Surface Coating Materials Regulation, SOR/2016-193 (updated 2019)

### 5 OBSERVATIONS AND RESULTS

Information in this section of the report should be provided to all prospective contractors, tenants, and/or workers who are likely to handle, come into contact with, or disturb asbestos or other regulated materials. Detailed specifications that outline specific abatement procedures are recommended when tendering any potential renovation/demolition work.

This information may require updating upon the removal of regulated materials upon completion of the renovations or demolition. A close out report stating that the materials are no longer present is also required once the materials are removed. If ACM is to remain in place, *Asbestos in the Workplace: A Guide to Assessment & Management of Asbestos in the Workplace* requires the owner to prepare and establish an Asbestos Management Plan for the building.

Contractors and maintenance personnel should be warned of the possibility of undisclosed materials when breaking into enclosed areas. Friable and Non-Friable building materials discovered in enclosed areas should be treated as asbestos until proven otherwise and other substances, self-evident as designated substances, should be handled in a likewise fashion.

#### 5.1 ASBESTOS

#### 5.1.1 ASBESTOS-CONTAINING MATERIALS

In accordance with the requirements of the NS document *Asbestos in the Workplace: A Guide to Removal of Friable Asbestos Containing Material*, homogenous materials (i.e. materials uniform in color and texture) are considered to be asbestos-containing if any sample which is collected from that homogeneous material, is identified to have an asbestos concentration of 0.5% or greater.

A total of twelve (12) building material samples were collected from four (4) homogeneous building materials and submitted for laboratory analysis of asbestos content using the EPA600/R-93/116 method with "positive stop". Positive stop methodology refers to discontinuing further analyses of samples from a homogenous material after the first positive identification of asbestos from a sample of that material.

Asbestos was not identified in any of the four building materials tested during the survey. As such, all samples have been identified as "non-asbestos" and are summarized in Section 5.1.2, below.

#### 5.1.2 BULK SAMPLES IDENTIFIED AS "NON-ASBESTOS"

The table below summarizes the results of bulk material samples collected from suspect materials during this survey, which had either no detectable concentrations of asbestos, or had asbestos concentrations less than the regulated threshold limit of 0.5% (by weight), and therefore can be considered as "non-asbestos" in accordance with *Asbestos in the Workplace: A Guide to Assessment & Management of Asbestos in the Workplace.* 

#### Table 5-1: Summary of Bulk Samples Identified as "Non-Asbestos"

| MATERIAL DESCRIPTION & LOCATION             | SAMPLE ID  | PHOTO<br>REFERENCE |
|---------------------------------------------|------------|--------------------|
| Insulation from the interior of the ceiling | AS1-A/B/C  | 3                  |
| Mortar from interior cinder block walls     | AS2-A/B/C  | 4-5                |
| Mortar from exterior stone walls            | AS3-A/B/C  | 6                  |
| Shingles taken from roof                    | AS4-A//B/C | 7                  |

1 For relevant photographs taken during the survey refer to Appendix A: Site Photographs.

2 For sample ID and concentration levels refer to Appendix B: Laboratory Certificates.

#### 5.2 LEAD

#### 5.2.1 LEAD PAINT

A total of three (3) paint samples from three unique painted surfaces were collected and analyzed at the time of the survey. The table below summarizes the results of laboratory analyses for the bulk paint and surface coating samples collected during the survey. Photos of paint samples are provided in Appendix A. Laboratory results sheets are provided in Appendix B.

#### Table 5-2: Summary of Bulk Paint Sample Analytical Results

| MATERIAL DESCRIPTION & LOCATION                              | SAMPLE INFORMATION                                                 |
|--------------------------------------------------------------|--------------------------------------------------------------------|
| Beige paint from interior walls<br>Photo 8                   | Sample ID: LP1<br>Concentration: <b>210 ppm</b><br>Condition: Good |
| Grey paint from interior floor<br>Photo 9                    | Sample ID: LP2<br>Concentration: <80 ppm<br>Condition: Good        |
| Brown paint from interior of metal door and trim<br>Photo 10 | Sample ID: LP4<br>Concentration: <82 ppm<br>Condition: Good        |

1 For relevant photographs taken during the survey refer to Appendix A: Site Photographs.

2 For sample ID and concentration levels refer to Appendix B: Laboratory Certificates.

#### Low-Level Lead Paint:

The Surface Coating Materials Regulation (SOR/2016-193) made under the federal Hazardous Products Act (HPA) prescribes an acceptable level of 0.009% (90 mg/kg or 90 ppm) lead by dry weight or less. As shown in Table 5-2, one (1) lead in paint results (samples LP1) exceeded the Surface Coating Materials Regulation guideline of 90 ppm (but were below 1,000 ppm) and are considered 'low-level lead-containing paint'.

If 'low-level lead-containing materials' are disturbed in a non-aggressive manner (i.e. no abrasive blasting, grinding, welding, heating, etc.), it is recommended that dust suppression and general construction health & safety measures be utilized; these include but are not limited to: not smoking, eating, drinking and chewing gum in the work area, dust suppression techniques being implemented, and facilities being made available for workers to wash hands and face.

#### **Lead-Containing Paint:**

Samples with lead concentrations equal to or greater than 1,000 ppm (0.1%) by weight are considered "lead-containing" under the NS Code of Practice for Working with Inorganic Lead. As shown in Table 5-2, none of the samples exceeded this threshold and therefore, are not considered 'lead-containing paint'.

#### 5.2.2 LEAD LEACHATE

According to the *Nova Scotia Guidelines for Disposal of Contaminated Solids in Landfills*, leachate testing is required for materials that exceed the guideline value, to determine if disposal at a landfill is acceptable.

The leachate extraction test must be done using the Toxicity Characteristic Leaching Procedure, Method 1311 that appears in the United States Environmental Protection Agency Publication SW-846 entitled "Test Method for Evaluating Solid Waste, Physical/Chemical Methods", as amended from time to time, or an equivalent test method approved by the department. If results of the testing exceed 5 mg/L, the material is considered leachable toxic and cannot be disposed of at a landfill facility. According to the *Management Guide for Construction and Demolition Debris* (November 2013), lead paint can be disposed of at an approved Construction & Demolition (C & D) waste site.

A total of one (1) paint sample from one unique painted surface was collected for lead leachate analysis at the time of the survey. Note that sample LL1 was collected from the same painted materials as samples LP1, which was also analyzed for total lead content (see Section 5.2.1). The table below summarizes the results of laboratory analyses for lead leachate. Photos of sample locations are provided in Appendix A. Laboratory results sheets are provided in Appendix B.

#### Table 5-3: Summary of Lead Leachate Analytical Results

| MATERIAL DESCRIPTION & LOCATION           | SAMPLE INFORMATION                                                            |
|-------------------------------------------|-------------------------------------------------------------------------------|
| Beige paint on interior walls<br>Photo 11 | Sample ID: LL1 (w/ substrate)<br>Concentration: <0.40 mg/L<br>Condition: Good |

1 For relevant photographs taken during the survey refer to Appendix A: Site Photographs.

2 For sample ID and concentration levels refer to Appendix B: Laboratory Certificates.

As shown in Table 5-3, the lead leachate result complied with applicable criteria (5 mg/L).

### 6 SUMMARY

Confirmed and potential hazardous materials identified during the survey are summarized below.

#### 6.1 ASBESTOS

Asbestos was not identified in any of the four building materials tested during the survey.

#### 6.2 LEAD IN PAINT

#### Low-Level Lead Paint:

Lead concentrations exceeding the *Surface Coating Materials Regulations* (90 ppm) criteria but below 1,000 ppm were reported in the sample listed below. This paint is considered 'low-level lead paint' and is considered a potential health risk if disturbed. This paint does not require specialized disposal.

• LP1: Beige paint applied to interior cinderblock walls.

#### **Lead-Containing Paint:**

The Code of Practice defines a "Lead-Containing Material" as a material containing an inorganic lead concentration exceeding 0.1% (1,000 ppm). None of the paint samples reported lead concentrations exceeding the 1,000 ppm criteria.

## 7 RECOMMENDATIONS

Based on the results of the Limited Regulated Materials Survey, the following recommendations are provided:

#### GENERAL

- Provide a copy of this report to all contractors who will bid on future renovation work for the areas investigated as part of this assessment.
- Retain qualified contractors to remove and dispose of identified, presumed, and potentially hazardous materials as per provincial and federal acts, regulations and codes of practice.
- Require all employees and contractors who may disturb hazardous materials wear appropriate Personal Protective Equipment.
- Require that contractors follow procedures to minimize the generation of dust which may contain asbestos, lead or other hazardous substances.

#### LEAD

• If 'low-level lead-containing materials' are disturbed in a non-aggressive manner (i.e. no abrasive blasting, grinding, welding, heating, etc.), it is recommended that dust suppression and general construction health & safety measures be utilized; these include but are not limited to: not smoking, eating, drinking and chewing gum in the work area, dust suppression techniques being implemented, and facilities being made available for workers to wash hands and face.

### 8 CLOSURE

This report has been prepared by Kallyn DeGrace. Internal senior technical review has been provided by Lee Hynes, P. Eng. Technical limitations associated with the report can be found in Appendix C.

Yours truly,

WSP Canada Inc.

Darach

Kallyn DeGrace Environmental Engineering Technologist - Atlantic Environment

Lee Hyne

Lee Hynes, P.Eng., M.A.Sc. Project Manager – Atlantic Environment





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Halifax Water First Lake Pumping Station, 1A Kingfisher Way, Lower Sackville, NS – Photographic Log Project Number 201-11341



Photo 1: Interior of pumping station from door, December 16, 2020.



Photo 3: Sample set AS1, pink insulation from ceiling, December 16, 2020.



Photo 2: Interior of pumping station from rear, December 16, 2020.



Photo 4: Sample AS2-A, mortar from interior wall, December 16, 2020.

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Halifax Water First Lake Pumping Station, 1A Kingfisher Way, Lower Sackville, NS – Photographic Log Project Number 201-11341



Photo 5: Samples AS2-B and AS2-C, mortar from interior wall, December 16, 2020.



Photo 7: Sample set AS4, shingles from roof of building, December 16, 2020.



Photo 6: Sample set AS3, mortar from exterior wall, December 16, 2020.



Photo 8: Sample LP1, beige paint from interior wall, December 16, 2020.

### d s w

Halifax Water First Lake Pumping Station, 1A Kingfisher Way, Lower Sackville, NS – Photographic Log Project Number 201-11341



Photo 9: Sample LP2, grey paint from interior floor, December 16, 2020.



Photo 11: Sample LL1, beige paint with substrate from interior wall, December 16, 2020.



Photo 10: Sample LP3, brown paint from metal door and trim, December 16, 2020.



Photo 12: Light ballast from interior light, non-PCB. December 16, 2020.

## **APPENDIX**



EMSL Canada Order 552016710 EMSL Canada Inc. 55GNVR34 Customer ID: MS 2756 Slough Street Mississauga, ON L4T 1G3 201-11341-00 Customer PO: Phone/Fax: (289) 997-4602 / (289) 997-4607 Project ID: http://www.EMSL.com / torontolab@emsl.com Attn: Phone: (902) 835-9955 Lee Hynes Fax: WSP Canada, Inc. 1 Spectacle Lake Drive Collected: 12/16/2020 Dartmouth, NS B3B 1X7 Received: 12/18/2020 Analyzed: 12/29/2020 Proj: 201-11341-00 Test Report: Asbestos Analysis of Bulk Materials for Nova Scotia Code of Practice Section 66 OHS Act - Asbestos in the Workplace via EPA600/R-93/116 Method

Lab Sample ID: 552016710-0001 Client Sample ID: AS1-A Sample Description: Insulation Analyzed Non-Asbestos TEST Date Color Fibrous Non-Fibrous Asbestos Comment PLM 12/24/2020 10.0% Pink 90.0% None Detected Lab Sample ID: 552016710-0002 Client Sample ID: AS1-B Sample Description: Insulation Analyzed Non-Asbestos TEST Date Color Fibrous Non-Fibrous Asbestos Comment PLM 12/24/2020 Pink 90.0% 10.0% None Detected AS1-C Lab Sample ID: 552016710-0003 Client Sample ID: Sample Description: Insulation Non-Asbestos Analyzed TEST Fibrous Non-Fibrous Comment Date Color Asbestos PLM 12/29/2020 Pink 90.0% 10.0% None Detected Client Sample ID: AS2-A Lab Sample ID: 552016710-0004 Sample Description: Mortar from interior Analyzed Non-Asbestos TEST Date Color Fibrous Non-Fibrous Asbestos Comment PLM 12/24/2020 Gray 0.0% 100.0% None Detected AS2-B Lab Sample ID: 552016710-0005 Client Sample ID: Sample Description: Mortar from interior Non-Asbestos Analvzed TEST Date Fibrous Non-Fibrous Comment Color Asbestos PLM 12/24/2020 Gray 0.0% 100.0% None Detected AS2-C Lab Sample ID: 552016710-0006 Client Sample ID: Sample Description: Mortar from interior Analyzed Non-Asbestos TEST Date Color Fibrous Non-Fibrous Asbestos Comment PLM 12/29/2020 Gray 0.0% 100.0% None Detected Lab Sample ID: 552016710-0007 AS3-A Client Sample ID: Sample Description: Mortar from exterior Analyzed Non-Asbestos TEST Fibrous Non-Fibrous Comment Date Color Asbestos PLM 12/24/2020 Gray 0.0% 100.0% None Detected



#### EMSL Canada Inc.

2756 Slough Street Mississauga, ON L4T 1G3 Phone/Fax: (289) 997-4602 / (289) 997-4607 <u>http://www.EMSL.com</u> / <u>torontolab@emsl.com</u>

#### Test Report: Asbestos Analysis of Bulk Materials for Nova Scotia Code of Practice Section 66 OHS Act - Asbestos in the Workplace via EPA600/R-93/116 Method

| Client Sample ID:   | AS3-B      |            |       |         |             |               | Lab Sample ID: | 552016710-0008 |
|---------------------|------------|------------|-------|---------|-------------|---------------|----------------|----------------|
| Sample Description: | Mortar fro | m exterior |       |         |             |               |                |                |
|                     |            | Analyzed   |       | Non     | -Asbestos   |               |                |                |
| TEST                |            | Date       | Color | Fibrous | Non-Fibrous | Asbestos      | Comment        |                |
| PLM                 |            | 12/24/2020 | Gray  | 0.0%    | 100.0%      | None Detected |                |                |
| Client Sample ID:   | AS3-C      |            |       |         |             |               | Lab Sample ID: | 552016710-0009 |
| Sample Description: | Mortar fro | m exterior |       |         |             |               |                |                |
|                     |            | Analyzed   |       | Non     | -Asbestos   |               |                |                |
| TEST                |            | Date       | Color | Fibrous | Non-Fibrous | Asbestos      | Comment        |                |
| PLM                 |            | 12/29/2020 | Gray  | 0.0%    | 100.0%      | None Detected |                |                |
| Client Sample ID:   | AS4-A      |            |       |         |             |               | Lab Sample ID: | 552016710-0010 |
| Sample Description: | Shingles   |            |       |         |             |               |                |                |
|                     |            | Analyzed   |       | Non     | -Asbestos   |               |                |                |
| TEST                |            | Date       | Color | Fibrous | Non-Fibrous | Asbestos      | Comment        |                |
| PLM                 |            | 12/24/2020 | Black | 0.0%    | 100.0%      | None Detected |                |                |
| Client Sample ID:   | AS4-B      |            |       |         |             |               | Lab Sample ID: | 552016710-0011 |
| Sample Description: | Shingles   |            |       |         |             |               |                |                |
|                     |            | Analyzed   |       | Non     | -Asbestos   |               |                |                |
| TEST                |            | Date       | Color | Fibrous | Non-Fibrous | Asbestos      | Comment        |                |
| PLM                 |            | 12/24/2020 | Black | 0.0%    | 100.0%      | None Detected |                |                |
| Client Sample ID:   | AS4-C      |            |       |         |             |               | Lab Sample ID: | 552016710-0012 |
| Sample Description: | Shingles   |            |       |         |             |               |                |                |
|                     |            | Analyzed   |       | Non     | -Asbestos   |               |                |                |
| TEST                |            | Date       | Color | Fibrous | Non-Fibrous | Asbestos      | Comment        |                |
| PLM                 |            | 12/29/2020 | Black | 0.0%    | 100.0%      | None Detected |                |                |

Analyst(s):

Anne Balayboa PLM (8) Tiffany Pilon PLM (4)

Reviewed and approved by:

and

Matthew Davis or other approved signatory or Other Approved Signatory

None Detected = <0.1%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency or the U.S. Government

Samples analyzed by EMSL Canada Inc. Mississauga, ON NVLAP Lab Code 200877-0

Initial report from: 12/29/202010:45:50



| Attn: | Lee Hynes              | Phone:     | (902) 835-9955      |
|-------|------------------------|------------|---------------------|
|       | WSP Canada, Inc.       | Fax:       |                     |
|       | 1 Spectacle Lake Drive | Received:  | 12/18/2020 08:50 AM |
|       | Dartmouth, NS B3B 1X7  | Collected: | 12/16/2020          |

Project: 201-11341-00

#### Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)\*

| Client SampleDescription | Collected Analyzed                                                 | Weight   | RDL    | Lead Concentration |
|--------------------------|--------------------------------------------------------------------|----------|--------|--------------------|
| LP1<br>552016713-0001    | 12/16/2020 12/21/2020<br>Site: Beige interior paint                | 0.2440 g | 82 ppm | 210 ppm            |
| LP2<br>552016713-0002    | 12/16/2020 12/21/2020<br>Site: Grey interior paint                 | 0.2518 g | 80 ppm | <80 ppm            |
| LP3<br>552016713-0003    | 12/16/2020 12/21/2020<br>Site: Brown paint, door and exterior trim | 0.2438 g | 82 ppm | <82 ppm            |

thanto

Rowena Fanto, Lead Supervisor or other approved signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted.

Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.008% wt based on the minimum sample weight per our SOP. "<" (less than) result signifies the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. Definitions of modifications are available upon request. Samples analyzed by EMSL Canada Inc. Mississauga, ON AIHA-LAP, LLC - ELLAP #196142

Initial report from 12/29/2020 08:20:16



| Attn: | Lee Hynes              | Phone:     | (902) 835-9955      |
|-------|------------------------|------------|---------------------|
|       | WSP Canada, Inc.       | Fax:       |                     |
|       | 1 Spectacle Lake Drive | Received:  | 12/18/2020 08:50 AM |
|       | Dartmouth, NS B3B 1X7  | Collected: | 12/16/2020          |

Project: 201-11341-00

#### Test Report: Toxicity Characteristic Leachate Procedure (1311/7000B)

| Client SampleDescription | Collected  | Analyzed                                            | RDL       | Lead Concentration |
|--------------------------|------------|-----------------------------------------------------|-----------|--------------------|
| LL1                      | 12/16/2020 | 12/22/2020                                          | 0.40 mg/L | <0.40 mg/L         |
| 552016713-0004           | Site: Beig | e paint with cinderblock substrate, leachate sample |           |                    |

Stanto

Rowena Fanto, Lead Supervisor or other approved signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. Definitions of modifications are available upon request.

Samples analyzed by EMSL Canada Inc. Mississauga, ON

Initial report from 12/29/2020 08:20:16

## **APPENDIX**

# C TECHNICAL LIMITATIONS



#### LIMITATIONS

#### Limited use

This Report was prepared for Halifax Water, solely for their exclusive use to provide an Assessment of current environmental conditions in association with the Site. WSP will not be responsible for any use of this report by any other party, for any decisions to be made based on it, or for the consequences thereof, unless written reliance is granted by WSP. Unless otherwise agreed in writing by WSP, it shall not be used to express or imply warranty as to the suitability of the property for a particular purpose. WSP disclaims responsibility of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs.

#### **Excerpts**

The Report is intended to be used in its entirety. No excerpts may be taken to be representative of the findings in the assessment.

#### Information from others

In evaluating the Site, WSP has relied in good faith on information provided by others, as noted in the Report. WSP has assumed that the information provided is correct and WSP assumes no responsibility for the accuracy, completeness or workmanship of any such information.

#### Standard of care

This project has been carried out using investigation techniques and engineering analysis methods consistent with those ordinarily exercised by WSP and other engineering/scientific practitioners, working under similar conditions and subject to the time, financial and physical constraints applicable to this project. The conclusions presented in this Report are based on Work undertaken by trained professional and technical staff and the reasonable and professional interpretation using accepted engineering and scientific practices current at the time the work was performed. Conclusions presented in this report should not be construed as legal advice. WSP makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in the Report, including, but not limited to, ownership of any property, or the application of any law to the findings of the Assessment.

#### Limited scope

The Report summarizes WSP's review of available data in accordance with the principal components of the stated regulations, standards and guidelines and the scope, terms and conditions of the contract or proposal to which the Assignment was conducted. No other warranties are either expressed or implied with respect to the professional services provided under the terms of the contract or proposal and represented in this Report. Conditions may exist which were not detected given the nature of the inquiry WSP was retained to undertake with respect to the Site. Additional environmental studies and actions may be recommended.

1 Spectacle Lake Drive Dartmouth, NS Canada B3B 1X7

T: +1 902-835-9955 F: +1 902-835-1645 wsp.com

#### Changes over time

The Report is based on data and information collected at the time of this Assessment, as stated in the Report. Site use or conditions change and the information and conclusions in the Report may no longer apply following the date of this Report. If any conditions become apparent that differ significantly from that presented in this Report, we request that we be notified to reassess the conclusions and recommendations provided herein. WSP disclaims any obligation to update this Report for conditions that may be identified after the date of this Report; however, WSP reserves the right to amend or supplement this report based on additional information, documentation or evidence.

#### Variability between test locations

Conclusions are based on the Site conditions observed by WSP at the time the work was performed and may include information obtained at specific testing and/or sampling locations. It is recognized that overall conditions can only be extrapolated to an undefined limited area around these testing and sampling locations. The conditions that WSP interprets to exist between testing and sampling points may differ from those that actually exist. The accuracy of any extrapolation and interpretation beyond the sampling locations will depend on natural conditions, the history of Site development and changes through construction and other activities. In addition, analysis has been carried out for the identified chemical and physical parameters only, and it should not be inferred that other chemical species or physical conditions are not present. WSP cannot warrant against undiscovered environmental liabilities or adverse impacts off-Site.

#### Use for design and construction

Design recommendations given in this report are applicable only to the project and areas as described in the text and then only if constructed in accordance with the details stated in this report. The comments made in this report on potential construction issues and possible methods are intended only for the guidance of the designer. The number of testing and/or sampling locations may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. Contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.

## FINAL DESIGN REPORT APPENDIX

# D FIRST LAKE SEWERSHED



## FINAL DESIGN REPORT APPENDIX

# E EXISTING AND PROPOSED PUMP CURVES





unix AUTHOR: ORDTO02 SACU (rev:8.1)

## FINAL DESIGN REPORT APPENDIX

# PRE-TENDER COST ESTIMATE
| First L                                                                                                                                                                           | ake Pumping Station Upgrades |                                                      |                   |                                                                                                                                                                                                                                                                                                                                                                                                        | MED                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------------------------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Estim                                                                                                                                                                             | ate of Probable Cost         |                                                      |                   |                                                                                                                                                                                                                                                                                                                                                                                                        | עריי                                                                                                                                                                                                                                                                                                                           |
| Estimate of Probable Cost<br>Tender<br>PROJECT NO.<br>DATE:<br>CLIENT:<br>CONSULTANT:<br>UNIT PRICE SOURCE:<br>NOTE: HST <u>NOT</u> INCLUDED IN INDICATED UNIT PRICES AND TOTALS. |                              | 201-11341-4<br>May 25, 20<br>Halifax W<br>WSP<br>WSP | 00<br>022<br>ater | This estimate of probable c<br>approximate only. Actual of<br>significantly from this estin<br>conditions such as materia<br>of year, industry workload,<br>estimate has been prepare<br>experience with similar pro-<br>has not been prepared by<br>estimates or quotes from c<br>uncertainties of what contu-<br>make any assumances that<br>within a reasonable range<br>bid. When assessing this p | onstruction cost is<br>cost may vary<br>nate due to market<br>I and labour costs, time<br>competition, etc. This<br>d based no our<br>jects. This estimate<br>obtaining any<br>ontractors. Due to the<br>ractors bid, WSP cannot<br>this estimate will be<br>of the tendered low<br>roject for business<br>imate should not be |
| ITEM                                                                                                                                                                              | DESCRIPTION                  | UNIT                                                 | EST.              | relied upon without consid                                                                                                                                                                                                                                                                                                                                                                             | ering these factors.                                                                                                                                                                                                                                                                                                           |
| NO.                                                                                                                                                                               |                              |                                                      | QUANT.            | UNIT PRICE                                                                                                                                                                                                                                                                                                                                                                                             | PRICE                                                                                                                                                                                                                                                                                                                          |
|                                                                                                                                                                                   | PROCESS UPGRADES             |                                                      |                   |                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                |

|   | PROCESS UPGRADES                                                               |     |   |             |             |
|---|--------------------------------------------------------------------------------|-----|---|-------------|-------------|
| 1 | Supply and install odor control system (Ambio)                                 | LS  | 1 | \$34,500.00 | \$34,500.00 |
| 2 | Remove 2 existing pumps and piping in older wetwell. Cap pipe and conduit.     | LS  | 1 | \$11,500.00 | \$11,500.00 |
| 3 | Supply and install 2 quick disconnects at old forcemain connections in older w | LS  | 1 | \$2,875.00  | \$2,880.00  |
| 4 | Supply and install new pump in newer wetwell                                   | LS  | 1 | \$40,250.00 | \$40,250.00 |
| 5 | Supply and install new SS piping in newer wetwell.                             | LS  | 1 | \$11,500.00 | \$11,500.00 |
| 6 | Supply and install 2 pressure relief valves and piping in newer wetwell        | ea. | 2 | \$5,750.00  | \$11,500.00 |
| 7 | Supply and install flowmeters                                                  | ea. | 2 | \$8,625.00  | \$17,250.00 |
| 8 | Supply and install wetwell depth sensors                                       | ea. | 1 | \$7,475.00  | \$7,480.00  |
|   |                                                                                |     |   |             |             |

### Sub Total \$136,860.00

| ITEM | DESCRIPTION                                                                        | UNIT | EST.   |             |             |
|------|------------------------------------------------------------------------------------|------|--------|-------------|-------------|
| NO.  |                                                                                    |      | QUANT. | UNIT PRICE  | PRICE       |
|      | CIVIL UPGRADES                                                                     |      |        |             |             |
|      |                                                                                    |      |        |             |             |
| 1    | Supply and install fencing                                                         | m    | 90     | \$258.75    | \$23,290.00 |
| 2    | Supply and install sliding gates                                                   | m    | 8      | \$948.75    | \$7,590.00  |
| 3    | Remove asphalt concrete pavement                                                   | m²   | 300    | \$17.25     | \$5,180.00  |
| 4    | Remove existing base course                                                        | m²   | 300    | \$11.50     | \$3,450.00  |
| 5    | Site grading                                                                       | LS   | 1      | \$11,500.00 | \$11,500.00 |
| 6    | Supply and install new base course (150mm Type 1, 150 mm Type 2)                   | m²   | 350    | \$57.50     | \$20,130.00 |
| 7    | Supply and install new asphalt concrete, 75mm                                      | m²   | 350    | \$46.00     | \$16,100.00 |
| 8    | Supply and install generator pad, concrete, reinforced, 150mm thick                | ea.  | 1      | \$1,725.00  | \$1,730.00  |
| 9    | Supply and install odor control system pad, concrete, reinforced, 150mm thick      | ea.  | 1      | \$2,875.00  | \$2,880.00  |
| 10   | Supply and install precast concrete control panel pedestal                         | ea.  | 1      | \$5,750.00  | \$5,750.00  |
| 11   | Supply and install bollards                                                        | ea.  | 4      | \$1,322.50  | \$5,290.00  |
| 11   | Supply and install traffic rated renovation style hatches (triplex + single hatch) | LS   | 1      | \$34,500.00 | \$34,500.00 |
| 12   | Demolition and disposal of existing building, equipment and foundation             | LS   | 1      | \$40,250.00 | \$40,250.00 |
| 13   | Yard piping                                                                        | LS   | 1      | \$37.95     | \$40.00     |
|      |                                                                                    |      |        |             |             |

|                                                 |    |   | Sub Total    | \$177 680 00 |
|-------------------------------------------------|----|---|--------------|--------------|
|                                                 |    |   | Sub Total    | \$177,000.00 |
| ELECTRICAL UPGRADES                             |    |   |              |              |
|                                                 |    |   |              |              |
| 1 Supply and install control panel              | LS | 1 | \$115,000.00 | \$115,000.00 |
| 2 Supply and install meter socket and enclosure | LS | 1 | \$6,900.00   | \$6,900.00   |
| 3 Supply and install disconnect switch          | LS | 1 | \$5,750.00   | \$5,750.00   |
| 4 Supply and install site lighting              | LS | 1 | \$4,600.00   | \$4,600.00   |
| 5 Provision of temporary power                  | LS | 1 | \$9,200.00   | \$9,200.00   |
| 5 Supply and install automatic transfer switch  | LS | 1 | \$138,000.00 | \$138,000.00 |
| 6 Supply and install backup generator           | LS | 1 | \$51,750.00  | \$51,750.00  |
| 7 Demolition of existing electrical equipment   | LS | 1 | \$6,900.00   | \$6,900.00   |
| 8 Supply and install conduits and wiring        | LS | 1 | \$11,500.00  | \$11,500.00  |
| 9 Supply and install underground conduits       | LS | 1 | \$11,500.00  | \$11,500.00  |
|                                                 |    |   | 1            |              |

Sub Total \$361,100.00

| ITEM | DESCRIPTION                                                    | UNIT | EST.   |             |             |
|------|----------------------------------------------------------------|------|--------|-------------|-------------|
| NO.  |                                                                |      | QUANT. | UNIT PRICE  | PRICE       |
|      | MISCELLANEOUS                                                  |      |        |             |             |
| 1    | Traffic control during paving and subgrade placement (2 weeks) | LS   | 1      | \$17,250.00 | \$17,250.00 |

Sub Total \$17,250.00

| \$692,890.00 | Subtotal                        |
|--------------|---------------------------------|
| \$34,644.50  | Mobilization/Demobilization @5% |
| \$72,753.45  | Contingency (10%)               |
| \$800,287.95 | Total (Excluding HST)           |

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## FINAL DESIGN REPORT APPENDIX





| ING | OLENT.           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | A A Halifax                           | Water                      |                            |                                                |                           |                                        |                                                        |                                 | rannana ran annanaisia                        |                       | 77 <i>1 1</i> 7 0000               | 179°Z/0ZZ                   |                             |                        |                        |
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|     | sen consultarit. | CONTENT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | SHEET 1                               | Was canada Inc. SHEET 2    | Tended law 0 Find          | 2435-9056 F 90.2435-1645 www.wp.com<br>SHEET 4 | SHEET 5                   | SHEET 6                                | SHEET 7                                                | SHEET 8                         | S S M T S D S S S S S S S S S S S S S S S S S | 200567 700 15M750     | 11 1/1 1/1 のののの<br>11 1/1 1/1 のののの | MLA) 1/ ZUZZ                | SHEET 12                    | SHEET 14               | SHEET 16               |











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| TO:           | Becky Kent, B.A., Chair, and Members of the Halifax Regional<br>Commission Board |  |  |  |  |  |  |  |
|---------------|----------------------------------------------------------------------------------|--|--|--|--|--|--|--|
| SUBMITTED BY: | Cathie Digitally signed by Cathie O'Toole Date: 2022.06.17<br>15:42:32 -03'00'   |  |  |  |  |  |  |  |
|               | Cathie O'Toole, MBA, FCPA, FCGA, ICD.D, General Manager                          |  |  |  |  |  |  |  |
| DATE:         | June 16, 2022                                                                    |  |  |  |  |  |  |  |
| SUBJECT:      | <b>Corporate Balanced Scorecard - 2022/23 Program and Year End Results</b>       |  |  |  |  |  |  |  |

### **ORIGIN**:

Annual Corporate Performance Measurement

### **<u>RECOMMENDATION</u>**:

The Board approve:

- 1. Corporate Balanced Scorecard targets for the 2022/23 fiscal year as detailed in the attached Corporate Balanced Scorecard summary.
- 2. The Organizational Award Program tied to the outcomes of 12 Organizational Indicators as detailed in the attached presentation.

### **BACKGROUND**:

Halifax Water has been utilizing a Corporate Balanced Scorecard (CBS) to measure performance since 2001. At that time, the CBS was viewed to be an excellent framework to connect the mission of the utility with the everyday activities of staff. The CBS development was very inclusive in 2001 and followed a process to identify Critical Success Factors (CSFs) in support of the mission, establish Organizational Indicators (OIs) to measure performance and set targets for continuous improvement. In March 2002, the Board approved an organizational award program tied to eight OIs which were the most objective and outward looking. This program was well received by staff and ensured that rewards were linked to strategic outcomes. With the transfer of wastewater/stormwater assets from HRM to Halifax Water on August 1, 2007, a broader mission, vision and CBS were developed to ensure it was inclusive of all services provided by the utility.

### **DISCUSSION:**

The mission of Halifax Water is *"to provide world class services to our customers and our environment*". The statement is simple, recognizes the connection between customers and the environment with the "one-water" mandate, and places the responsibility on employees to make Halifax Water a world class utility.

The vision statement for Halifax Water is:

- We will provide our customers with high quality water, wastewater, and stormwater services.
- Through adoption of best practices, we will place the highest value on public health, customer service, fiscal responsibility, workplace safety and security, asset management, regulatory compliance, and stewardship of the environment.
- We will fully engage employees through teamwork, innovation, and professional development

The vision statement expanded on the values and principles of a world class utility in fulfilling its mission and captures the medium to long-term aspirations of Halifax Water. With the vision statement developed, staff then selected the critical success factors that support the mission, and through an interactive process, settled on the following:

- 1. High Quality Drinking Water
- 2. Service Excellence
- 3. **Responsible Financial Management**
- 4. Effective Asset Management
- 5. Safety and Security
- 6. Regulatory Compliance
- 7. Environmental Stewardship
- 8. Motivated and Satisfied Employees

There are OIs established for each CSF to enable performance measurement and establishment of targets. Each year, the OIs are reviewed and refined based on operational objectives and approved budgets.

The critical success factors supporting the mission and vision of Halifax Water have not changed, but this year they will be presented to employees and the public in a way that aligns with the four strategic pillars approve in the 2022/23 Business Plan.

### Changes proposed for 22/23 OI Targets

1. The measurement of Lost Time Incidents (LTIR) has been changed to align with industry standards. It is recommended to target a 0.5 reduction each year for the next 4 years, with the ultimate goal of eventually establishing a target of 0.5 or less lost time incidents, consistent with world class companies.

### Changes made last year (21/22)

- 1. The Customer Satisfaction target was increased from 90% to 95%. Maintaining this level of customer satisfaction will be challenged by stormwater service expansion, a rate application hearing.
- 2. The target percentage of public health and environmental regulatory infractions was simplified to focus on infractions resulting in a summary offense tickets. It formerly included written Ministerial Orders (Warnings or Directives) or Prosecutions. The rule set and process for summary offense tickets is clearly defined and captures issues which may also result in Ministerial Orders or Prosecutions.
- 3. The target for 21/22 capital expenditures (% of budget spent by end of fiscal year) was adjusted downward from 80%-90% to 70% -80%. This is still very aggressive and is not currently achievable.

The attached Corporate Balance Scorecard Summary identifies the CSFs and OIs for 2022/23, as well as a projection of actual results for 2021/22. Final results will be available after completion of the 2021/22 fiscal year audit and will be reported to the Halifax Water Board at the June Board meeting.

Consistent with prior years and the methodology approved by the Halifax Water Board, the most objective OIs have been considered for the organizational award program. Of the 30 OIs detailed in the attachment, 12 are recommended for inclusion in the award program. These 12 OIs are reflective of seven CSFs which are critical to our mission and the most objective and outward looking. The recognition of an organizational award hinges on a minimum score of 7.0 to give a passing grade out of a maximum score of 12.0. Funds for the award program are connected to the operating expense to revenue ratio being below the target for the fiscal year. In this regard, if the operating expense to revenue ratio is met, funds are already embedded in the operational budget. The Operating Expense to Revenue ratio OI has been modified this year to reflect a target that incorporates the equivalent of \$2 million in expense reduction.

The targets for these OIs are meant to be stretch goals, such that the utility is pushing for both efficiency and effectiveness in its service delivery. In many cases, the improvements in efficiency will realize enough savings to pay for the award program itself. The water loss control initiative is a prime example of how the utility has realized gains in efficiency with significant historical financial savings. In keeping with the cost containment theme, water and wastewater service cost per connection measures under Responsible Financial Management have targets to realize 2%

savings compared to the approved operations budget. In addition, under the Environmental Stewardship theme, the utility is expected to reduce energy consumption (and therefore greenhouse gas emissions) as a result of capital improvements. The continuation of the organization award tied to the outcomes of the CBS helps promote a high level of performance and will realize future savings for the utility.

### **BUDGET IMPLICATIONS**

Funds for the Award Program are available with the realization of the operating expense to revenue ratio below the target amount. In this regard, funds would be embedded within the 2022/23 Operations Budget. In many cases, meeting the OI targets will realize direct savings to the utility, improved operational effectiveness, and/or improved customer service.

### **ALTERNATIVES**

None recommended.

### ATTACHMENT

Summary Corporate Balanced Scorecard Corporate Balanced Scorecard 2022/23 Presentation

| Report Prepared by:    | Cathie<br>O'Toole<br>Digitally signed by Cathie<br>O'Toole<br>Date: 2022.06.17<br>15:42:59 -03'00' |
|------------------------|----------------------------------------------------------------------------------------------------|
|                        | Cathie O'Toole, MBA, FCPA, FCGA, ICD.D, 902-490-4840                                               |
| Financial Reviewed by: | Digitally signed by Allan<br>Campbell<br>Date: 2022.06.17<br>15:44:36 -03'00'                      |
|                        | Louis de Montbrun, CPA, CA Director, Corporate Services/CFO<br>Service, 902-490-3685               |

| Organizational Indicators                                                                                                                  | 2020/21<br>Results | 2021/22<br>Target | 2021/22<br>Results | 2022/23<br>Target |
|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------|--------------------|-------------------|
| High Quality Drinking Water                                                                                                                |                    |                   |                    |                   |
| Adherence with 5 objectives of Water Safety Plan for all water systems - Percentage of sites achieving targets                             | 76                 | 80                | 70                 | 80                |
| Bacteriological tests - Percentage free from Total<br>Coliform                                                                             | 100%               | 99.9%             | 99.94%             | 99.9%             |
| Customer satisfaction about water quality - Percentage<br>from customer survey                                                             | 84%                | 85%               | 89%                | 85%               |
| Service Excellence<br>Customer satisfaction with service - Percentage from                                                                 | 96%                | 95%*              | 96%                | 95%*              |
| Water service outages - Number of connection<br>hours/1000 customers                                                                       | 3612.62            | 200               | 192.42             | 200               |
| Wastewater service outages – Number of connection hours/1000 customers                                                                     | 0.92               | 4                 | 0.93               | 4                 |
| Average speed of answer – Percentage of calls answered within 20 seconds.                                                                  | 71%                | 70%               | 60.4%              | 70%               |
| Responsible Financial Management                                                                                                           |                    |                   |                    |                   |
| Operating expense/revenue ratio percentage                                                                                                 | 81.5%              | 82%               | 81.19%             | 83%               |
| Annual cost per customer connection – Water                                                                                                | \$498              | \$543             | \$540              | \$543             |
| Annual cost per customer connection – Wastewater                                                                                           | \$724              | \$758             | \$741              | \$782             |
| Effective Asset Management<br>Water leakage control – target leakage allowance of 160<br>litres/service connection/day *Note 1             | 193                | 160-170           | 220                | 160-170           |
| I&I reduction - Number of inspections to identify private<br>property discharge of stormwater into the wastewater<br>system *Note 2        | 1316*              | 900               | 1502               | 1200              |
| Peak flow reduction from wet weather management<br>capital projects *Note 3                                                                | 70 l/sec*          | 5-10 l/sec*       | N/A                | 5-10 l/sec*       |
| Percentage of time GIS and Cityworks are available                                                                                         | 100%               | 96-98%            | 99.99%             | 96-98%            |
| Capital budget expenditures - Percentage of budget<br>spend by end of fiscal year                                                          | 30.78%             | 70-80%            | 28.62              | 70-80%            |
| Workplace Safety and Security                                                                                                              |                    |                   |                    |                   |
| Average score on internal safety audits                                                                                                    | 94.5%              | 85-95%            | 96.7%              | 85-95%            |
| NS Labour and Advanced Education compliance - # of<br>Incidents with written compliance orders                                             | 0                  | 0-2               | 0                  | 0-2               |
| Lost time accidents -Number of accidents resulting in lost<br>time per 100 employees<br>* CHANGE for 22/23: Lost Time Incident Rate Note 4 | 0.59               | 1.5-2.0           | 2.0                | 3.5               |
| Safe driving - Number of traffic Accidents per 1,000,000<br>km driven (maximum of 5)                                                       | 5.5                | 4                 | 3.36               | 4                 |



| Training - Number of employees trained or re-certified<br>before due date                      | 59%*  | 80-90%  | 70%   | 80-90%  |
|------------------------------------------------------------------------------------------------|-------|---------|-------|---------|
| Percentage of completed safety talks                                                           | 86%   | 80-90%  | 85%   | 80-90%  |
| Regulatory Compliance                                                                          |       |         |       |         |
| Percentage of public health and environmental                                                  | 0     | 0-2     | 0     | 0-2     |
| regulatory infractions resulting in a summary offense tickets                                  |       |         |       |         |
| Percentage of WWTFs complying with NSE approval permits (Project for 21/22 at end of February) | 93%   | 95-100% | 96.2% | 95-100% |
| Environmental Stewardship                                                                      |       |         |       |         |
| Number of ICI properties inspected/interactions by                                             | 356   | 500     | 361   | 250     |
| Pollution Prevention each year                                                                 |       |         |       |         |
| Energy management kwh/m3 reduction associated with capital projects                            | +8%   | 3%      | 7.76% | 3%      |
| Bio-solids residual handling - % of sludge meeting bio-                                        | 98.6% | 92-97%  | 98.5% | 92-97%  |
| solids concentration targets                                                                   |       |         |       |         |
| Motivated and Satisfied Employees                                                              |       |         |       |         |
| Number of arbitrations divided by total number of grievances                                   | 0     | 0       | 0     | 0       |
| Percentage of jobs filled with internal candidates                                             | 75%   | 80%     | 68%   | 80%     |
| Employee satisfaction survey result                                                            | B+    | Α       | B+    | A       |
| Average number of days absenteeism                                                             | 7.54  | <7      | 7.16  | <7      |

Notes:

- 1. Water leakage control The final results are not available until year-end, but current data indicates this target will not be met for 2021/22.
- 2. I&I inspections The target is proposed to increase to 1200 next year, and the methodology is under review for additional change. Environmental Engineering will be tracking inspections and requests for inspections in greater detail this year to propose a new metric in 2023/24.
- 3. Peak flow reduction The Crescent Avenue lining program start was delayed due to a longer than normal NSUARB approval process. As a result, the program was completed in October 2021, after the start of the calendar year Q4 data collection through flow monitoring. As a result, it is recommended this target carry forward to 2022/23 so that complete a complete Q4 dataset is available to measure the peak flow reduction.
- 4. Lost Time Incidents Rate (LTIR) The measurement of Lost Time Incidents will change to align with industry standards. Lost Time Cases x 200,000 / Total Employee Hours Worked (*The number 200,000 equates to approx. 100 employees, working 40 hours per week, and 50 weeks per year with 2 week leave average.*) We are recommending targeting a 0.5 reduction each year for the next 4 years, and our ultimate goal is to eventually have a target of 0.5 or less lost time incidents, consistent with world class companies.





## Corporate Balanced Scorecard Year end results and 2022/23 Targets

Presented to Halifax Water Board June 23, 2022

Cathie O'Toole General Manager







# History of Corporate Balanced Scorecard at Halifax Water

- Halifax Water started a Continuous Improvement Program in 1999
- In 2000, Halifax Water looked for methodology to measure organizational performance that was meaningful
- In 2001 the Halifax Water Board approved a Corporate Balanced Scorecard [CBS], and an Organizational Award Program on March 28, 2002
- CBS ensures all employees focused on strategic outcomes
- Critical success factors [CSFS] are developed in support of the mission
- Organizational indicators [OIs] are used to measure performance



## The Mission & Vision of Halifax Water

- Halifax Water's mission is to provide world class services for our customers and our environment; and the vision of how this will be accomplished is threefold:
  - We will provide our customers with high quality water, wastewater and stormwater service.
  - Through the adoption of best practices, we will place the highest value on public health, customer service, fiscal responsibility, workplace safety and security, asset management, regulatory compliance and stewardship of the environment.
  - We will fully engage employees through teamwork, innovation and professional development.





## **Critical Success Factors**

- High Quality Drinking Water
- Service Excellence
- Responsible Financial Management
- Effective Asset Management
- Workplace Safety and Security
- Regulatory Compliance
- Environmental Stewardship
- Motivated and Satisfied Employees





## **Organizational Indicators**

- Organizational Indicators (OI's) are the measures of our performance within each CSF and provide the definition and detail to best understand them. The OI's are organizational, not individual measures.
- The OI's provide both a detailed clarification of the CSF and allow a target or goal for performance to be established and tracked.



## **Organizational Performance Award Program**

- Based on a subset [12] of our strategic OI's which are the most objective.
- Program pays for itself by meeting operating expense to revenue ratio target; ratio is reduced from approved budget to accommodate the award program potential.
- It is not a given; a threshold of 7.0 in scoring must be reached in a given year, and the gateway indicators must be met.
- To be eligible for the award, employees must work a minimum of nine months during the fiscal year [April 1st to March 31st]



## **CSF: High Quality Drinking Water**

| Organizational Indicators                                                                                                                           | 2020/21<br>Results | 2021/22<br>Target | 2021/22<br>Result   | 22/23<br>Target |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------|---------------------|-----------------|
| High Quality Drinking Water<br>Adherence with 5 objectives of Water Safety<br>Plan for all water systems - Percentage of sites<br>achieving targets | 76                 | 80                | 70                  | 80              |
| Bacteriological tests - Percentage free from Total Coliform                                                                                         | 100%               | 99.9%             | <mark>99.94%</mark> | 99.9%           |
| Customer satisfaction about water quality -<br>Percentage from customer survey                                                                      | 84%                | 85%               | 89%                 | 85%             |





## **CSF: Service Excellence**

| Organizational Indicators                                                                             | 2020/21<br>Results | 2021/22<br>Target | 2021/22<br>Result | 22/23<br>Target |
|-------------------------------------------------------------------------------------------------------|--------------------|-------------------|-------------------|-----------------|
| Service Excellence<br>Customer satisfaction with service -<br>Percentage from customer survey *Note 1 | 96%                | 95%*              | 96%               | 95%*            |
| Water service outages - Number of<br>connection hours/1000 customers *Note 2                          | 3612.62            | 200               | 192.42            | 200             |
| Wastewater service outages – Number of connection hours/1000 customers                                | 0.92               | 4                 | 0.93              | 4               |
| Average speed of answer – Percentage of calls answered within 20 seconds.                             | 71%                | 70%               | 60.4%             | 70%             |

....



### **CSF: Responsible Financial Management**

| Organizational Indicators                                                      | 2020/21<br>Results | 2021/22<br>Target | 2021/22<br>Result | 22/23<br>Target |
|--------------------------------------------------------------------------------|--------------------|-------------------|-------------------|-----------------|
| Responsible Financial Management<br>Operating expense/revenue ratio percentage | 81.5%              | 82%               | 81.19%            | 83%             |
| Annual cost per customer connection – Water                                    | \$498              | \$543             | \$540             | \$543           |
| Annual cost per customer connection –<br>Wastewater                            | \$724              | \$758             | \$741             | \$782           |

• The operating expense/revenue ratio is a gateway indicator. If it is not achieved, there is no organizational award paid out.



## **CSF: Effective Asset Management**

| Organizational Indicators                                                                                                      | 2020/21<br>Results | 2021/22<br>Target | 2021/22<br>Result | 22/23<br>Target |
|--------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------|-------------------|-----------------|
| Effective Asset Management<br>Water leakage control – target leakage allowance<br>of 160 litres/service connection/day *Note 3 | 193                | 160-170           | 220               | 160-170         |
| I&I reduction - Number of inspections to identify private property discharge of stormwater into the wastewater system *Note 4  | 1316*              | 900               | 1502              | 1200            |
| Peak flow reduction from wet weather<br>management capital projects *Note 5                                                    | 70 l/sec*          | 5-10 l/sec*       | N/A               | 5-10 l/sec*     |
| Percentage of time GIS and Cityworks are available                                                                             | 100%               | 96-98%            | 99.99%            | 96-98%          |
| Capital budget expenditures - Percentage of<br>budget spend by end of fiscal year *Note 6                                      | 30.78%             | 70-80%            | 28.62%            | 70-80%          |



## **CSF: Workplace Safety & Security**

| Organizational Indicators                                                                         | 2020/21<br>Results | 2021/22<br>Target | 2021/22<br>Result | 22/23<br>Target |
|---------------------------------------------------------------------------------------------------|--------------------|-------------------|-------------------|-----------------|
| Workplace Safety and Security<br>Average score on internal safety audits                          | 94.5%              | 85-95%            | 96.7%             | 85-95%          |
| NS Labour and Advanced Education<br>compliance - # of Incidents with written<br>compliance orders | 0                  | 0-2               | 0                 | 0-2             |
| Lost time accidents -Number of accidents resulting in lost time per 100 employees                 | 0.59               | 1.5-2.0           | 2.0               | 3.5             |
| Safe driving - Number of traffic Accidents per 1,000,000 km driven (maximum of 5)                 | 5.5                | 4                 | 3.36              | 4               |
| Training - Number of employees trained or re-<br>certified before due date *Note 7                | 59%*               | 80-90%            | 70%               | 80-90%          |
| Percentage of completed safety talks                                                              | 86%                | 80-90%            | 85%               | 80-90%          |



## **CSF: Regulatory Compliance**

| Organizational Indicators                                                                                                                         | 2020/21<br>Results | 2021/22<br>Target | 2021/22<br>Result | 22/23<br>Target |
|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------|-------------------|-----------------|
| Regulatory Compliance<br>Percentage of public health and<br>environmental regulatory infractions resulting<br>in a summary offense ticket *Note 8 | 0                  | 0-2               | 0                 | 0-2             |
| Percentage of WWTFs complying with NSE approval permits                                                                                           | 93%                | 95-100%           | 96.2%             | 95-100%         |


# **CSF: Environmental Stewardship**

| Organizational Indicators                                                                                    | 2020/21<br>Results | 2021/22<br>Target | 2021/22<br>Result | 22/23<br>Target |
|--------------------------------------------------------------------------------------------------------------|--------------------|-------------------|-------------------|-----------------|
| Environmental Stewardship<br>Number of ICI properties inspected by<br>Pollution Prevention each year *Note 9 | 356                | 500               | 361               | 250             |
| Energy management kwh/m3 reduction associated with capital projects                                          | +8%                | 3%                | 7.76%             | 3%              |
| Bio-solids residual handling - % of sludge meeting bio-solids concentration targets                          | 98.6%              | 92-97%            | 98.5%             | 92-97%          |



# **CSF: Motivated and Satisfied Employees**

| Organizational Indicators                                                                            | 2020/21<br>Results | 2021/22<br>Target | 2021/22<br>Result | 22/23<br>Target |
|------------------------------------------------------------------------------------------------------|--------------------|-------------------|-------------------|-----------------|
| Motivated and Satisfied Employees<br>Number of arbitrations divided by total<br>number of grievances | 0                  | 0                 | 0                 | 0               |
| Percentage of jobs filled with internal candidates                                                   | 75%                | 80%               | 68%               | 80%             |
| Employee satisfaction survey result                                                                  | B+                 | A                 | B+                | A               |
| Average number of days absenteeism                                                                   | 7.54               | <7                | 7.16              | <7              |





# **Employees Organizational Award**

The highest possible score is 12.0 [1.0 for each OI]. If HRWC performs well, then everyone should be rewarded as follows:

| <u>Total OI Score</u> | OP Award Amount |
|-----------------------|-----------------|
| <u>&gt;</u> 11.0      | \$1,000         |
| 10.0                  | \$900           |
| 9.0                   | \$800           |
| 8.0                   | \$700           |
| 7.0                   | \$600           |
| < 7.0                 | <b>\$</b> 0     |

These values will be pro-rated if a score falls between them.

**Example:** For the total OP Award score of 8.5, each employee will get an organizational award of \$750.

# **Based on 12 OIs which are the most objective:**

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| Organizational Indicator                             | Max. Score | Result |
|------------------------------------------------------|------------|--------|
| Water Quality Master Plan Objectives                 | 1.0        | 0.0    |
| Customer Water Quality Survey Results                | 1.0        | 1.0    |
| Customer Service Survey Results                      | 1.0        | 1.0    |
| Operating Expense/Revenue Ratio [Gateway]            | 1.0        | 1.0    |
| Water Loss Control Reduction                         | 1.0        | 0.0    |
| Peak Flow Reduction                                  | 1.0        | 0.0    |
| Percentage of Time GIS and CityWorks are Operational | 1.0        | 1.0    |
| # of Lost Time Accidents per 100 Employees [Gateway] | 1.0        | 1.0    |
| # of Traffic Accidents per 1,000,000 km              | 1.0        | 1.0    |
| % of WWTFs Compliant with NS Environment Permits     | 1.0        | 1.0    |
| Energy Management – Water & Wastewater               | 1.0        | 1.0    |
| Biosolids Residual Handling                          | 1.0        | 1.0    |
| TOTAL MAXIMUM SCORE                                  | 12.0       | 9.0    |

# Summary

- The track record of the CBS at Halifax Water has been very positive; it drives performance.
- Staff obtains Board approval of the Organizational Award Program on an annual basis
- Organizational Award Program funding is available by meeting the Operating Expense to Revenue Ratio Target.
- The Organizational Award Program is not a given; the organization must score at least 7.0 to have an award, and the gateway indicators must be achieved
- Financial targets are based on the approved operating budget.
- CBS results must be submitted to Halifax Council as part of the annual Accountability Report.



# Recommendation

It is recommended that the Board approve:

1. Corporate Balanced Scorecard targets for the 2022/23 fiscal year as detailed in the attached Corporate Balanced Scorecard summary.

2. The Organizational Award Program tied to the outcomes of 12 Organizational Indicators as detailed in the attached presentation.









| TO:           | Becky Kent, B.A., Chair, and Members of the Halifax Regional Water<br>Commission Board |
|---------------|----------------------------------------------------------------------------------------|
| SUBMITTED BY: | Rochelle Bellemare<br>Date: 2022.03.18<br>10:04:34 -03'00'                             |
|               | Rochelle Bellemare                                                                     |
|               | Manager, Human Resources                                                               |
| APPROVED:     | Cathie Digitally signed by Cathie O'Toole Date: 2022.03.18<br>10:17:22 -03'00'         |
|               | Cathie O'Toole, MBA, FCPA, FCGA, ICD.D                                                 |
|               | General Manager                                                                        |
| DATE:         | March 15, 2022                                                                         |
| SUBJECT:      | Diversity, Equity and Inclusion Framework                                              |

# <u>ORIGIN</u>

2020/21 Business Plan

# **RECOMMENDATION**

It is recommended the Board endorse the Diversity, Equity and Inclusion framework goals for 2022/23 - 2024/25 as set out in the report dated March 15, 2022.

# BACKGROUND

In 2021 the Halifax Water Board had requested development of a three-year framework for Diversity, Equity and Inclusion activities.

## **DISCUSSION**

Diversity, equity and inclusion outlines the efforts an institution takes to create a more welcoming environment for people of less-privileged identities. Halifax Water has many on-going initiatives, and the proposed initiatives for 2022/23 - 2024/25 are attached.

The purpose of this report is to seek approval for the framework that will guide development of detailed plans and activities regarding diversity, equity and inclusion over the next three years.

The framework proposes some high-level objectives and targets that will enable us to measure success.

The proposed objectives are:

- 1. Increase the percentage of employees who agree that the workplace reflects a diverse cultural background to 75% by the end of the three-year period.
- 2. Increase customers' recognition of Halifax Water's Corporate Social Responsibility by 10% by the end of the three-year period.
- 3. Work towards gender equality and increase employee perception that the workplace reflects gender equality as measured by the employee survey.
- 4. Increase accessibility at primary Halifax Water work locations compared to status quo.
- 5. Expand employee knowledge and inclusion of the LBGTQ2S+ community and measure awareness via the employee survey.

Updates on annual activities and progress on diversity, equity and inclusion initiatives have been provided to the Halifax Water Board in June 2020 and June 2021, reporting on the most recently completed fiscal years. A report on accomplishments relative to planned activities for 2021/22 will be submitted to the Halifax Water Board at the June 2022 Board meeting.

# ALTERNATIVES

The Board can reject or modify the framework goals.

# **BUDGET IMPLECATIONS**

Funding for initiatives identified in 2022/23 are included within the approved Operating Budget.

| Report Prepared by:    | Rochelle Bellemare<br>Date: 2022.03.18<br>10:05:00-03'00'                                  |             |
|------------------------|--------------------------------------------------------------------------------------------|-------------|
|                        | Rochelle Bellemare                                                                         |             |
|                        | Manager, Human Resources (902) 490-4807                                                    |             |
| Financial Reviewed by: | Digitally signed by Allan<br>Campbell<br>Date: 2022.03.18<br>09:58:18-03'00' On behalf of: |             |
|                        | Director, Corporate Services/CFO (902) 490-3685                                            | Page 2 of 2 |

| Water                                                                                     | ε <i>τοτ</i> /ττοτ – 2                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                      | Halifax Water Board<br>March 24, 2022<br>ATTACHMENT                                                                                   |
|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                           | Q1 (April – June)                                                                                                                                                                                                                                                                                                                                                                                    | Q2 (July – September)                                                                                                                                                                                                                                                                                                              | Q3 (Oct – December)                                                                                                                                                                                                                                                                                                  | Q4 (January – March)                                                                                                                  |
| ercentage of<br>s who agree<br>orkplace<br>diverse cultural<br>di to 75% by<br>ear period | <ul> <li>Roll out DEI Policy and<br/>Fair Hiring Policy</li> <li>Review D&amp;I questions<br/>for the annual<br/>employee survey and<br/>incorporate additional<br/>questions as applicable</li> <li>Complete Unconscious<br/>Bias Training current<br/>employees</li> <li>Expand committee<br/>meeting with Union<br/>president to include an<br/>additional person from<br/>each union.</li> </ul> | <ul> <li>Diversity Moments:<br/>increase employee<br/>participation to 50%<br/>over 3-year period,<br/>introduce an incentive<br/>for if article is used<br/>for if article is used<br/>diversity how we<br/>celebrate our selected<br/>diversity<br/>events/moments<br/>(event, written, logo<br/>change, email blast)</li> </ul> | <ul> <li>Develop plan to train outstanding employees and new hires in Unconscious Bias Training, Indigenous Training, Indigenous Training and Psychologically Health and Safety training and Safety training</li> <li>Train all employees in Respectful Workplace Training and develop plan for new hires</li> </ul> | <ul> <li>Establish a baseline<br/>metric for number of<br/>applicants received<br/>from an extended<br/>reach organization</li> </ul> |
| ustomers<br>n of Halifax<br>orporate Social<br>lilty by 10% by<br>ear period              |                                                                                                                                                                                                                                                                                                                                                                                                      | <ul> <li>Verify if customer<br/>survey tracks this<br/>measurement and add<br/>diversity questions to<br/>survey</li> <li>Through social media<br/>feeds acknowledge our<br/>community<br/>involvement, donations,<br/>and sponsorship<br/>activities</li> </ul>                                                                   | <ul> <li>Collaborate with<br/>HALIFAX on the Anti-<br/>Black Racism Policy,<br/>strategy, and action<br/>plan</li> </ul>                                                                                                                                                                                             |                                                                                                                                       |

STRAIGHT from the SOURCE

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ITEM # 7



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| work towards gender<br>equality and increase the<br>perception that the<br>workplace reflects gender<br>equality as measured by<br>the employee survey<br>the employee survey<br>(from 78% t                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | t Haurax Water<br>tes increase is<br>on that 'My<br>ce reflects<br>equality' from<br>loyee Survey<br>s% to 80% in<br>Leaders:<br>opportunities<br>rvisory<br>nce and | <ul> <li>Create a partnership with Construction Association of NS (CANS) and support their partnership with NSCC</li> </ul> | In conjunctive women in Nomen in Nomen in Nomen in Committee, Committee, media camp attract and women to Hovater to |
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# DEI Framework Goals – 2023/24 & 2024/25

| Objective                                                                                                                                        | 2023/24                                                                                                                                                                                                                                                                                                                                                               | 2024/25                                                                                                                                                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Increase percentage of employees who<br>agree that the workplace reflects a diverse<br>cultural background to 75% by end of 3-year<br>period     | <ul> <li>Implement plan to train outstanding<br/>employees and new hires in Unconscious<br/>Bias Training, Indigenous Treaty Partner<br/>Cultural Training and Psychologically Health<br/>and Safety training</li> <li>Diversity Moments: increase employee<br/>participation to 50% over 3-year period,<br/>introduce an incentive for if article is used</li> </ul> | <ul> <li>Expand suite of diversity training</li> <li>Increase the baseline metric of how applicants were from one of our extreach organizations by 5% for by en 2024/2025</li> <li>Diversity Moments: increase emploparticipation to 50% over 3-year perintroduce an incentive for if article i</li> </ul> |
| Increase customers recognition of Halifax<br>Water's Corporate Social Responsibility by<br>10% by end of 3-year period.                          | <ul> <li>Calculate metric and develop plan for<br/>2024/2025 to keep goal on track, adjust<br/>goal if needed after findings</li> </ul>                                                                                                                                                                                                                               | <ul> <li>Calculate metric and adjust plan and,<br/>goal as needed</li> </ul>                                                                                                                                                                                                                               |
| Work towards gender equality and increase<br>the perception that the workplace reflects<br>gender equality as measured by the<br>employee survey | <ul> <li>Celebrate International Women's Day</li> <li>Employ a 3<sup>rd</sup> party consultant to conduct an evaluation of pay equity</li> <li>Increase female presence in future<br/>Performance Matters (Aspiring Leaders) training</li> </ul>                                                                                                                      | <ul> <li>Celebrate International Women's Date Evaluate consultant suggestions and develop a potential implementation</li> <li>In accordance with Fair Hiring Policy, a diversity lens</li> </ul>                                                                                                           |
| Increase accessibility at primary Halifax<br>Water work locations compared to status<br>quo                                                      | <ul> <li>Conduct an evaluation of what accessibility<br/>aspects need addressing</li> </ul>                                                                                                                                                                                                                                                                           | <ul> <li>Budget to roll out most required<br/>enhancements for 2024/2025 and de<br/>plan for future years</li> </ul>                                                                                                                                                                                       |
| Expand employee knowledge and inclusion<br>of the LGBTQ2S+ community                                                                             | <ul> <li>Promote GBA+ training (free)</li> </ul>                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                            |

STRAIGHT from the SOURCE



| TO:           | Becky Kent, B.A., Chair and Members of the Halifax Regional Water<br>Commission Board                 |
|---------------|-------------------------------------------------------------------------------------------------------|
| SUBMITTED BY: | Kenda<br>Signature<br>Date: 2022.06.16<br>09:48:53-03'00'                                             |
|               | Kenda MacKenzie, P.Eng., Director of Regulatory Services                                              |
| APPROVED:     | Cathie Digitally signed by Cathie O'Toole Date: 2022.06.17<br>15:41:24 -03'00'                        |
|               | Cathie O'Toole, MBA, FCPA, FCGA, ICD.D, General Manager                                               |
| DATE:         | June 1, 2022                                                                                          |
| SUBJECT:      | Stormwater Infrastructure Cost Sharing Memorandum of Understanding with Halifax Regional Municipality |

# **ORIGIN**

On January 25, 2018, the Halifax Water Board of Commissionaires approved the Policy Framework for the Halifax/Halifax Water Integrated Stormwater Management Policy

# **RECOMMENDATION**

It is recommended that the Halifax Water Board approve the memorandum of understanding (MOU), approved by <u>HRM Regional Council on May 3, 2022</u> between HRM and Halifax Water for the funding of stormwater projects as shown in Appendix A of this report.

# BACKGROUND

The 2007 Transfer Agreement (the "Transfer Agreement") between the Municipality and Halifax Water transferred municipal wastewater and stormwater assets to Halifax Water within the Service Boundaries. A primary principle of the agreement was to avoid cross subsidization between utility rate payers and tax payers. The Transfer Agreement also recognized the need to have clear roles and responsibilities and established a Special Technical Committee (STC) of municipality and utility employees to work together on transfer related technical issues or issues where there was some joint responsibility or benefit.

While the administration and operation of wastewater systems is relatively straight forward, the overall responsibility for stormwater management is multi-jurisdictional. The federal, provincial,

and municipal governments along with Halifax Water and private property owners each have specific roles and responsibilities as stormwater moves through the stormwater cycle.

In 2013, Halifax Regional Council and the Halifax Water Board approved a two-year interim funding framework for stormwater systems that defined cost sharing responsibilities for HRM, Halifax Water, Residents, and Developers for various types of projects. The interim funding framework was used to address several priority areas that included Cow Bay Road, First Lake Drive, and Metropolitan Avenue.

The demand for upgraded stormwater facilities continued to grow and far exceeded the ability of either benefiting party to fund them over the short to medium terms. As the interim funding framework expired in 2015, it was necessary to develop an alternative cost sharing arrangement for capital projects between HRM and Halifax Water.

In January 2018, the HRM/Halifax Water Integrated Stormwater Management Policy Draft Framework was adopted by both Halifax Regional Council and the Halifax Water Board. The Policy Framework identified the need for a Capital Investment Strategy for stormwater infrastructure that is consistent with the Transfer Agreement.

The HRM/Halifax Water Integrated Stormwater Management Policy Draft will provide both organizations the framework to assign costs for both integrated capital projects and the implementation of some of the National Disaster Mitigation Program (NDMP) projects will support the critical infrastructure analysis outlined within and required through HalifACT 2050. Halifax Water is incorporating some of the flood mitigation programming into its proposed Climate Action Plan.

# **DISCUSSION**

An important component of the implementation plan was the development of a MOU with HRM. Following the direction of HRM Regional Council and the Halifax Water Board in 2018, HRM and Halifax Water agreed on the MOU including a cost sharing framework that provides the necessary guidance on project governance and implementation for various stormwater projects such as:

- Deep stormwater system installation projects
- Operational improvements, upsizing and/or upgrading of stormwater system assets or
- Projects identified within the NDMP suite of stormwater projects.

The cost sharing framework is defined within the MOU, with a focus on benefits infrastructure installations and enhancements have to the rate base. The MOU uses the 2013 interim funding framework as a guide and has been prepared by both HRM and Halifax Water staff and was reviewed through the STC.

HRM and Halifax Water have agreed on a draft set of guiding principles and a cost sharing

framework that provides the necessary guidance on project governance and implementation. The appropriate sharing of costs between the Municipality, Halifax Water and private sector owners of real property is a key component of the integration plan. Municipal staff and Halifax Water have determined the following principles to guide the sharing of such stormwater capital costs between the Municipality and Halifax Water:

1. Support the policies and principles outlined in the HRM/Halifax Water Integrated Stormwater Management Policy Draft Framework.

2. Apply to projects that have been identified as joint priorities or general stormwater projects, as well as opportunities that are identified during right of way or utility renewal projects.

3. Costs shall be allocated to the cost causer and/or to those deriving a direct benefit as defined by the MOU. This includes private property owners.

4. Costs shall be apportioned in a reasonable, fair, and equitable manner.

5. Cost apportionment of stormwater capital costs should not apply to upgrades required by the subdivision and/or future development of land. In these cases, the developer is responsible for the required upgrades. Halifax Water or the Municipality may choose to cost share if there is a joint benefit arising from the upgrade or an oversizing of proposed infrastructure.

6. Consider the effects of climate change to be required in design, and project costs will include the cost of climate change adaptation.

7. The assignment of cost shall be on a broad basis and shall depend on the number of benefitting parties (i.e., 100%, 50-50, 1/3-1/3), and whether the level of benefit is significant or insignificant.

8. The assignment of cost shall be by mutual agreement between Halifax Water and HRM.

| Cost Sharing Summary                                                                                                                                                                                            |                         |                     |                  |                              |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------|------------------|------------------------------|--|
|                                                                                                                                                                                                                 |                         | Cost Responsibility |                  |                              |  |
| Project Type                                                                                                                                                                                                    | Project Lead            | HRM                 | Halifax<br>Water | Private<br>Property<br>Owner |  |
| Minor or Major Drainage System Asset<br>Renewal and/or Upgrade                                                                                                                                                  | Halifax Water           |                     | 100%             |                              |  |
| New Storm Sewer required to upgrade<br>Existing Combined Sewer                                                                                                                                                  | Halifax Water           |                     | 100%             |                              |  |
| New Deep Storm Sewer to provide<br>minor drainage to address Private<br>Property Minor Stormwater Impacts,<br>which reduces I/I into a wastewater<br>system, and which prolongs the life of a<br>Municipal road | HRM or<br>Halifax Water | 34%                 | 33%              | 33%                          |  |

The proposed cost apportionment between the Municipality, Halifax Water and private property owners, which uses the 2013 interim funding framework as a guide, are as follows:

| Remedy Street Flooding and Icing<br>Problems within HRM right-of-way                     | HRM | 100% |     |
|------------------------------------------------------------------------------------------|-----|------|-----|
| New Major Drainage System where one<br>has not been historically required or<br>provided | HRM | 50%  | 50% |

Approval of the MOU has been obtained from HALIFAX Regional Council, and is now being requested by the Halifax Water Board and ultimately the NSUARB prior to signing.

# **BUDGET IMPLICATIONS**

There are no deep stormwater system or NDMP projects proposed in the upcoming 2022/23 budget. Future projects will be brought forward through the regular capital budgeting process.

# ALTERNATIVES

Halifax Water Board could not approve entering into the MOU. This is not recommended for reasons outlined in the report.

# ATTACHMENT

Appendix A – Memorandum of Understanding (MOU) Regarding: Stormwater Projects Cost Sharing Policy between The Halifax Regional Water Commission and Halifax Regional Municipality.

| Report Prepared by:    | Kenda<br>Signature<br>Digitally signed by Kenda<br>Signature<br>Date: 2022.06.16<br>09:49:32 -03:00'         |
|------------------------|--------------------------------------------------------------------------------------------------------------|
|                        | Kenda MacKenzie, P.Eng.,                                                                                     |
|                        | Director Regulatory Services, 902-237-7116                                                                   |
| Financial Reviewed by: | Louis de<br>Montbrun     Digitally signed by Louis<br>de Montbrun       Date: 2022.06.16<br>16:07:37 -03'00' |
|                        | Louis de Montbrun, CPA, CA<br>Director, Corporate Services/CFO, 902-490-3685                                 |
|                        |                                                                                                              |



PO Box 1749 Halifax, Nova Scotia B3J 3A5 Canada

# MEMORANDUM OF UNDERSTANDING (MOU) Regarding: Stormwater Projects Cost Sharing Policy

# between

The Halifax Regional Water Commission (Halifax Water) and Halifax Regional Municipality (the Municipality)

# I PURPOSE AND SCOPE

The Halifax/Halifax Water Integrated Stormwater Management Policy Draft Framework (ISMP), approved by Halifax Regional Council in January 2018 and the Halifax Water Board in February 2018, identifies the need for a capital investment strategy whereby funding is provided by the benefitting parties.

In October 2018, HRM staff were directed by HALIFAX Regional Council to work with Halifax Water to develop a joint implementation plan for the top 10 priority sites identified in the National Disaster Mitigation Program (NDMP) Flood Risk Assessment report. Before this can be completed, HRM and Halifax Water need to agree on a cost sharing framework that will provide guidance on project governance and implementation.

The purpose of this MOU is to identify the roles and responsibilities of each party as they relate to the implementation of stormwater infrastructure projects within the Halifax Water stormwater service boundary contained in their regulations and approved by the NSUARB. This Memorandum represents a fair and reasonable basis on which to allocate costs for joint capital works program relating to stormwater systems, subject to approval by Halifax Regional Council, the Halifax Water Board, and the Nova Scotia Utility and Review Board.

# II BACKGROUND

Currently there is no cost sharing policy to guide Halifax Water and HRM staff to identify equitable cost recovery methods for new public stormwater infrastructure to address a variety of public and private drainage issues. An interim funding solution was approved by HRM Council and the Halifax Water Board back in 2013 but expired in 2015.

Infrastructure Policy & Standards

The ISMP provides guidance on governance when delivering stormwater services, in a manner that meets both legislative requirements and community expectations relating to public safety and environmental stewardship. Approved by Regional Council and the Halifax Water Board of Commissioners in 2018, the ISMP states that a capital investment strategy must be consistent with the stated purposes of the 2007 Transfer Agreement as follows:

"To evolve the operation and maintenance of municipal wastewater and stormwater services towards a system whereby the general HRM taxpayer does not subsidize the Halifax Water ratepayer, and the Halifax Water ratepayer does not subsidize the HRM taxpayer."

# III GUIDING PRINCIPLES

- 1. The MOU shall be consistent with policies and principles outlined in the Integrated Stormwater Management Policy.
- 2. This Memorandum applies to projects that have been identified as joint priorities or general stormwater projects, as well as opportunities that are identified during right of way or utility renewal projects.
- 3. Costs shall be allocated to the cost causer and/or to those deriving a direct benefit as defined by this document. This includes private property owners.
- 4. Costs shall be apportioned in a reasonable, fair, and equitable manner.
- 5. The MOU does not apply to upgrades required by the subdivision and/or future development of land. In these cases, the developer is responsible for the required upgrades. Halifax Water or the Municipality may choose to cost share if there is a joint benefit arising from the upgrade or an oversizing of proposed infrastructure.
- 6. This MOU shall consider the effects of climate change to be required in design, and project costs will include the cost of climate change adaptation.
- 7. The assignment of cost shall be a on broad basis and shall depend on the number of benefitting parties (i.e., 100%, 50-50, 1/3-1/3), and whether the level of benefit is significant or insignificant.
- 8. The assignment of cost shall be by mutual agreement between Halifax Water and HRM.

Infrastructure Policy & Standards

# **IV DEFINITIONS**

# Capital Costs

Capital Costs include studies, property acquisition, surveying, engineering design, construction, contract administration and inspection costs.

# Deep Storm Sewer

A sewer in which the elevation of the storm pipe is below the elevation of adjacent foundation elevation. It allows for the majority of adjacent properties to drain towards the storm sewer by gravity, where reasonable.

## Major Drainage System

The path which stormwater will follow when the capacity of the Minor Drainage System is exceeded.

# Major Storm

The 1:100 year storm, which has a 1% probability of being equalled in any given year, and is the storm used as the basis for the design of the Minor and Major Drainage Systems together.

## Minor Drainage System

The system which is used for initial stormwater flows, or for flows generated by the Minor Storm.

## Minor Storm

The 1:5 year storm, which has a 20% probability of being equalled in any given year, and is the storm used as the basis for the design of the Minor Storm System.

## Private Property Minor Stormwater Impacts

Flooding or other stormwater problems related to private property as a result of a Minor Storm. May be responsibility of the private property owner when public systems are insufficient.

# V BENEFIT TO HALIFAX WATER

The following conditions represent a benefit to Halifax Water:

- 1. Where a Minor or Major Drainage System has insufficient capacity to meet the original intended design to service existing Halifax Water customers, and an upgrade will provide adequate capacity.
- 2. Where an existing stormwater system requires renewal.

Infrastructure Policy & Standards

3. Where the project results in a decrease of Inflow and Infiltration into sanitary sewer system owned by Halifax Water.

# VI BENEFIT TO THE MUNICIPALITY

The following conditions represents a benefit to the Municipality

- 1. Where there are street flooding and/or icing problems within the street right-of-way.
- 2. Where the replacement of an existing Minor Drainage System with a new Deep Storm Sewer will help stabilize or prolong the life of a Municipal road or other Municipal infrastructure.
- 3. Where no formal stormwater drainage system (Minor and/or Major) exists and providing a formal system will help stabilize or prolong the life of a Municipal road or other Municipal infrastructure.

# VII BENEFIT TO PRIVATE PROPERTY OWNERS

The following conditions represent a benefit to private property. The Private Property Owner's share may be collected through an area rate, or Council may decide to allocate this share to the appropriate general tax rate.

- 1. Where the installation of a new stormwater system will remedy private property flooding/icing resulting from a Minor Storm event.
- 2. Where the replacement of an existing Stormwater System with a new Deep Storm Sewer will remedy private property flooding/icing issues resulting from a Minor Storm event.

# VIII APPLICATION

The following table provides example of allocating costs in accordance with this Memorandum.

| Cost Sharing Summary                                                                                                                                                                                            |                         |      |                  |                              |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|------|------------------|------------------------------|--|
|                                                                                                                                                                                                                 |                         | Co   | bility           |                              |  |
| Project Type                                                                                                                                                                                                    | Project Lead            | HRM  | Halifax<br>Water | Private<br>Property<br>Owner |  |
| Minor or Major Drainage System Asset<br>Renewal and/or Upgrade                                                                                                                                                  | Halifax Water           |      | 100%             |                              |  |
| New Storm Sewer required to upgrade<br>Existing Combined Sewer                                                                                                                                                  | Halifax Water           |      | 100%             |                              |  |
| New Deep Storm Sewer to provide<br>minor drainage to address Private<br>Property Minor Stormwater Impacts,<br>which reduces I/I into a wastewater<br>system, and which prolongs the life of a<br>Municipal road | HRM or<br>Halifax Water | 34%  | 33%              | 33%                          |  |
| Remedy Street Flooding and Icing<br>Problems within HRM right-of-way                                                                                                                                            | HRM                     | 100% |                  |                              |  |
| New Major Drainage System where one<br>has not been historically required or<br>provided                                                                                                                        | HRM                     | 50%  |                  | 50%                          |  |

# IX EFFECTIVE DATE AND SIGNATURE

This MOU shall be effective upon the approval of Regional Council.



| TO:           | Becky Kent, B.A., Chair and Members of the Halifax Regional Water<br>Commission Board              |
|---------------|----------------------------------------------------------------------------------------------------|
| SUBMITTED BY: | Reid<br>Campbell<br>Date: 2022.06.15<br>15:17:16 -03'00'                                           |
|               | Reid Campbell, M.Eng., P. Eng., Director, Engineering & Technology<br>Services                     |
| APPROVED:     | Cathie<br>O'Toole<br>Digitally signed by Cathie<br>O'Toole<br>Date: 2022.06.17<br>15:42:02 -03'00' |
|               | Cathie O'Toole, MBA, FCPA, FCGA, ICD.D, General Manager                                            |
| DATE:         | June 8, 2022                                                                                       |
| SUBJECT:      | Asset Management Policy                                                                            |

# **ORIGIN**

Asset Management Roadmap June 9, 2022 Halifax Water Board Audit and Finance Committee

# **RECOMMENDATION**

It is recommended that the Halifax Water Board approve the Asset Management Policy.

# BACKGROUND

In 2013, Halifax Water staff prepared a draft asset management (AM) policy. At the time, the policy was not formally adopted and staff focused on implementation of the initial 2011 AM Roadmap recommendations. Halifax Water staff completed an asset management program reassessment in 2021/22 resulting in an updated AM Roadmap. The AM Roadmap defines a program of implementation activities to be undertaken over the next five years. One of the early activities identified was to update the AM Policy and approve as a formal Halifax Water policy.

The policy review commenced in January 2022 involving a workshop and interviews to review the values, priorities to be incorporated into principles for the policy. The updated draft policy was presented at a second workshop to confirm the main themes and key words for each. The final draft updated AM policy was reviewed at the senior staff level and consistent with Halifax Water's policy and procedures for new policies, the policy is being shared with the Labour Management

Committees for CUPE locals 1431 and 227. The updated Asset Management Policy was presented to the Halifax Water Board's Audit and Finance Committee on June 9, 2022, with a recommendation for it to be sent to Halifax Water Board for approval.

# DISCUSSION

An AM Policy is part of the overall AM management system. The AM management system is a set of interrelated and interacting elements of an organization that include policy (asset the objectives management and principles) and the strategy and plan (the processes needed to achieve the AM objectives and principles). The AM management system is the set of tools, policies, plans, business processes, and information systems that are integrated to ensure the AM principles will be implemented.

The AM Policy connects the organization's strategic objectives to the asset management system. It outlines the intentions and direction of the organization through defined AM principles aimed at ensuring effective service delivery that meets organizational objectives.

The AM Policy provides Halifax Water's commitment to asset management and demonstrates



that the policy is integrated throughout the utility in a coordinated, cost-effective, and organizationally sustainable way. It is also an indicator to ratepayers that the Halifax Water Board follows good stewardship principles and aims to deliver affordable services that consider the legacy to future ratepayers.

The Roadmap recommends developing and approving an updated AM Policy that will inform the development of an Asset Management Strategy. The strategy will identify how the policy

principles will be implemented. A report on the AM Strategy project will be brought forward to the Halifax Water Board through the Audit and Finance Committee once complete.

# **BUDGET IMPLICATIONS**

The development of the Asset Management Policy was incorporated into the 2021/22 Asset Management Program Roadmap Update – Implementation line item in the capital budget. The policy is expected to be reviewed every two years with a nominal amount of staff effort needed for the review and any updates and with no anticipated additional capital costs.

# ALTERNATIVES

There are no applicable alternatives.

# **ATTACHMENT**

Attachment 1 – Proposed Asset Management Policy

| Report Prepared by:    | AWUS Digitally signed by Valerie<br>Williams<br>Date: 2022.06.15<br>10:40:44 -03'00'         |
|------------------------|----------------------------------------------------------------------------------------------|
|                        | Valerie Williams, P. Eng.                                                                    |
|                        | Manager, Asset Management & Capital Planning                                                 |
| Financial Reviewed by: | Louis deDigitally signed by Louis<br>de MontbrunMontbrunDate: 2022.06.15<br>20:43:59 -03'00' |
|                        | Louis de Montbrun, CPA, CA<br>Director, Corporate Services/CFO                               |



## Intent:

To commit to asset management as an integrated management system aimed at service delivery. This policy defines the scope of the asset management system and connects to Halifax Water's mission, vision, and values.

## **Definitions:**

Common asset management related terms, definitions, and references are available on the <u>Halifax</u> <u>Water Asset Management Team</u> intranet site.

## Scope:

This policy applies to:

- i. Board commissioners and employees that manage or influence service delivery.
- ii. All services provided by the utility.
- iii. All core infrastructure assets owned or operated by the utility.

Halifax Water will strive for the expansion of the scope to include all assets that have actual or potential value to the organization including natural assets, data and information, knowledge, and people.

This policy will guide the development of Halifax Water's Asset Management Strategy.

## **Guiding Documents and Integration:**

This policy compliments and aligns with the following corporate policies, strategies, and plans:

- Five-Year Business Plan and the corporate vision, mission, and values
- Annual Business Plan
- Integrated Resource Plan (IRP)
- Enterprise Risk Management (ERM)
- Asset management-related Board guidance

## **Principles:**

## 1) Strategic and Forward Looking

Halifax Water will make decisions and provisions that enable its assets to meet future challenges, including changing demographics and population, customer expectations, legislative requirements, and technological and environmental factors including climate change.

## 2) Evidence-Based Decision Making

Halifax Water will continuously review and improve data, data structures, and data accessibility to make evidence-based decisions that consider the balance of service levels, whole life cost, and risk. Halifax Water will take a holistic approach to decision making to consider all assets in a service context and the interrelationships between different assets to optimize service continuity.

Page 1 of 4





## 3) Quality and Service Focused

Halifax Water will strive to deliver reliable, high-quality service that is efficient, cost-effective, and based on defined levels of service that balance community expectations and regulatory requirements with risk, affordability, and available resources.

# 4) Communication and Stakeholder Engagement

Halifax Water will encourage the sharing of data, information, and knowledge between departments to support the improvement of asset management practices and culture across service areas. Halifax Water will establish a stakeholder engagement strategy to enable transparent communications on the state of assets, levels of service, and the cost of service delivery.

## 5) Fiscal Responsibility

Halifax Water will approach service delivery and asset management in a way that is financially responsible, choosing practices, interventions, and operations that aim to reduce the cost of asset ownership, while satisfying defined levels of service, and risk thresholds.

## 6) Continuous Improvement

Halifax Water will continually improve its service delivery approach by systematically reviewing the asset management program processes, procedures, and tools. Halifax Water will stay informed on leading asset management and service delivery industry practices and will seek to be recognized as an industry thought leader.

#### 7) Environment and Sustainability

Halifax Water will strive to be environmentally, and economically sustainable into the long term by incorporating triple bottom line considerations into long term planning, climate change, and infrastructure resiliency actions.

## Procedure:

<u>AM Strategy</u> – Halifax Water commits to developing and maintaining an asset management strategy that will identify the practices and processes needed to implement the asset management policy principles and reciprocally integrate with the organization's other policies, strategies, management systems, business plans, and processes.

<u>Culture</u> – Halifax Water is committed to creating a service delivery culture where employees and commissioners consider asset management as part of delivery decisions.

Policy Review – Halifax Water will formally review the policy every 2 years.

<u>Training</u> – Halifax Water is committed to providing training, developing knowledge, and building capacity in asset management throughout the organization and for the Board commissioners.

STRAIGHT from the SOURCE

Page 2 of 4



#### Accountability:



<u>Halifax Water Board of Commissioners</u> is responsible for adopting this policy and supporting the allocation of resources for the implementation of the asset management program.

<u>General Manager</u> is responsible for advocacy and oversight of the asset management program and communicating the value of asset management to the rest of the organization.

Long Range Planning Committee is responsible for aligning the asset management program with the overall strategic direction of the organization.

<u>Infrastructure Planning Committee</u> is responsible for implementation planning for the asset management and infrastructure planning programs in alignment with other relevant corporate programs and projects to achieve the organizational service objectives identified by the Long Range Planning Committee. This includes reporting on program progress.

<u>Corporate Asset Management Team</u> provides utility-wide leadership in and consultation on asset management practices and concepts and consolidates asset management data from across the organization for enhanced decision making. The Corporate Asset Management Team supports the Asset Management Implementation Teams.

Page 3 of 4





<u>Asset Management Implementation Teams (AMITs)</u> are the links between Operations and Engineering and support day to day operational functions that meet customer service delivery expectations. AMITs are established to work towards coordinated and integrated decisions about assets, the value and services they provide, and the expenditures needed to meet agreed levels of service.

<u>Department Managers</u> are responsible for advocating asset management within their respective departments. This includes participating in or supporting the AMITs wherever possible and communicating to departmental staff about AMITs' role in asset management.

<u>Halifax Water Staff</u> will consider how their decisions impact service delivery and whether their actions are aligned with the principles identified in this policy. This may include embracing new business processes, technology, and tools necessary to be effective at asset management.

Revision: 20220609



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| TO:           | Becky Kent, B.A., Chair, and Members of the Halifax Regional<br>Water Commission Board |
|---------------|----------------------------------------------------------------------------------------|
| SUBMITTED BY: | Louis de<br>Montbrun<br>Date: 2022.06.16<br>15:34:42 -03'00'                           |
|               | Louis de Montbrun, CPA, CA<br>Director, Corporate Services/CFO                         |
| APPROVED:     | Cathie Digitally signed by Cathie O'Toole Date: 2022.06.17<br>13:01:16 -03'00'         |
|               | Cathie O'Toole, MBA, FCPA, FCGA, ICD.D<br>General Manager                              |
| DATE:         | June 8, 2022                                                                           |
| SUBJECT:      | 2021/22 Cost Containment                                                               |

# **INFORMATION REPORT**

# **ORIGIN**

- The Cost Containment Process as approved by the Halifax Regional Water Commission Board (the "Board"), October 3, 2013.
- April 14, 2015, Nova Scotia Utility and Review Board (NSUARB) Decision HRWC General Rate Application (M06540).

# BACKGROUND

The process for cost containment as approved by the Board on October 3, 2013, called for the implementation of several recommended actions that would assist Halifax Water in addressing the NSUARB request for a more rigorous approach to cost containment. One key recommendation was the establishment of a reporting structure whereby, "on a quarterly basis, the monthly financial report of the Board will also include an update on Cost Containment Initiatives".

In the Decision on the 2015 Rate Hearing, the NSUARB directed Halifax Water to file annual reports on its efforts to contain the operating costs of the utility, with this report to be filed no later than June 30 of each year.

# **DISCUSSION**

A summary report of cost containment initiatives for the 2021/22 is attached. The report shows cost containment initiatives effecting operations for 2021/22 for new initiatives implemented during the year, along with amounts of an ongoing nature from fiscal years 2013/14 to 2020/21 inclusive. The inclusion of initiatives and amounts from prior years reflects an intentional focus on sustainable results over the long term. The estimated cost savings to 2021/22 is \$6.9 million, as outlined by category in Figure #1 below:

| \$1,144,942                                             | 1.6.60/                                                                         |
|---------------------------------------------------------|---------------------------------------------------------------------------------|
| \$1 144 942                                             | 1 6 60 /                                                                        |
| <i><i><i>ϕ</i></i>,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,</i> | 16.6%                                                                           |
| \$3,170,972                                             | 45.9%                                                                           |
| \$108,700                                               | 1.6%                                                                            |
| \$2,336,011                                             | 33.8%                                                                           |
| \$33,611                                                | 0.5%                                                                            |
| \$112,138                                               | 1.6%                                                                            |
| \$6,906,374                                             | 100.0%                                                                          |
|                                                         | \$3,170,972<br>\$108,700<br>\$2,336,011<br>\$33,611<br>\$112,138<br>\$6,906,374 |

As shown above, cost containment initiatives are impacted most in the areas of Human Resource and Facilities/Process Strategies. Under Human Resource Strategies, the effects of the pension plan re-design initiated in 2015/16 is one of the main contributors to cost containment savings for the current year. Annual savings related to pension plan re-design approximates \$1.7 million, which represents 53.6% of the savings within Human Resource Strategies, and 24.6% of the total projected savings for 2021/22. An actuarial valuation performed on the pension plan January 1, 2019 resulted in the plan experiencing its first surplus since the year 2000. As a result, Halifax Water was no longer required to make special payments to cover the unfunded liability, creating a savings of \$0.8 million annually. This represents savings within Human Resource Strategies of 19.5%, and 9.0% of the total projected savings for 2021/22. The actuarial valuation performed January 1, 2022 again reported Halifax Water was no longer required to make special payments to cover any unfunded liability, as it was in a surplus position therefore, the funding status with respect to special payments will remain the same until the next actuarial valuation January 1, 2025. Additionally, if the results of the actuarial valuation are accepted by the Halifax Water Board, employer and employee contribution rates for current service costs will be reduced in 2022/23 resulting in some additional savings from 2022 - 2025.

Facilities/Process Strategies contain initiatives of varying nature, however a main contributor in this category is Halifax Water's Energy Efficiency Program. Projects under this program represent approximately \$1.4 million or 58.4% of savings reported within the Facilities/Process Strategies, and 19.7% of the total projected savings for 2021/22. Some

of the prominent initiatives under the program related to energy savings include the renewable natural gas (RNG) utilized at the Mill Cove and Timberlea wastewater treatment plants (\$0.3 million), the annual shutdown of the ultraviolet disinfection systems at the Harbour Solution and Eastern Passage wastewater treatment plants (\$0.2 million), heat recovery processes at the Harbour Solution plants (\$0.1 million), and lighting upgrades at various other facilities.

New cost containment initiatives implemented during 2021/22 resulted in one-time and ongoing cost savings amounting to \$0.6 million. These initiatives are highlighted for ease of reference in the attachment, 2021/22 Cost Containment Initiatives. Cost savings resulting from these new initiatives fall within the following categories, ranked in order of magnitude:

- Procurement Strategies \$0.3 million
- Facilities/Process Strategies \$0.3 million

Significant initiatives during 2021/22 were:

- 1. <u>Procurement Strategies</u>
  - Procurement strategies from a capital perspective have led to much of the cost savings realized in the current year. For example, the 2019 Municipal Auditor General (MAG) Fleet Use Audit led to a reduction in the Fleet Upgrade Capital Program in 2021/22 of \$1.1 million, resulting in cost savings associated with depreciation expense of approximately \$218 thousand annually. Adjustments were also made in the Sewer Jet Replacement Program where \$0.3 million was trimmed from the capital budget by choosing to replace the chassis and perform modifications on an existing vehicle rather than purchase a new unit, again resulting in depreciation savings of an estimated \$55 thousand annually.
- 2. Facilities/Process Strategies

Cost savings are being experienced at both the Mill Cove and Timberlea wastewater treatment plants, where anaerobic digesters are being used to produce biogas or renewable natural gas (RNG), which is then used to heat the digesters and all facility buildings. Cost savings are an estimated \$257 thousand annually.

# **BUDGET IMPLICATIONS**

Available information on cost containment initiatives were taken into consideration when the 2022/23 budget was developed. Initiatives that impact future fiscal periods will be incorporated into future periods.

# **ATTACHMENTS**

2021/22 Cost Containment Initiatives

| Report Prepared by: | Digitally signed by Allan<br>Campbell<br>Date: 2022.06.16<br>11:18:35-03'00' |
|---------------------|------------------------------------------------------------------------------|
|                     | Allan Campbell, B. Comm, CPA, CMA<br>Manager, Finance, (902) 490-4288        |

|   |            |          |           | 2021/22 |
|---|------------|----------|-----------|---------|
|   |            |          | Year      | Cost    |
| # | Initiative | Comments | Initiated | Savings |
|   |            |          |           |         |

#### 1 General Budget Strategies

|       | Sub-tota                                                                             | al                                                                                                                                                                                                                                                                                                                                                       |         | \$0         |
|-------|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------|
| 2 Pro | curement Strategies                                                                  |                                                                                                                                                                                                                                                                                                                                                          |         |             |
|       | Customer account collections                                                         | Coordination of collection services related to closed customer accounts in<br>conjunction with the Provincial Public Procurement Act, rather than outsourcing to<br>private organizations                                                                                                                                                                | 2014/15 | \$10,000    |
|       | Lab Testing                                                                          | Savings as a result of contract tendering                                                                                                                                                                                                                                                                                                                | 2013/14 | \$60,000    |
|       | NSPI rate reclassification                                                           | Eastern Passage Wastewater Treatment Facility (WWTF)                                                                                                                                                                                                                                                                                                     | 2014/15 | \$16,000    |
|       | NSPI rate reclassification                                                           | Duffus Street Pumping Station                                                                                                                                                                                                                                                                                                                            | 2015/16 | \$15,000    |
|       | Chemical purchasing                                                                  | Able to purchase a corrosion inhibitor with a higher concentration of active<br>ingredient, thus foregoing additional costs that would have resulted under current<br>dosage requirements                                                                                                                                                                | 2015/16 | \$400,000   |
|       | Garbage collection - JD Kline Plant                                                  | A request for proposal (RFP) was put out to consolidate the garbage collection,<br>which resulted in a cost savings with respect to internal man-hours and use of HW<br>vehicles.                                                                                                                                                                        | 2016/17 | \$1,370     |
|       | Utilizing HW staff to setup excavations sites                                        | Using trained HW staff as TWS for job sites, unless outside traffic control personal<br>are required                                                                                                                                                                                                                                                     | 2016/17 | \$50,000    |
|       | RFP for biosolids transport                                                          | As a result of a RFP, the is expected to be an approximate 33% cost reduction<br>related to transporting biosolids from the Halifax, Dartmouth, Herring Cove and<br>Eastern Passage WWTF                                                                                                                                                                 | 2017/18 | \$220,000   |
|       | Insourcing (Halifax Water's Annual Report)                                           | The ability to perform in-house graphic design work versus contracting this work<br>outside created savings with respect to the 2018 report of approximately \$100/page.<br>Recurring annual savings will fluxuate depending on the size of the report in<br>subsequent years.                                                                           | 2018/19 | \$9,200     |
|       | Equipment calibration                                                                | Internal staff are now able to calibrate fixed gas detectors instead of outsourcing this to a MSA technician service provider.                                                                                                                                                                                                                           | 2019/20 | \$3,000     |
|       | Reduction in sampling                                                                | Reduced the amount of lab testing over the year as greater reliance and confidence<br>was placed on the new, in-line analyzers.                                                                                                                                                                                                                          | 2019/20 | \$5,000     |
|       | Elimination of a customer satisfaction survey                                        | HW performs 2 customer surveys annually, the Forth Quarter Urban Report and the Atlantic Quarterly Survey. Upon review it was determined there was a redundancy in question asked between the 2 surveys therefore, it was decided to consolidate the questioning into the Forth Quarter Urban Report.                                                    | 2020/21 | \$5,319     |
|       | Reduction in fleet repair costs                                                      | Savings associated with the removal of 16 units from the fleet as a direct result of<br>the Municipal Auditor General's audit of fleet in 2019, and subsequent action taken<br>by Fleet Utilization Management for Halifax Water, for units that did not meet the<br>minimum fleet utilization standards.                                                | 2020/21 | \$41,500    |
|       | Reduction in depreciation costs related to Fleet                                     | As recommended in the 2019 MAG Fleet Use Audit, the Fleet Upgrade Capital<br>Program was reduced in 2021/22 by \$1.1 million resulting in savings associated<br>with depreciation costs over the next 5-years estimated at \$0.2 million per year.                                                                                                       | 2021/22 | \$218,000   |
|       | Reduction in depreciation costs related to discounted meter purchase                 | As the AMI metering project was concluding, an opportunity to purchase AMI meters<br>in bulk became available, to take advantage of significant price savings from a<br>capital perspective.                                                                                                                                                             | 2021/22 | \$1,254     |
|       | Reduction in depreciation costs related to Fleet                                     | An adjustment was made to the Sewer Jet Replacement Program whereby, rather than replace an existing unit, it was decided to replace the truck chassis along with a complete rebuild of the tank, pumps and body assembly. Cost of a new unit would approximate \$550 thousand compared to a budgeted cost of \$275 thousand for the alternative chosen. | 2021/22 | \$55,000    |
|       | Operational cost savings related to purchase of a single axle, hydro excavation unit | After an successful pilot with a single axle, hydro excavation unit, it was decided to purchase the rental unit. It is expected the savings as a result of purchasing the unit versus outsourcing the work will be in the range of \$28-\$42 thousand per year, net of depreciation over a 7-year period.                                                | 2021/22 | \$28,000    |
|       | Procurement of annual audit fees                                                     | Reduction in the annual audit fees through a request for proposal (RFP) process.<br>The contract term is for a 5-year period, and assuming an inflation factor of 2% over<br>fees of the prior year, potential savings over the term could approximate \$41,000.                                                                                         | 2021/22 | \$6,300     |
|       | Sub-tota                                                                             | al                                                                                                                                                                                                                                                                                                                                                       |         | \$1,144,943 |
| 3 Hun | nan Resource Strategies                                                              |                                                                                                                                                                                                                                                                                                                                                          |         |             |
|       | Heavy Truck and Equipment Service                                                    | the addition of a new Heavy Equipment Technician provides in-house maintenance                                                                                                                                                                                                                                                                           | 2013/14 | \$100,000   |

Beeper PayElimination of an inconsistency between Water and Wastewater Services, as Water<br/>Services staff do not receive beeper pay. This involves 10 non-union staff in total.2013/14\$75,000Workload, labor force assessmentA reduction in number of staff in Development Approvals. The volume of work did<br/>not warrant 6 planning technologists, and as a result this number has been reduced<br/>to 4.2015/16\$140,000

#### Halifax Water Summary Report - Cost Containment Initiatives 2021/2022

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| 1/202 | .2                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                             |         |             |
|-------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------|
|       | Pension plan re-design                                                                | Through the collective bargaining process, HW was able to negotiate pension plan<br>re-design to make the plan more sustainable. It is estimated the employer's share<br>contributions will decrease from the current 12.95% to 9.85% effective January 1,<br>2015.                                                                                                                                                                         | 2015/16 | \$1,700,000 |
|       | Re-structuring within the organization to create a new<br>"Corporate Services" sector | January 1, 2016 saw the elimination of two (2) full time positions and a re-design of several other jobs.                                                                                                                                                                                                                                                                                                                                   | 2015/16 | \$35,000    |
|       | Workload, labor force assessment                                                      | January 1, 2016 saw the elimination the administrative assistant within Regulatory<br>Services.                                                                                                                                                                                                                                                                                                                                             | 2015/16 | \$57,000    |
|       | Workload, labor force assessment                                                      | November, 2016 saw the elimination of a Compliance Sampling position as a result<br>of a reduction in sampling requirements.                                                                                                                                                                                                                                                                                                                | 2016/17 | \$81,966    |
|       | Overtime reductions                                                                   | Overtime has been reduced at the Harbour Solutions Plants with respect to sick leaves, vacation, etc. when weather conditions allow and operational needs are met. Also, Halifax WWTF staff are responding to after hours calls at the Dartmouth and Herring Cove facilities in an effort to minimize the need for overtime call-outs.                                                                                                      | 2016/17 | \$40,000    |
|       | Actuarial Valuation - January 1, 2019                                                 | The actuarial valuation performed January 1, 2019 reported a surplus for the<br>pension plan. As a result, special payments by Halifax Water to fund the unfunded<br>liability are no longer required for at least 3 years when the next valuation is to be<br>performed                                                                                                                                                                    | 2018/19 | \$618,900   |
|       | Modifications to the Pre-Retirement Leave Program                                     | In June 2019, employees were given the opportunity to withdraw their accrued<br>benefit under the Pre-Retirement Leave Program in the form of a lump-sum<br>payment, rather than continuing to accrue a benefit under a modified program. The<br>Pre-Retirement Leave Program had been closed to new, non-union employees<br>hired after March 31, 2018, and is now effectively closed for all other employees<br>hired after June 7. 2018. | 2019/20 | \$260,000   |
|       | Hiring deferral                                                                       | Hiring of the Administrative Assistant in Legal Services was deferred for at least two years. The position became vacant in May 2020, and savings of salary and benefits were realized.                                                                                                                                                                                                                                                     | 2020/21 | \$63,105    |
|       | Sub-tota                                                                              | al                                                                                                                                                                                                                                                                                                                                                                                                                                          |         | \$3,170,972 |
| Inf   | ormation Technology Strategies                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                             |         |             |
|       | Xerox managed print solutions                                                         | Rationalization and replacement of photocopiers and printers                                                                                                                                                                                                                                                                                                                                                                                | 2013/14 | \$20.000    |
|       | Network                                                                               | Change in cost model by Eastlink, giving HW the new pricing                                                                                                                                                                                                                                                                                                                                                                                 | 2013/14 | \$80,000    |
|       | Telephone land lines                                                                  | Rationalization of services and eliminate duplication of resources as required                                                                                                                                                                                                                                                                                                                                                              | 2013/14 | \$8,700     |
|       |                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                             |         |             |
|       | Sub-tota                                                                              | al                                                                                                                                                                                                                                                                                                                                                                                                                                          |         | \$108,700   |
| Fac   | cilities/Process Strategies                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                             |         |             |
|       | Chlorine Utilization - Pockwock                                                       | Discontinuation of the pre-chlorination process                                                                                                                                                                                                                                                                                                                                                                                             | 2013/14 | \$40,000    |
|       | Lab Testing                                                                           | Price benefits from purchasing product from a different source mainly affecting the<br>Harbour Solution Plants                                                                                                                                                                                                                                                                                                                              | 2013/14 | \$105,000   |
|       | Pumper Truck Utilization                                                              | pilot project to be scheduled initially for stormwater customers only as a test                                                                                                                                                                                                                                                                                                                                                             | 2013/14 | \$130,000   |
|       | Waste oil boiler system - Herring Cove WWTF                                           | new system to allow the use of waste oil from Metro Transit as an alternative<br>heating source                                                                                                                                                                                                                                                                                                                                             | 2014/15 | \$13,250    |
|       | System sampling for HPC's                                                             | sampling was reduced from weekly to monthly                                                                                                                                                                                                                                                                                                                                                                                                 | 2014/15 | \$8,025     |
|       | NSE system assessments                                                                | Assessment reports are being completed in-house rather that being outsourced                                                                                                                                                                                                                                                                                                                                                                | 2014/15 | \$25,000    |
|       | Decommissioning of the Bedford South pumping station                                  | The developer driven system expansion will permit the use of gravity and pressure<br>reduction rather than the pumping station                                                                                                                                                                                                                                                                                                              | 2014/15 | \$15,000    |
|       | Lighting upgrades - Bennery Lake WSP                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2014/15 | \$4,793     |
|       | Insulation upgrades - Bennery Lake WSP                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2014/15 | \$36,000    |
|       | Lighting upgrades - Eastern Passage WWTF                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2014/15 | \$7,880     |
|       | Lighting upgrades - Dartmouth WWTF                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2014/15 | \$22,542    |
|       | Lighting upgrades - Herring Cove WWTF                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2014/15 | \$13,744    |
|       | Lighting upgrades - Halifax WWTF                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2014/15 | \$29,845    |
|       | Lighting upgrades - Aerotech BPF                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2014/15 | \$19,109    |

Change in Recycling Pickups

Lighting upgrades - Aerotech BPF HVAC upgrades - Eastern Passage WWTF

Orchard Park in-line turbine project

Wind farm - Pockwock WSP

condition of pipes

E-delivery

Biogas CHP system - Mill Cove

HVAC upgrades - Roach's Pond pumping station

MCC 190 cooling and heat recovery - Halifax WWTF

Aeration system upgrades - Eastern Passage WWTF

Disposal of water treatment plant solid residual material

Advanced investigative tool for leaks and structural

By changing the schedule for recycling pickups from bi-weekly to every three (3) weeks, the anticipated annual savings will range from \$2,500 to \$2,700.

The current program has been halted as a cost containment initiative and as a result

A new location for the disposal of the residual material was found

Transitioning from traditional billing methods to e-delivery

of the information received.

\$2,700

\$20,711

\$13,500

\$13,164

\$76,382

\$24,479

\$130,399

\$86,000

\$36,000

\$150,000

\$20,000

2014/15

2014/15

2014/15

2014/15

2014/15

2014/15

2014/15

2014/15

2014/15

2014/15

2015/16

Halifax Water Summary Report - Cost Containment Initiatives 2021/2022

| Highway #7 Booster Station Upgrade                        | Expected energy savings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2015/16 | \$14,300  |
|-----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----------|
| Dartmouth WWTF - UV Channel Isolation                     | Expected energy savings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2015/16 | \$59,460  |
| Halifax WWTF - Fixed Compressed Air Leaks                 | Expected energy savings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2015/16 | \$2,293   |
| Halifax WWTF - UV Channel Isolation                       | Expected energy savings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2015/16 | \$62,115  |
| Herring Cove WWTF - MCC 190 Cooling/Heat Recovery         | Expected energy savings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2015/16 | \$8,496   |
| Sampling                                                  | Using internal staff at the Mill Cove facility to perform the required daily sampling at the facility, rather than the compliance staff, limiting their site visits to once a week.                                                                                                                                                                                                                                                                                                                                                                                                        | 2015/16 | \$4,160   |
| Process alternative                                       | A centrifuge was rented for the Mill Cove WWTF (with the option to purchase) on a trial basis to dewater liquid sludge that typically would be transported to the Aerotech WWTF. The transport of the liquid sludge resulted overtime costs, as well as reducing the time available for HW truck to service other facilities. This process assisted the Aerotech in reaching its compliance goals and reduced overtime costs by an estimated 50%. This equipment will enable HW proceed with a digester clean out project, which would otherwise be sub-contracted at a cost of \$200,000. | 2015/16 | \$40,000  |
| Process change                                            | It was decided that flanges for meter sizes greater than 2" would be the<br>responsibility of the customer, since when meters are replaced, the flanges are not<br>replaced.                                                                                                                                                                                                                                                                                                                                                                                                               | 2015/16 | \$4,854   |
| UV disinfection shutdown - HHSP and Eastern Passage WWTFs | Annual shutdown of UV disinfection system resulted in cost savings associated with<br>electrical energy savings, peak demand reduction,                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2016/17 | \$234,268 |
| Halifax WWTF - Carbon Scrubber By-Pass                    | Implemented April, 2016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2016/17 | \$59,386  |
| Tools developed internally                                | Tools developed internally to install new operating nuts on buried valves. Previously<br>nuts were lost on buried valves resulting in a need to excavate the valve and install<br>new nuts. Cost savings are achieved regarding excavation and reinstatement.                                                                                                                                                                                                                                                                                                                              | 2016/17 | \$20,000  |
| Spruce Hill transmission main                             | Two long term leaks were discovered in the transmission main resulting in cost<br>savings from the perspective of water loss control.                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2016/17 | \$3,000   |
| Utilization of industrial water                           | A new filter system was installed at the Eastern Passage WWTF that provides the<br>capability to use the current industrial water system rather than potable water to<br>deliver water to the polymer feed systems.                                                                                                                                                                                                                                                                                                                                                                        | 2016/17 | \$26,000  |
| Cost reductions (material transport)                      | Modifications to the screening/grit skip eliminated the need to purchase 2 new<br>screening compactors, which also resulted in the amount of material transported of<br>approximately 28 metric tonnes.                                                                                                                                                                                                                                                                                                                                                                                    | 2017/18 | \$2,000   |
| Herring Cove WWTF - Carbon Scrubber By-Pass               | Implemented April, 2017                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2017/18 | \$12,177  |
| Servicing oxygen monitors in-house                        | Technical Service staff have been trained by the manufacturer to service the fleet of personal gas monitors in-house, specifically the replacement of the oxygen sensor. These monitors, 165 in total, are used by all operation and treatment departments throughout the organization.                                                                                                                                                                                                                                                                                                    | 2018/19 | \$30,000  |
| Pumping Station Starters (4160V)                          | The pumping station starters were upgraded to vacuum starters, thus eliminating the need for annual servicing of the starters to be outsourced. Any maintenance can now be handled by in-house industrial electricians.                                                                                                                                                                                                                                                                                                                                                                    | 2018/19 | \$1,500   |
| Automated Flushing Stations                               | Automated flushing stations are now used to ensure the proper chorine residuals<br>are achieved in all areas of the transmission and distribution system. Previously this<br>operation was performed manually on a daily basis from approximately June to<br>September. As a result labor and vehicle costs have been reduced accordingly.                                                                                                                                                                                                                                                 | 2018/19 | \$8,000   |
| Corrosion Sampling                                        | Corrosion sampling in the distribution system was reduced from bi-weekly to<br>monthly in June, 2018, since enough baseline data has been collected and there<br>are no immediate plans to change corrosion control in the near future.                                                                                                                                                                                                                                                                                                                                                    | 2018/19 | \$12,600  |
| Alternative product                                       | An alternative timing belt was introduced to replace the normal v-belt/sheave configuration, which reduced slippage between the v-belts and sheaves resulting in a reduction in power demand. The product has been installed at both the Halifax and Herring Cove WWTF, with the expectation of implementation at other wastewater and water facilities.                                                                                                                                                                                                                                   | 2018/19 | \$40,000  |
| Dosage Optimization                                       | Desiccant filters were fitted to the polymer totes to prevent warm, moist air from contaminating the polymer dosed to thicken centrifuge and drum thickener solids. The polymer no longer reacts early with water before being dosed, thus allowing the optimization of the dose and preventing polymer waste, leading to reduced consumption.                                                                                                                                                                                                                                             | 2019/20 | \$20,000  |
| Alternative product                                       | The HP biofilter exhaust fan motor belts will be replaced with syncrodrive timing<br>belts, saving energy (electricity) through the prevention of slippage. Belts and<br>sheaves have been purchased and will be installed in October, 2019.                                                                                                                                                                                                                                                                                                                                               | 2019/20 | \$4,500   |
| Building maintenance                                      | Installed new weather stripping in the overhead door in the truck bay at the<br>AeroTech plant to reduce heating costs                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2019/20 | \$1,500   |
| Polymer optimization                                      | Began polymer optimization in an effort to ensure good quality biosolids as well as a good quality centrate without having excess amounts of polymer. Were able to reduce the feed rate from 60% to 21%.                                                                                                                                                                                                                                                                                                                                                                                   | 2019/20 | \$15,000  |
| Improvements to aeration train                            | Installed a curtain in the aeration train to enable better mixing of the microorganisms with the chemical, thereby reducing chemical costs and providing better quality treatment.                                                                                                                                                                                                                                                                                                                                                                                                         | 2019/20 | \$15,000  |
| Optimization of polymer dosing (Mill Cove)                | By implementing daily jar testing to determine the startup dose setpoint, polymer dosing was optimized.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2019/20 | \$14,000  |
| Belt drive change-out (Mill Cove)                         | Replacing the belt drive with a synchronous chain drive on a 30 horsepower blower<br>resulted in a cost savings associated with energy consumption.                                                                                                                                                                                                                                                                                                                                                                                                                                        | 2019/20 | \$1,275   |
| Upgrading equipment (Mill Cove)                           | Upgrading the water flow meter used in the dilution of polymer resulted in lowering<br>water usage in the process by approximately 20,000 litres per day.                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2019/20 | \$12,000  |

|   | Fan belt/ pulley replacements - Mill Cove WWTF                                   | Expected energy savings - based on 12,750 kWh                                                                                                                                                                                                                                                                                                                                                                                                                    | 2019/20 | \$1,300               |
|---|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----------------------|
|   | Fan belt/ pulley replacements - Dartmouth WWTF                                   | Expected energy savings - based on 177,980 kWh                                                                                                                                                                                                                                                                                                                                                                                                                   | 2019/20 | \$20,000              |
|   | Preventative maintenance program established                                     | A preventative maintenance program was created in conjunction with HW operations staff to clean centrifuge centrate lines weekly at a cost of \$235. Clogging of centrate in the centrate lines were being experienced resulting in a backup in the centrifuge drum and bio-solids bin. Every 2-3 weeks it was costing approximately \$1,000 to remove obstructions by an outside contractor, in addition to internal staff time and equipment.                  | 2020/21 | \$10,000              |
|   | Centrifuge adjustments                                                           | Adjustments to the weir plate on both centrifuges at the dewatering facility<br>allows more water to escape during the dewatering process, resulting in a<br>product that is 6% dryer on average. Having a more compacted product results is<br>fewer trucks going to the N-Viro facility saving on tipping fees. In addition, solids<br>in the resulting product is now over 28% which is subject to a reduced rate, a<br>savings of approximately \$12/ tonne. | 2020/21 | \$15,000              |
|   | Chemical substitution                                                            | Carbon source (Micro C) is a proprietary compound used as a food supply for<br>micro-organisms in the denitrification process at the Aerotech WWTF, which is<br>effective but quite expensive. HW has been able to source beer wort from a local<br>brewery as a substitute for Micro C. Beer wort is a waste product in brewing beer<br>which is high in carbon.                                                                                                | 2020/21 | \$85,000              |
|   | Reduction in heating fuel costs                                                  | The installation of a 18,000 BTU heat pump in the admin area of the Leachate<br>Facility, coupled with repairs to an existing unit in the lab area, resulted in<br>heating fuel savings.                                                                                                                                                                                                                                                                         | 2020/21 | \$5,000               |
|   | Solar PV - COMFIT/ Renewable Energy Generation                                   | Operational at the Halifax WWTF for the period January - March 2021                                                                                                                                                                                                                                                                                                                                                                                              | 2020/21 | \$28,593              |
|   | Fan belt/ pulley replacements - Eastern Passage WWTF                             | Expected energy savings - based on 118,348 kWh                                                                                                                                                                                                                                                                                                                                                                                                                   | 2020/21 | \$13,366              |
|   | Harbour Solution Plants (2020/21) - Ventilation Air Heat<br>Recovery             | Expected energy savings for the Halifax, Dartmouth and Herring Cove WWTF                                                                                                                                                                                                                                                                                                                                                                                         | 2015/16 | \$91,527              |
|   | Utilizing alternative assets to perform similar duties                           | Rather than using vacuum trucks to get loads of digested waste from Mill Cove on days when they are unable to centrifuge, the 2 new dump trucks from AeroTech are used. This will be done a initially during long weekends and holidays when no dumping is available through the RE Group, at an estimated daily savings of \$750.                                                                                                                               | 2021/22 | \$8,250               |
|   | The production of biogas used to heat the digesters, and all facility buildings  | Both the Mill Cove and Timberlea WWTF's have anaerobic digesters which produce<br>biogas or renewable natural gas (RNG) which is used to heat the digesters as well<br>as all the facility buildings.                                                                                                                                                                                                                                                            | 2021/22 | \$256,569             |
|   | Reduction in the usage of caustic                                                | The pH set point was reduced from 7.1 to 6.8 in order to reduce the amount of caustic consumed, while still enduring nitrification in the bioreactors. Usage was monitored over a 6-week period, and the savings are estimated to be in the range of 30%                                                                                                                                                                                                         | 2021/22 | \$30,000              |
|   | Sub-tota                                                                         | al                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         | \$2,336,011           |
| 6 | C. Deduce Denoy and Drinting Costs                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |         |                       |
| 0 | Electronic HRWC Board Packages                                                   | Send Board packages out electronically rather than issuing hard copies                                                                                                                                                                                                                                                                                                                                                                                           | 2013/14 | \$7.500               |
|   | Stewardship Report                                                               | The Stewardship Report will be published electronically only, with no hard copies                                                                                                                                                                                                                                                                                                                                                                                | 2013/14 | \$3,000               |
|   | Changes to document archiving                                                    | Transitioning file storage from outside contractor to public resources                                                                                                                                                                                                                                                                                                                                                                                           | 2013/14 | \$3,175               |
|   | Changes to document archiving                                                    | Transitioning file storage from outside contractor to public resources                                                                                                                                                                                                                                                                                                                                                                                           | 2016/17 | \$9,000               |
|   | Cost reduction associated with off-site storage                                  | There has been an effort to reduce the number of boxes (documents) stored in facilities such as Iron Mountain, by sorting and purging documents in accordance with the document retention policy of the Commission.                                                                                                                                                                                                                                              | 2018/19 | \$10,000              |
|   | Cost reduction associated with the 23rd Annual Report (General Manager's office) | The annual report for the year ended March 31, 2019 saw the number of copies produced drop from 275 copies in the previous year to 150 copies. This represents not only a cost savings but also an environmental benefit associated with paper reduction.                                                                                                                                                                                                        | 2019/20 | \$936                 |
|   | Sub-tota                                                                         | al                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         | \$33,611              |
| 7 | Technology and Business Process Changes                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |         |                       |
| 1 | Workload, labor force assessment                                                 | Through the utilization of technology, such as a Customer Relationship                                                                                                                                                                                                                                                                                                                                                                                           | 2015/16 | \$47,605              |
|   |                                                                                  | has been removed.                                                                                                                                                                                                                                                                                                                                                                                                                                                |         |                       |
|   | Workload, labor force assessment                                                 | has been removed.<br>Re-structuring by management within the advanced metering infrastructure (AMI)<br>project as a result of technological efficiencies anticipated.                                                                                                                                                                                                                                                                                            | 2015/16 | \$64,533              |
|   | Workload, labor force assessment                                                 | A budgeted addition (customer service representative)<br>has been removed.<br>Re-structuring by management within the advanced metering infrastructure (AMI)<br>project as a result of technological efficiencies anticipated.                                                                                                                                                                                                                                   | 2015/16 | \$64,533<br>\$112,138 |

\$6,906,374


| TO:           | Becky Kent, B.A., Chair, and Members of the Halifax Regional Water<br>Commission Board                                                        |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| SUBMITTED BY: | Susheel Digitally signed by<br>Susheel Arora Date: 2022.06.15<br>11:50:09 -03'00'                                                             |
| APPROVED:     | Susheel Arora, M.A.Sc. P.Eng. Director, Operations<br>Cathie<br>O'Toole<br>O'Toole<br>Cathie O'Toole, MBA, FCPA, FCGA, ICD.D, General Manager |
| DATE:         | June 13, 2022                                                                                                                                 |
| SUBJECT:      | Lead Service Line Replacement Program                                                                                                         |

## **INFORMATION REPORT**

#### <u>ORIGIN</u>

In October 2020, the Nova Scotia Utility and Review Board issued order M09589 granting Halifax Water authority for the approval to pay for private lead service replacements at utility cost (up to \$10,000). This report provides an annual update on the Get the Lead Out Program.

#### BACKGROUND

In October 2016, the Halifax Water Board approved a business plan for a new approach to Lead Service Lateral (LSL) replacement, consistent with the National Drinking Water Advisory Council (NDWAC) recommendations to the USEPA.

On August 22, 2017, the Nova Scotia Utility and Review Board issued an order granting Halifax Water authority to undertake emergency LSL renewals to the water meter at utility cost and to provide a 25% rebate (up to a maximum of \$2500) to homeowners undertaking a LSL replacement.

In October 2020, the Nova Scotia Utility and Review Board issued order M09589 granting Halifax Water authority for the approval to pay for private lead service replacements at utility cost (up to \$10,000). The new Halifax Water Get the Lead Out program will replace all lead service lines by 2038 as opposed to the previous program goal of 2050.

## **DISCUSSION**

The attached report reflects the first year of the new approved Get the Lead Out Program. With this being the first year of the program, the internal replacement goals were 150 private and 100 public lead service lines. This goal was exceeded with a total of 185 private and 105 public lead service lines replaced. The average cost of a private replacement was \$4,424 and the average cost of a public replacement was \$6,733. For 2022/23, the target is 200 private and 150 public lead service line replacements.

### ATTACHMENT

Get The Lead Out: 2021/22 Program Summary

| Report Prepared by: | 14/bally                                             |  |
|---------------------|------------------------------------------------------|--|
| Report Prepared by. | Melissa Healey, M.A.Sc., C.E.T.                      |  |
|                     | Water Quality Program Supervisor, Phone 902-209-8370 |  |
|                     |                                                      |  |



902-420-9287 450 Cowie Hill Road P.O. Box 8388 RPO CSC Halifax, Nova Scotia Canada B3K 5M1

# Get The Lead Out: 2021/22 Program Summary

June 16, 2022





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Halifax

Water



## **1** Introduction

In October 2020, the Nova Scotia Utility and Review Board issued order M09589 granting Halifax Water authority for the approval to pay for private lead service replacements at utility cost (up to \$10,000). This report provides an annual update on the Get the Lead Out Program.

## 2 Background

In October 2016, the Halifax Water Board approved a business plan for a new approach to Lead Service Lateral (LSL) replacement, consistent with the National Drinking Water Advisory Council (NDWAC) recommendations to the USEPA.

On August 22, 2017, the Nova Scotia Utility and Review Board issued an order granting Halifax Water authority to undertake emergency LSL renewals to the water meter at utility cost and to provide a 25% rebate (up to a maximum of \$2500) to homeowners undertaking a LSL replacement.

In October 2020, the Nova Scotia Utility and Review Board issued order M09589 granting Halifax Water authority for the approval to pay for private lead service replacements at utility cost (up to \$10,000). The new Halifax Waters Get the Lead Out program will replace all lead service lines by 2038 as opposed to the 2016 goal of 2050.

Replacements are being coordinated with HRM's street paving and renewal schedule to minimize disruption to the community and be cost-efficient for ratepayers. A limited number of individual replacements are being completed with priority given to customers who are most at-risk from lead exposure. Replacements are completed at no cost to the property owner (up to a maximum of \$10,000).

Halifax Water schedules the replacements, which could take place at any time throughout the life of the program. In addition to integrating with HRM on street paving and a property owner requested program, Halifax Water can also set up targeted programs to replace lead service lines including targeting sensitive populations, geographical areas, point of sale or other criteria. Targeted programs will be built out as the program matures.

Figure 1 below, shows evolution of the Get the Lead Out program, including regulatory, industry and utility drivers.







Figure 1::Evolution of the Get the Lead Out Program

#### Get the Lead Out Program Overview 2020/21 3

Halifax Water's approach to manage its customer's exposure to lead is designed to be consistent with the National Drinking Water Advisory Council's (NDWAC) recommendations to the USEPA on the Lead and Copper Rule, which have been endorsed by the American Water Works Association, to the degree they can be applied in Canada and do not conflict with local regulatory requirements.

The 5 pillars of the approach and progress made towards each pillar in the 2021/22 fiscal year are described below:

#### 3.1 Lead Service Line Inventory

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Understanding where lead service lines exist is critical to the success and ultimate completion of the LSL replacement program. Where service lines are buried infrastructure, the inventory is only as good as historical record keeping practices, and practices varied over time. Within the lead service line boundary, which is the part of the distribution system that would have been serviced by a centralized water system prior to 1960, There are 14,459 domestic services in Halifax, and 8,840 in Dartmouth that at one point could have been lead. To date, efforts have been focused on the following tasks to improve the accuracy of the existing inventory along with developing a machine learning model to help predict service line material as described in the following sections.

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## 3.1.1 Improving Inventory Accuracy

Each year, the accuracy of the inventory is improved through consolidation and review of records, hydroexcavation of service boxes and gathering information from property owners. Changes are made where necessary to improve the accuracy of the inventory.

To date, there are an estimated 8,300 service points within the Halifax lead boundary which have been reviewed and updated for accuracy. Dartmouth streets are being reviewed on a case by case basis and will be completed once the remainder of the Halifax boundary has been reviewed. The majority of the uncertainty in records and large number of unknown material service lines are in Dartmouth due to historical record keeping practices. Despite the high number of unknowns, there were large scale public lead service line replacement practices in Dartmouth in the 1970's and it is anticipated that many of these unknowns are copper.

Table 1 shows changes to the inventory from last year to this year as a result of lead service line replacements, work done through consolidating and reviewing records, hydroexcavation of service boxes, and gathering information from property owners.

| Date          | Public<br>Lead | Public<br>Unknown | Private<br>Lead | Private<br>Unknown |
|---------------|----------------|-------------------|-----------------|--------------------|
| April 1, 2021 | 1,395          | 2,566             | 2,968           | 7,547              |
| April 2, 2022 | 1,314          | 2,608             | 2,896           | 6,234              |

Table 1: Inventory of lead and unknown service lines as of April 1 of each year

## 3.1.2 Service Line Material Predictive Modeling via Machine Learning

Even with the efforts being made to digitize and authoritate records, there are still gaps and many unknowns that require hydroexcavation to confirm material prior to replacement. To reduce costs of the program and the need to hydroexcavate every service, Halifax Water engaged Blue Conduit, a company born out of the Flint water crisis that uses machine learning algorithms to predict service material based on historical records, property records, past construction practices and any other information that is available.

In the 2021/2022 fiscal year, Halifax Water received service line predictions for service lines within the lead service line boundary in Halifax. The predictions were provided as a percent likelihood of a service line being composed of lead. Currently, Halifax Water is verifying the reliability of the predictions by conducting physical observations of service line material and comparing them to the corresponding likelihood of lead prediction. The goal is to determine a threshold precent likelihood of lead where a physical observation (hydroexcavation) of the service line is not required.

In Dartmouth, due to the lack of information on services lines in this region, more hydroexcavations are required to build a foundation for the Blue Conduit model. It is anticipated that an updated Halifax model and the first Dartmouth model will be received in early fall 2022.

STRAIGHT from the SOURCE



### 3.2 Lead Service Line Replacement

For 2021/2022 fiscal year, the first year of the new Get the Lead Out program, Halifax Water's goal was to replace 150 private lead service lines and 100 public lead service lines. This goal was exceeded as shown in the Figure 2 below. For 2022/2023, the goal is to replace 200 private lead service lines and 150 public lead services lines to reach the program goal of removing all lead service lines from the system by 2038.

Figure 2 summarizes the number of public and private renewals completed since 2011. The grey boxes added in 2016 represent approved contractors who can replace both the private and public portions at the same time in order to reduce the time span of having a partial replacement. The positive impact of the early adopters in the rebate program from 2017-2019 and the Get the Lead Out program in 2021/22 are evident from this figure.

Table 2 below summarizes the number of replacements in 2021/22 as part of the new Get the Lead Out program, broken down by program with reference to where the program sits within the Halifax Water Regulations.

In 2021/22, all but one private lead service on HRM recapitalization paving projects and Halifax Water capital projects were replaced. In this case, the homeowner declined the replacement. There were 128 applications to the property owner requested lead service line replacement program in fiscal year 2021/22. Out of these, 54 lead service lines were replaced in 2021/2022 and 52 have already been contracted for replacement in 2022/2023. It is anticipated that the remaining 28 will also be renewed in 2022/2023.

| Program                            | HW Regulations<br>subsection | # of private<br>renewals | # of public<br>renewals |
|------------------------------------|------------------------------|--------------------------|-------------------------|
| Unplanned disturbance              | 51A.(3)                      | 8                        | 3                       |
| Service Line Leaks                 | 51A.(4)                      | 8                        | 4                       |
| HRM/Halifax Water Capital          | 51A.(5)                      | 69                       | 45                      |
| Property Owner Requested           | 51A.(6)                      | 51                       | 21                      |
| Customer initiated with 25% rebate | 51A.(7)                      | 34                       | 17                      |
| Other (abandoned)                  | N/A                          | 15                       | 15                      |
| Total                              |                              | 185                      | 105                     |

## Table 2: Summary of replacements in 2021/22 broken down by program type









Figure 2: Number of public (orange) and private (blue) service lines replaced by fiscal year. Grey bars indicate residents who used the same day authorized contractor program to renew both public and private service lines in the same day

## 3.3 Public Outreach

Halifax Water is continually working to increase customer awareness and engagement in the lead service line replacement program. Halifax Water developed and launched the property owner requested lead service line replacement program in March of 2021. This program prioritizes replacements based on health risk, geography and integration with HRM's paving program.

A new website was developed <u>https://www.halifaxwater.ca/get-the-lead-out</u>, to guide property owners through the online application process for this program. If property owners do not want to wait for Halifax Water to schedule their replacement, they can continue to replace on their own timeline and receive the 25% rebate.

Halifax Water responded to 167 customer inquiries related to lead, and letters were issued directly to homeowners either through replacement programs or to engage homeowners in our regulatory requirement for lead and copper sampling.

When a customer applies to have their lead service line replaced, they are sent information about the Get the Lead Out Program. They are also provided with a pitcher filter and 6 replacement filters which are certified for the removal of lead, to be used for drinking and cooking during and after their lead service line replacement when they may experience elevated levels of lead due to the construction process. A historical summary of filter kits provided is shown in Table:3.

STRAIGHT from the SOURCE



|                   | 2017/18 | 2018/2019 | 2019/2020 | 2020/2021 | 2021/2022 |
|-------------------|---------|-----------|-----------|-----------|-----------|
| Total Filter Kits | 140     | 176       | 161       | 119       | 224       |
| Provided          |         |           |           |           |           |

Table:3 Number of filter kits provided to residents as part of the LSL replacement program.

### 3.4 Corrosion Control and Water Quality Monitoring

Halifax Water and Dalhousie University continue to conduct research to optimize and monitor corrosion control treatment. Outcomes of research have led to greater effectiveness for corrosion control treatment at both JD Kline and Lake Major treatment plants. Research in 2021/22 focused on two areas:

- Full scale monitoring of the impact of an increase in orthophosphate dose through sampling at customer homes and sampling sentinel lead racks and coupons within Halifax Water infrastructure.
- Pipe loop and bench scale studies on the use of sequestrants in addition to orthophosphate to simultaneously control lead, iron, and manganese.

Halifax water continues to use the following routine corrosion control sampling programs:

- I. Distribution Coupon Monitoring
- II. Distribution Corrosion Control and Biostability Monitoring
- III. Lead Rack Monitoring

## 3.5 Customer Sampling

#### 3.5.1 Lead Service Line Replacement Monitoring program

Post lead service line replacement is offered to all customers in the program. Samples are provided at 3 and 6 months post replacement as past data show that lead levels are typically below detection by 6 months. Participation in this program varies from year to year and is dependent on customer desire to participate. This year there were 62 kits delivered and 50 kits returned.

## 3.5.2 Customer Request Lead Sampling

Halifax Water provides complimentary lead testing for customers who have a known or suspected lead service line, and who live in a house built prior to 1960 within the lead service boundary, consistent with Health Canada protocols. Results are sent to the customer once they are available. For the 2021/22 fiscal year, there were 32 delivered to customers and 24 of those sample kits were returned and analyzed.





## 3.5.3 Annual Regulatory Residential Monitoring Program

Halifax Water conducts an annual residential sampling program to monitor the effectiveness of the corrosion control program by analyzing lead and copper levels in customers' homes throughout the distribution system as per Health Canada's protocol for Guidance on Corrosion Control Monitoring. Once per year, 100 homes are tested on a volunteer basis, 50 in each of the Halifax and Dartmouth Systems. 6-hour stagnated samples are collected. Figure 3 below shows the 90<sup>th</sup> percentile of this sampling program. The regulatory limit is a 90<sup>th</sup> percentile below 15 ug/L.



*Figure 3: Historical results of 90<sup>th</sup> percentile lead concentrations for first-litre 6-hr stagnation regulatory sampling* 

## 4 Lessons Learned from Year 1 of Get The Lead Out

Year one of the Get the Lead Out program came with many successes and challenges and lessons learned which are being used to guide year two, including those described below.

 There were a large number of hydroexcavations required by Operations as a result of requested replacements through the property owner requested applications, HRM paving projects, and capital work. There were also a significant number of additional hydroexcavations required to train the model for the the inventory modeling project. With the program launching later in the season, it was difficult to conduct investigative work by hydroexcavation on every service line. This resulted in late season tendering of replacements.

> STRAIGHT from the SOURCE



As described above, work is underway to improve the accuracy of the inventory to reduce the number of hydroexcavations required each year. In the mean-time, Halifax Water staff are reaching out to homeowners requesting a photo of the water line coming through the foundation at the meter or conducting a home site inspection for the upcoming season.

These efforts have been able to reduce a portion of required hydroexcavations through identification of lead in the home, but information from homeowners can vary in its detail and accuracy and these observations only provide information on the private portion of the service line.

2. In year 1, CCTV videos of the wastewater laterals were conducted pre and post construction. This was done to identify any wastewater laterals that should be replaced at the same time as the lead service line and also to provide confirmation that construction practices did not damage the wastewater lateral in case of future homeowner concerns.

However, adding CCTV into the process both extended the timeline and the cost per replacement. After reviewing a full season of using this process, there was not much overlap in required public wastewater lateral replacement through analysis of these videos. Thus the benefit to this work given the cost and operational resources required to process the videos resulted in removing this requirement from the program moving forward.

3. Due to the nature of the program, and different replacement programs for property owner requested, capital work and integration with HRM, there was room for improvement after the first year with internal communications and business processes. A Junior Utility Engineer has been assigned to manage replacements through the property owner requested program for consistency and to improve program delivery.

#### 4.1 Survey

A post-construction survey was sent out to participants in late fall of 2021. The survey consisted of a series of questions about the contractor process, Halifax Water, and the overall Get the Lead Out Program. Homeowners were asked to rate questions ranging from very satisfied to very dissatisfied regarding communications from Halifax Water/Contractor, reinstatement work, the application process, sampling process, and timelines of the replacement. Homeowners were also asked to rank the likeness of recommending the program out of 10.

There were 22 responses received and most of the responses fell under the very satisfied or satisfied category. These responses and comments were used to make improvements to the 2022/2023 year.

#### Example Customer Quotes:

"We very much appreciate the opportunity to have our lead line replaced free of charge, thank you!"

STRAIGHT from the SOURCE



"Thank you! Everything went really smoothly and the replacement happened much sooner than expected."

"The time between I was notified for approval to replace the line and the time of work started is reasonable. However, the reinstatement of the property will be done in the following spring and it is too long. Overall, we appreciate this program that provides clean water to my family and also reduces the financial burden. I have recommended this program to my friends nearby who have the lead pipe in their house. Thank you."

"I feel that the program was very successful for me. However, I feel that "getting the lead out" should be a top priority for HRM and that it probably needs 10 times the current budget. Just looking out for my fellow residents. Thanks so much for this program."

"It was very much appreciated. Great program, especially given that homeowners shouldn't have to bear the brunt of this cost, incurred because of practices many decades ago. The only real wrinkle was the water sampling afterwards. The online form was glitchy and reports came many weeks later."

## **5** Financial Summary

Table 4: Financial summary of lead service line replacement by program in 2021/22

|                          | Private Replacements |                   |                  | Public Replacements |           |            |  |
|--------------------------|----------------------|-------------------|------------------|---------------------|-----------|------------|--|
| Program                  | # of private         | Total             | Unit Cost        | # of public         | Total     | Unit Cost  |  |
|                          | replacements         | Cost \$           | to Halifax       | replacements        | Cost \$   | to Halifax |  |
|                          |                      |                   | Water            |                     |           | Water      |  |
| Unplanned disturbance    | 8                    | \$45 <i>,</i> 845 | \$5,731          | 3                   | \$23,214  | \$7,738    |  |
| Service Line Leaks       | 8                    | \$77,187          | \$9 <i>,</i> 648 | 4                   | \$32,429  | \$8,107    |  |
| HRM/Halifax Water        | 69                   | \$366,233         | \$5 <i>,</i> 308 | 45                  | \$289,217 | \$6,427    |  |
| Capital                  |                      |                   |                  |                     |           |            |  |
| Property Owner Requested | 51                   | \$302,394         | \$5 <i>,</i> 706 | 21                  | \$225,642 | \$10,745   |  |
| 25% rebate               | 34                   | \$28,217          | \$838*           | 17                  | \$136,478 | \$8,028    |  |
| Other (abandoned)        | 15                   | \$0.00            | \$0              | 15                  | \$0       | \$0        |  |
| Total                    | 185                  | \$819,876         | \$4,424          | 105                 | \$706,980 | \$6,733    |  |

\*The cost to Halifax Water which is only 25% of the total cost of the renewal due to the rebate





|                                     | 2017/18           | 2018/19          | 2019/20          | 2020/21           | 2021/22   |
|-------------------------------------|-------------------|------------------|------------------|-------------------|-----------|
| Customer Request Lead Sampling      | \$4,914           | \$13,305         | \$15,092         | \$5,236           | \$5,566   |
| LSL Replacement Monitoring Program  | \$12 <i>,</i> 285 | \$14,636         | \$6 <i>,</i> 863 | \$1,925           | \$2,080   |
| Pitcher Filter Kits                 | \$10,271          | \$11,759         | \$10,878         | \$18,270          | \$16,880  |
| Communications                      | \$11 <i>,</i> 900 | \$2 <i>,</i> 607 | \$23.00          | \$6,778           | \$860     |
| Staff                               | \$148,758         | \$228,016        | \$246,988        | \$211,935         | \$302,624 |
| Lead Service Line Rebate            | \$14,107          | \$102,333        | \$81,111         | \$52 <i>,</i> 600 | \$28,217  |
| Inventory Modelling                 | N/A               | N/A              | N/A              | \$18,750          | \$81,705  |
| Hydro-excavations*                  | NC                | NC               | NC               | \$45 <i>,</i> 500 | \$142,500 |
| Total non-replacement program costs | \$202,235         | \$372,656        | \$360,955        | \$308,394         | \$580,432 |
|                                     |                   |                  |                  |                   |           |
| Average Public Replacement          | \$8,067           | \$11,468         | \$11,648         | \$10,147          | \$6,733   |
| Average Private Replacement         | N/A               | N/A              | N/A              | N/A               | \$4,424   |

Table 5: Financial summary of non-replacement lead program costs and historical summary of average LSL replacement costs

\*Based on an estimated \$500 per service

*NC* – *Not captured for reporting purposes* 

STRAIGHT from the SOURCE

## 6 **Program Statistics**

Table 6: Summary of statistics of the lead program since inception in 2017

|                             | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/2022 |
|-----------------------------|---------|---------|---------|---------|-----------|
| Public replacements         | 82      | 115     | 103     | 74      | 105       |
| Private replacements        | 84      | 128     | 128     | 86      | 185       |
| Rebates                     | 18      | 105     | 89      | 50      | 26        |
| Filter kits issued          | 140     | 158     | 161     | 119     | 224       |
| Customer kits analyzed      | 78      | 150     | 196     | 68      | 74        |
| Lead ticket inquiries       | 263     | 300     | 426     | 333     | 167       |
| Hydro-excavations completed | N/A     | N/A     | N/A     | 91      | 285       |





| TO:           | Becky Kent, B.A., Chair and Members of the Halifax Regional Water<br>Commission Board                                                           |  |  |  |  |  |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| SUBMITTED BY: | KendaDigitally signed by Kenda<br>SignatureSignatureDate: 2022.06.16<br>13:49:31-03'00'Kenda MacKenzie, P.Eng., Director of Regulatory Services |  |  |  |  |  |
| APPROVED:     | Cathie<br>O'Toole<br>Cathie O'Toole<br>Cathie O'Toole, MBA, FCPA, FCGA, ICD D, General Manager                                                  |  |  |  |  |  |
| DATE:         | June 1, 2022                                                                                                                                    |  |  |  |  |  |
| SUBJECT:      | Stormwater Credit Update                                                                                                                        |  |  |  |  |  |

## <u>ORIGIN</u>

The Nova Scotia Utility and Review Board Decision M07731 dated April 12, 2017, at paragraph [102] directed "that HRWC provide a semi-annual update on March 31 and September 30 of each year on the status of the credit program participation. This should be filed with the Board and any interested parties and be made available on the HRWC website." Halifax Water subsequently suggested that given the low volume and materiality of credits annual reporting would be preferable and the Board agreed indicated in a letter dated October 10, 2019 that the stormwater credit information should be filed by June 30th each year.

## BACKGROUND

With the initial introduction of stormwater charges in 2013, there was a request by some non-residential customers to consider a credit program to acknowledge the reduced impact their private side stormwater management systems had on the public stormwater system. It was not until the subsequent application in 2017 that a credit program was adopted.

In order to qualify for the credit program, the private stormwater management system for the property must match the post-development peak flow rate with the pre-development peak flow rate for, at minimum, the 1:5 year storm event. This can be achieved utilizing a number of design components such as, but not limited to:

- Detention Ponds
- Detention Tanks
- In line pipe storage
- Roof Storage

- Engineered Wetlands and/or
- Green Infrastructure

A Non-Residential Customer that demonstrates their Site Related Flows are detained on their property or an adjacent property, as part of an overall stormwater management plan, is eligible to receive a credit. The initial stormwater credit application must be submitted and accompanied by a record drawing for the site specific stormwater management plan or site grading plan prepared and stamped by a professional engineer. The record drawing must include the calculations confirming the stormwater management system for the property either matches the post-development peak flow rate with the pre-development peak flow rate the 1:5 year storm event, or betters the post-development peak flow rate to a larger storm event. Record drawings prepared in support of a Building Permit Application process can be considered and should include the required information related to the recommended maintenance and cleaning activities and the respective frequency.

The stormwater credit must be re-applied for annually using the Stormwater Credit Renewal Form and the application shall provide confirmation that the private stormwater management system was maintained and cleaned as per the recommendations of the professional engineer or the manufacturer's recommendations. The certification can be provided by the person responsible for maintaining and managing the property or site.

In areas where combined stormwater and wastewater systems exist, a credit cannot be provided, as the detention achieved in these sewersheds may be used to create wastewater capacity for development.

Residential Customers that would like to apply for a credit and be billed as a Non-Residential Customer, must complete the application form and submit all of the same documentation for review. They are also required to reapply annually with the Stormwater Credit Renewal form.

By undertaking the above, the Customer is eligible for a credit between 30% and 50% on their Non-Residential, Site Related Flow Stormwater bill.

## DISCUSSION

In 2021/22 stormwater credits were applied to two accounts, for a total value of \$26,179.

## **BUDGET IMPLICATIONS**

Each year the number of credits applied for is dependent on the eligible customers. It is anticipated to be in the order of \$40,000 in 2022/23.

| Report Prepared by:    | Kenda<br>Signature<br>Date: 2022.06.16<br>13:49:48 -03'00'                                               |  |
|------------------------|----------------------------------------------------------------------------------------------------------|--|
|                        | Kenda MacKenzie, P.Eng.,<br>Director Regulatory Services, 902-237-7116                                   |  |
| Financial Reviewed by: | Louis de<br>Montbrun<br>Digitally signed by Louis<br>de Montbrun<br>Date: 2022.06.16<br>15:36:23 -03'00' |  |
|                        | Louis de Montbrun, CPA, CA<br>Director, Corporate Services/CFO                                           |  |



| TO:           | Becky Kent, B.A., Chair, and Members of the Halifax Regional Water<br>Commission Board                                 |
|---------------|------------------------------------------------------------------------------------------------------------------------|
| SUBMITTED BY: | Jacob Fulton<br>Date: 2022.06.17<br>15:34:07 -03'00'                                                                   |
| APPROVED:     | Jeff Myrick, Manager of Communications<br>Cathie<br>O'Toole<br>Cathie O'Toole, MBA, FCPA, FCGA, ICD.D, General Manager |
| DATE:         | June 15, 2022                                                                                                          |
| SUBJECT:      | Stakeholder Engagement Update                                                                                          |

## **INFORMATION REPORT**

## <u>ORIGIN</u>

The Nova Scotia Utility and Review Board (NSUARB), in their Order for Matter No. M09494, Regional Development Charges (RDCs) update, directed Halifax Water to enhance stakeholder engagement on a number of topics that impact infrastructure planning and framework for the future framework for the development of the RDCs.

## BACKGROUND

In the Order issued by the NSUARB dated April 7, 2021, the stakeholder engagement was:

- to review projects, programs and studies and assign an appropriate percentage in the next RDCs update of the related costs to growth related needs for regional infrastructure, and
- to include them in the calculation of future RDCs;
- for future RDCs applications, to indicate which of the methods for determination of Benefit to Existing (BTE) it has utilized for each project;
- review identified "information gaps" concerning Halifax Water's Wet Weather Management Program, Asset Management Program and Stormwater Management efforts, as well as the Wastewater Treatment Facilities (WWTFs) study;
- to refine its BTE methodology and calculations prior to the next RDCs application;
- to establish a specific methodology for apportioning I/I reduction project costs to BTE and to growth in future RDCs applications;
- to establish a specific methodology for apportioning WWTF project costs to BTE and to growth in future RDCs applications;

- to review the RDCs on an annual basis to determine whether the RDCs would change by  $\pm 15\%$ , and where that threshold is triggered, to pursue an update of the RDCs, and to file an annual reporting with the NSUARB for comment by stakeholders;
- to develop a new Industrial Commercial Institutional (ICI) RDCs methodology to be used in the next RDCs five-year application, based on the Residential Equivalent Unit (REU) approach; and
- to identify potential Demand Side Management initiatives and to evaluate those initiatives so the cost-effective measures can be included in the next RDCs application.

## **DISCUSSION**

### Engagement Activities:

- February 23, 2022 Cathie O'Toole, General Manager of Halifax Water; Kenda MacKenzie, Director, Regulatory Services and Kevin Gray, Manager, Engineering Approvals, participated in a presentation to the Urban Development Institute. This provided updates on RDCs activities and outlined our plans for further engagement. Urban Development Institute members in attendance provided feedback and questions related to RDCs and payment timing.
- Kevin Gray, Manager Engineering Approvals regularly attends the quarterly Development Liaison Group (DLG) meetings. The DLG is comprised of representatives from HRM Planning and Development (7), Nova Scotia Home Builders Association (4), Urban Development Institute (4), Halifax Water (1), Nova Scotia Power (1) and Heritage Gas (1). Halifax Water provides updates on milestones relating to the RDCs and other relevant policy updates.
- April 14, 2022 Halifax Water's senior management team met and completed a stakeholder mapping exercise to identify stakeholders based on interest and influence in RDCs. This allows further refinement of the stakeholder engagement plan focusing on issues of most significant interest to stakeholders.
- May 17, 2022 Halifax Water hosted RDCs breakfast session for stakeholders. More than 50 stakeholders were invited, and 14 attended a session designed to start a formal and long-term engagement process. The attached presentation and key graphics from the session were emailed to all attendees and stakeholders who were invited but did not attend. Topics covered included:
  - What is the RDC? Why are RDCs needed?
  - Key initiatives for Halifax Water.
  - Key assumptions for RDCs.
  - Meaningful engagement and a collaborative path forward.

#### Discussion Points:

This was a positive and productive session with open and meaningful discussion. Some of the discussion points included:

- Process and timing of the collection of the regional development charge.
- Stakeholders asked if there is an opportunity to charge the homeowner directly for RDCs. Under the current collection framework, additional costs (ie financing, interest) are passed along to the homeowner, and provide no additional benefit to the homeowner and/or Halifax Water.
- The importance of communication and transparency regarding any changes to the RDCs process.
- Halifax Water should make more effort to reduce impacts and footprints and incentivize users to change behaviours.
- Halifax Water should communicate information and provide updates on its innovation initiatives.

#### Key discussion topics moving forward:

Based on these discussions, Halifax Water will be working with the development community and other stakeholders over the long-term on topics such as:

- Long-term planning and associated infrastructure needs
- Refining allocation methods and calculations
- Reporting
- Halifax Water to provide updates on Demand Side Management

#### Next Steps:

The next stakeholder engagement session will be scheduled for the week of September 26<sup>th</sup>. The goal is to develop working groups based on the following topics:

- Wet Weather Management Plan
- Benefit to Existing
- Residential Equivalent Units
- In advance of the September session, Halifax Water will also be conducting targeted outreach to other key stakeholders to update them and encourage their participation in this work.
- Contact the Consumer Advocate over the summer and offer them a formal update on RDCs engagement activity.
- Developing stakeholder engagement activities for the remainder of fiscal 2022/23.



| TO:           | <b>Becky Kent</b> , Chair, and Members of the Halifax Regional Water Commission Board                               |  |  |
|---------------|---------------------------------------------------------------------------------------------------------------------|--|--|
| SUBMITTED BY: | Sille Can Start 16:10:22-03:00'                                                                                     |  |  |
|               | Louis de Montbrun, Director, Corporate Services                                                                     |  |  |
| APPROVED:     | Cathie Digitally signed by Cathie<br>O'Toole Date: 2022.06.17<br>13:15:54 -03'00'<br>Cathie O'Toole General Manager |  |  |
|               | Cathle O Toole, General Manager                                                                                     |  |  |
| DATE:         | June 16 <sup>th</sup> , 2022                                                                                        |  |  |
| SUBJECT:      | Regional Development Charge – Financial Status Report for the Fiscal Year ended March 31, 2022.                     |  |  |
|               |                                                                                                                     |  |  |

## **INFORMATION REPORT**

## <u>ORIGIN</u>

Nova Scotia Utility and Review Board approval of Regional Development Charges for water and wastewater M09494.

## BACKGROUND/DISCUSSION

Halifax Water oversees the water and wastewater Regional Development Chagres for the upgrading of regional water and wastewater systems to facilitate projected population growth. The Nova Scotia Utility and Review Board approved the most recent update of the charges in February 2021.

In accordance with the Halifax Water Regulations, Halifax Water is obligated to provide an accounting of all charges received and all costs incurred with respect to the infrastructure improvement.

Attached is an annual report showing the cumulative accounting of all Regional Development Charges received and disbursed as of the end of the fiscal year at March 31, 2022. The format provides an entry of debit and credit transaction with a cumulative total to date for each charge from inception to the applicable year-end.

## **Collections and Expenditures**

| Regional Development<br>Charge | Receipts     | Interest    | Disbursements | Cumulative   |
|--------------------------------|--------------|-------------|---------------|--------------|
| Water                          | \$6,899,082  | \$94,250    | \$3,729,740   | \$3,263,592  |
| Wastewater                     | \$85,803,897 | \$1,080,107 | \$23,031,126  | \$63,852,878 |
| Grand Total                    | \$92,702,978 | \$1,174,357 | \$26,760,866  | \$67,116,469 |

As of March 31, 2022, both water and wastewater Regional Development Charges are in positive cash positions. Combined, the net balance is \$67.12 million with the implementation of \$26.76 million in infrastructure projects. The Regional Development Charge program is anticipated to be cost neutral, fulfilling the desired need to provide central services for the projected growth of the Halifax Regional Municipality (HRM).

HRM Regional Planning team are targeting the completion of the draft Regional Plan by end of 2022, with a review of the future growth areas 2023/24. The recent announcement of the nine Special Planning Areas, being advanced as part of the joint provincial/municipal initiative to advance the creation new building lots, may influence the population projections. With the uncertainity of changes to planning projections, staff are unable to adjust the current infrastructure plan and revenue estimates. However, staff are currently reviewing the nine areas against the current infrastructure plan and associated timings to make any relevant adjustments to the plan. Note, staff remain confident the plan has the ability to provide the appropriate system capacity as development continues.

Given the above, where the population projections have not been adjusted, nor the infrastrure plan, the review of the of the other inputs to the RDC model were completed assuming the overall infrastructure lists within the 20-year charge period is unchanged.

Staff have inputted the actual collections and actual expenditures into the financial model, and are projecting collections based on current population projections and the infrastructure list.

## Annual Validation of the Charges

The Halifax Water Regulations state:

(14) Subject to subsections (15) and (16), the administration of the Regional Development Charge for water shall, every five years after May 31, 2021, be reviewed by the Commission, including with reference to any changes to the Infrastructure Master Plan.

(15) In the event changes to the inputs to the Infrastructure Master Plan, including growth projections, land use, consumption rates, inflow/infiltration assumptions, capital costs, financing costs, and benefit to existing Customers, result in changes to the infrastructure requirements identified in the Infrastructure Master Plan, including the timing of their implementation, the Regional Development Charge, will be reviewed by the Commission and adjusted, subject to Board approval, prior to a five year review described in subsection (14).

(16) In the event the changes to infrastructure requirements described in subsection (15) result in an impact of 15%, either in the positive or the negative, to the Regional Development Charge, the Commission will change the Regional Development Charge, subject to Board approval, to reflect such impact in infrastructure requirements.

The Nova Scotia Review Board decision dated October 29, 2020, it states:

The requirement of the above noted five-year review and interim reviews of the RDC remain unchanged in the Halifax Water Rules and Regulations. The Board reiterates the importance of such reviews, and the need to seek an immediate change to the RDC rate if the review results in a change in excess of  $\pm 15\%$ . This is important not only to avoid the potential for rate shock, but also to ensure such extra costs (or reduced costs) are allocated fairly between different generations of developers.

## Annual Indexing of Charges

Regional Development Charges, Sections 29(4) and 30(4) of the Regulations state:

The wastewater Regional Development Charge shall be indexed each year on April 1<sup>st</sup>, in accordance with the indexing set out in the Consumer Price Index for Halifax, as published by Statistics Canada for the immediately preceding month, when compared to the same month for the immediately preceding year

The consumer price index for Halifax can be found on the Statistics Canada website here: <u>Consumer Price Index</u>, <u>annual average</u>, <u>not seasonally adjusted (statcan.gc.ca)</u>. Using that data, the annual escalation can be calculated.

| 2017 | 131.2 | 1.1% |
|------|-------|------|
| 2018 | 134.0 | 2.1% |
| 2019 | 136.0 | 1.5% |
| 2020 | 136.7 | 0.5% |
| 2021 | 142.0 | 3.9% |

2021 Annual Index =  $\underline{142.0 - 136.7} = 3.9\%$ 136.7

The 2021 Annual Index of an increase of 3.88%, which was applied to Regional Development Charges on April 1, 2022 has no impact to the overall calculation, projected collections, or project expenditures of the Regional Development Charges.

## **Escalation of Infrastructure Costs**

The Regional Development Charges financial model utilizes a blended average of national and local non-residential construction indexes, similar to the method laid out in the Capital Cost Contribution policy within the regulations, to escalate the infrastructure cost estimates to the estimated year of construction.

The Non-Residential Construction indexes for Canada and Halifax can be found on the Statistics Canada website here: <u>Building construction price indexes</u>, by type of building (statcan.gc.ca)

| Stats Can Non-Res Construction |                                   |                                    |                                |                                 |
|--------------------------------|-----------------------------------|------------------------------------|--------------------------------|---------------------------------|
| Year                           | Canada<br>Index value<br>as at Q4 | Halifax<br>Index value<br>as at Q4 | Canada<br>Percentage<br>change | Halifax<br>Percentage<br>change |
| Q4 2001                        | 61.1                              | 63.9                               | 0                              |                                 |
| Q4 2002                        | 62.6                              | 65.5                               | 2.5%                           | 2.5%                            |
| Q4 2003                        | 64.4                              | 67.4                               | 2.9%                           | 2.9%                            |
| Q4 2004                        | 70.0                              | 71.8                               | 8.7%                           | 6.5%                            |
| Q4 2005                        | 73.5                              | 74.8                               | 5.0%                           | 4.2%                            |
| Q4 2006                        | 80.3                              | 78.5                               | 9.3%                           | 4.9%                            |
| Q4 2007                        | 86.8                              | 82.8                               | 8.1%                           | 5.5%                            |
| Q4 2008                        | 94.0                              | 88.4                               | 8.3%                           | 6.8%                            |
| Q4 2009                        | 86.8                              | 88.0                               | -7.7%                          | -0.5%                           |
| Q4 2010                        | 88.3                              | 89.4                               | 1.7%                           | 1.6%                            |

| Q4 2011 | 92.0  | 91.9  | 4.2%  | 2.8%  |
|---------|-------|-------|-------|-------|
| Q4 2012 | 93.9  | 93.8  | 2.1%  | 2.1%  |
| Q4 2013 | 94.6  | 94.5  | 0.7%  | 0.7%  |
| Q4 2014 | 96.0  | 96.4  | 1.5%  | 2.0%  |
| Q4 2015 | 96.6  | 98.0  | 0.6%  | 1.7%  |
| Q4 2016 | 98.2  | 98.3  | 1.7%  | 0.3%  |
| Q4 2017 | 100.9 | 101.1 | 2.7%  | 2.8%  |
| Q4 2018 | 105.8 | 101.9 | 4.9%  | 0.8%  |
| Q4 2019 | 108.1 | 102.5 | 2.2%  | 0.6%  |
| Q4 2020 | 109.4 | 102.8 | 1.2%  | 0.3%  |
| Q4 2021 | 121.7 | 114.4 | 11.2% | 11.3% |

|                     | Canada | Halifax | Combined |
|---------------------|--------|---------|----------|
| Twenty-year average | 3.6%   | 3.0%    | 2.99%    |
| Five-year average   | 4.5%   | 3.2%    | 3.75%    |
| Average of 5 and 20 | 4.0%   | 3.1%    | 3.55%    |
| Note:               |        |         |          |

- StatsCan publishes data quarterly

- Used averages of the 4th quarter indexes

The inflation experienced in 2021, although averaged and blended, alters the annual escalation assumption from 2.24% to 3.55%. This results in projected cost estimates escalating annually at a higher rate.

## **Interest During Construction**

Interest during construction is charged on the individual phase cost for the year in which it is constructed. This is reimbursed to the constructor of the phase cost whether it be a developer or Halifax Water. It is applied to each phase cost within the financial models of the Regional Development Charges. Interest during construction is set by adding 0.75% to the 10-year average of the Canadian Overnight Repo Rate Average (CORRA) issued by the Bank of Canada.

| Summary      | Date      |       |
|--------------|-----------|-------|
| Low          | 12/1/2021 | 0.10% |
| High         | 12/1/2018 | 1.78% |
| Average      |           | 0.87% |
| Average +0.7 | '5% Risk  | 1.62% |

The updating of Interest During Construction within the financial models from 1.77% to 1.62% has minimal impacts the charges.

## **Balance Financing**

Interest is charged on the projected Regional Development Charge cumlative balance when expenditures is higher than collections. The interest rate is set by adding 0.75% to the 10-year average of Canadian Yield Bonds.

| Summary        | Date   |           | V122543 |
|----------------|--------|-----------|---------|
| Low            |        | 7/1/2020  | 0.48%   |
| High           |        | 12/1/2013 | 2.72%   |
| Average        |        |           | 1.68%   |
| Average +0.759 | % Risk |           | 2.43%   |

The updating of interest rates within the financial models from 3.01% to 2.43% has minor impacts on the charges due to the rolling cumulative balance over the charge period. The charges experience both negative and positive cumulative balances over the twenty-year period.

## **Conclusion**

Considering all variables including, collections, expenditures, inflations, and interest rates the water and wastewater Regional Development Charges are projected to be under collected by 12.00% wastewater and 16.85% water.

The 2019 Regional Development Charge application to the NSUARB predicted water and wastewater collections to be \$3,964,944 and \$12,640,391 respectively. Actual 2021 water and wastewater collections were \$3,8,41,922 and \$18,150,190, respectively, with the updated NSUARB approved rates not taking effect until May 31, 2021.

Halifax Water is proposing to leave the RDC charge unchanged until there is greater certainty with population projections and a more detailed review can be completed of the infrastructure plan required to support the growth projections.

Halfiax Water did escalate the Regional Development Charge on April 1, 2022 by the Halifax Consumer Price Index as approved by the NSUARB. Growth in Halifax remains higher than that predicted within the 2019 Regional Development Charge application. Higher collections strengthen the financial model. For these reasons, Halifax Water recommends the water and wastewater charges to remain unchanged.

## **ATTACHMENT**

1. Halifax Water Regional Development Charge Report – Summary to March 31, 2022

| Report prepared by: | Lift Digitally signed by Kevin<br>Gray<br>Date: 2022.06.17<br>16:15:26 -03'00' |  |
|---------------------|--------------------------------------------------------------------------------|--|
| Report prepared by. | Kevin Gray, MURP, P.Eng.<br>Manager, Engineering Approvals                     |  |
|                     | Alicia Digitally signed by Alicia Scallion                                     |  |
| Report reviewed by: | Scallion Justice 2022.06.17<br>16:13:19-03'00'<br>Alicia Scallion, CPS, CA     |  |
|                     | Manager, Accounting<br>902-497-9785                                            |  |

# HALIFAX WATER

# **Regional Development Charge Report**

# Summary to March 31, 2022

| Regional Development Charge | Receipts     | Interest    | Disbursements | Cumulative   |
|-----------------------------|--------------|-------------|---------------|--------------|
| Water                       | \$6,899,082  | \$94,250    | \$3,729,740   | \$3,263,592  |
| Wastewater                  | \$85,803,897 | \$1,080,107 | \$23,031,126  | \$63,852,878 |
| Grand Total                 | \$92,702,978 | \$1,174,356 | \$26,760,866  | \$67,116,469 |

#### HALIFAX WATER REGIONAL DEVELOPMENT CHARGE - WATER Summary to March 31, 2022

| Transaction Description                                                    | Receipts       | Interest | Disbursements | Cumulative  |
|----------------------------------------------------------------------------|----------------|----------|---------------|-------------|
|                                                                            |                |          |               |             |
|                                                                            |                |          |               |             |
| 2014/15 Summary                                                            | \$135,518.26   |          |               | \$135,518   |
| 2015/16 Summary                                                            | \$229,939.19   |          |               | \$365,457   |
| 2016/17 Summary                                                            | \$444,849.65   |          |               | \$810,307   |
| 2017/18 Summary                                                            | \$489,377.06   |          |               | \$1,299,684 |
| 2018/19 Summary                                                            | \$607,340.12   |          |               | \$1,907,024 |
| 2019/20 Summary                                                            | \$496,601.83   | \$45,032 |               | \$2,448,659 |
| 2020/21 Summary                                                            | \$653,533.96   | \$22,908 |               | \$3,125,100 |
|                                                                            |                |          |               |             |
| 2021/22 Summary                                                            |                |          |               |             |
| Collections                                                                | \$3,841,921.69 | \$26,309 |               | \$6,993,332 |
| 3-3290 Peninsula Internediate Looping (Cork Street - Dublin to Windsor)    |                |          | \$657,175     | \$6,336,156 |
| 3-2821 Lucasville Road Twinning (Phase 1)                                  |                |          | \$2,120,873   | \$4,215,283 |
| 3-2910 Port Wallace Transmisison main (Main Street to Caledonia Road)      |                |          | \$99,263      | \$4,116,020 |
| 3-3103 Peninsula Intermediate Looping (Berlin Street -Connaught to Dublin) |                |          | \$852,428     | \$3,263,592 |
|                                                                            |                |          |               |             |
|                                                                            |                |          |               |             |
| Summary to March 31, 2022                                                  | \$6,899,082    | \$94,250 | \$3,729,740   | \$3,263,592 |

#### **Project Information**

Nova Scotia Utility & Review Board Approval Date: February 2021

Regional Development Charge - Water - Single Unit Dwelling \$1,723.84 / unit (2021)

Regional Development Charge - Water - Multi Unit Dwelling \$1,157.80 / unit (2021)

Regional Development Charge - Water - Commercial \$8.51 / m2 (2021)

Total Escalated Infrastructure Cost: \$ 347,086,773

Total Escalated Infrastructure Cost recovered through RDC: \$106,184,479

Percentage of Total Infrastructure Cost to be recovered through RDC Charge - 30.59%

#### HALIFAX WATER REGIONAL DEVELOPMENT CHARGE - WASTEWATER Summary to March 31, 2022

| Transaction Description                              | Receipts        | Interest     | Disbursements   | Cumulative   |
|------------------------------------------------------|-----------------|--------------|-----------------|--------------|
|                                                      |                 |              |                 |              |
|                                                      |                 |              |                 |              |
| 2014/15 Summary                                      | \$5,316,501.18  |              |                 | \$5,316,501  |
| 2015/16 Summary                                      | \$4,782,583.79  |              | \$6,037,557.03  | \$4,061,528  |
| 2016/17 Summary                                      | \$8,215,956.76  |              |                 | \$12,277,485 |
| 2017/18 Summary                                      | \$10,671,360.04 |              |                 | \$22,948,845 |
| 2018/19 Summary                                      | \$13,081,858.76 |              |                 | \$36,030,704 |
| 2019/20 Summary                                      | \$11,224,911.36 | \$528,825.26 | \$11,643,615.64 | \$36,140,824 |
| 2020/21 Summary                                      | \$14,360,535.11 | \$228,984.48 | \$2,371,117.81  | \$48,359,226 |
| 2021/22 Summary                                      |                 |              |                 |              |
| Collections                                          | \$18,150,189.72 | \$322,296.90 |                 | \$66,831,713 |
| 6-2274 - Clayton Park Lateral Lining - Top hat Pilot |                 |              | \$471,482.88    | \$66,360,230 |
| 6-1688 - Sewer Separation - Romans & Federal Avenues |                 |              | \$2,507,352.46  | \$63,852,878 |
|                                                      |                 |              |                 |              |

| Summary to March 31, 2022 | \$85,803,897 | \$1,080,107 | \$23,031,126 | \$63,852,878 |
|---------------------------|--------------|-------------|--------------|--------------|
|                           |              |             |              |              |

#### **Project Information**

Nova Scotia Utility & Review Board Approval Date: February 2021

Regional Development Charge - Wastewater - Single Unit Dwelling \$5,495.68 / unit (2021)

Regional Development Charge - Wastewater - Multi Unit Dwelling \$3,691.13 / unit (2021)

Regional Development Charge - Wastewater - Commercial \$27.12 / m2 (2021)

Total Escalated Infrastructure Cost: \$890,147,462

Total Escalated Infrastructure Cost recovered through RDC: \$ 369,676,747

Percentage of Total Infrastructure Cost to be recovered through RDC Charge - 41.52%



| TO:           | Becky Kent, Chair, and Members of the Halifax Regional Water<br>Commission Board                    |  |  |
|---------------|-----------------------------------------------------------------------------------------------------|--|--|
| SUBMITTED BY: | Kenda<br>Signature Date: 2022.06.17<br>14:02:00 -03'00'                                             |  |  |
|               | Kenda MacKenzie, P.Eng., Director, Regulatory Services                                              |  |  |
| APPROVED:     | Cathie Digitally signed by Cathie<br>O'Toole Date: 2022.06.17<br>14:25:35 -03'00'                   |  |  |
|               | Cathie O'Toole, General Manager                                                                     |  |  |
| DATE:         | June 14 <sup>th</sup> , 2022                                                                        |  |  |
| SUBJECT:      | Capital Cost Contribution Areas – Financial Status Report for the Fiscal Year ended March 31, 2022. |  |  |

## **INFORMATION REPORT**

## <u>ORIGIN</u>

Halifax Water and Nova Scotia Utility and Review Board approval of various capital cost contribution charges.

## BACKGROUND/DISCUSSION

Halifax Water oversees twelve (12) Capital Cost Contribution (CCC) charge areas for oversized water and wastewater infrastructure. The Halifax Water Board and subsequently the NSUARB directly approved eleven (11) area specific CCC charges consistent with our CCC policy, with one being inherited and endorsed at the time of the wastewater/stormwater merger in 2007. The overall CCC policy and the specific charge rates were developed for the equitable facilitation of master water and wastewater infrastructure within new development areas or new service extension areas.

In accordance with the approved policy, Halifax Water is obligated to provide an accounting of all funds received and all costs incurred with respect to the infrastructure improvement. Attachment A is an annual report showing the cumulative accounting of all CCC funds received and disbursed as of the end of the fiscal year at March 31, 2022. The format provides a detailed entry of each individual debit and credit transaction with a cumulative total to date for each individual charge area from inception to the applicable

year-end. As well, the summaries contain the respective rates, and for those CCCs that were approved with a CPI adjustment, (Bedford West Water, Bedford West Wastewater, Lakeside Timberlea and Geizer Hill) is provided.

As of March 31, 2022, the results show that six (6) charge areas are in a negative cash position and six (6) are in a positive cash position. Combined, the net current deficit is \$0.2 million with the implementation of \$34.6 million in infrastructure projects. The net cash position of the CCCs have shown steady improvement over the last three years as the net current deficits at fiscal year end were \$1.7 million in 2021, \$1.7 million in 2020 and \$2.6 million in 2019. The CCC program is anticipated to be cost neutral within each charge area and fulfilling the desired facilitation role within these development areas.

This report will be forwarded to the NSUARB for information in accordance with the policy requirements.

## ATTACHMENT

1. Halifax Water Capital Cost Contribution Report – Summary to March 31, 2022

| Report prepared by: | Heather Digitally signed by<br>Heather Britten<br>Britten Date: 2022.06.17<br>14:03:53 -03'00' |
|---------------------|------------------------------------------------------------------------------------------------|
|                     | Quality Assurance Officer                                                                      |
|                     | 902-490-1895                                                                                   |
| Report prepared by: | Killy                                                                                          |
|                     | Kevin Gray, MURP, P.Eng.                                                                       |
|                     | Manager, Enginering Approvals<br>902-490-5939                                                  |
|                     |                                                                                                |



| SUBJECT:         | <b>Operational Performance Information Report</b>                                      |
|------------------|----------------------------------------------------------------------------------------|
|                  | Cathie O'Toole, MBA, FCPA, FCGA, ICD.D, General Manager                                |
| <b>APPROVED:</b> |                                                                                        |
|                  | Kenda MacKenzie, P.Eng. Director, Regulatory Services                                  |
|                  |                                                                                        |
|                  | Susheel Arora, M.A.Sc., P.Eng. Director, Operations                                    |
| SUBMITTED BY:    |                                                                                        |
| TO:              | Becky Kent, B.A., Chair, and Members of the Halifax Regional Water<br>Commission Board |

## **INFORMATION REPORT**

## **ORIGIN**:

Regular update.

This report provides a high level overview of operational performance for the utility. The safety statistics results are first, followed by indicators and statistics for water and wastewater.

## ITEM # 1-I Page 2 of 8 Halifax Water Board June 23, 2022

#### **CBS** Target vs. Year Ago **Organizational Metrics Results** 2021-22 (Apr '20 – Mar '21) # of Lost Time Accidents resulting in lost time per 100 employees 2.0 1.5-2.0 .59 (501) # of Motor-vehicle accidents per 1,000,000 km driven (18 MVA's) 3.36 4 5.5 # of workplace inspections conducted 180 252 Score % of safety talks conducted 85% 80% to 90% 86% 93 94 # of near misses reported N/A # of employees on accommodation or gradual return to work 57 N/A N/A\* # of WCB claims 24 N/A 14 # of work refusals 0 1 N/A 0 # of incidents with written compliance orders 0 0 - 2# of employees trained or recertified before due date 80% to 90% 59%\* 72%

## SAFETY STATISTICS – Final Results for 2021-22 (April 1, 2021 to March 31, 2022)

\*2020-21 YTD Data not tracked electronically (due to ViP transition)

| Organizational Metrics                                                                            | Results | CBS<br>2022/23 Target |
|---------------------------------------------------------------------------------------------------|---------|-----------------------|
| Lost Time Incident Reporting (Lost Time Cases x 200,000 / Total Employee Hours Worked)            | 0       | 3.5                   |
| Safe driving (Number of traffic accidents per 1,000,000 km driven – reported quarterly) (2 MVA's) | 0       | 4                     |
| Workplace inspections conducted                                                                   | 1       | Score                 |
| Safety Talks conducted (reported at the end of each quarter)                                      | N/A     | 80-90%                |
| Near misses reported                                                                              | 16      | N/A                   |
| Employees on accommodation or gradual return to work                                              | 14      | N/A                   |
| WCB claims                                                                                        | 4       | N/A                   |
| Work refusals                                                                                     | 0       | N/A                   |
| Incidents with written compliance orders                                                          | 0       | 0-2                   |
| Employees trained or recertified before due date                                                  | 342     | 80-90%                |

## SAFETY STATISTICS – April 1, 2022 to May 31, 2022 (unless stated otherwise)

ITEM # 1-I Page 4 of 8 Halifax Water Board June 23, 2022



#### **AVERAGE DAILY WATER PRODUCTION**

| Regional Water Main Break/Leak Data |                    |                                                    |  |
|-------------------------------------|--------------------|----------------------------------------------------|--|
| Year                                | Total Breaks/Leaks | Current 12 Month Rolling<br>Total (up to May 2022) |  |
| 2021/22                             | 232                |                                                    |  |
| 2020/21                             | 179                |                                                    |  |
| 2019/20                             | 191                |                                                    |  |
| 2018/19                             | 226                | 221                                                |  |
| 2017/18                             | 206                | 251                                                |  |
| Total                               | 1034               |                                                    |  |
|                                     |                    |                                                    |  |
| Yr. Avg.                            | 206.8              |                                                    |  |

#### Water Accountability

Losses per Service Connection/Day (International Water Association Standard)

Period Ending March 31, 2022

Real Losses: 267 litres

CBS Target: 160
### ITEM # 1-I Page 5 of 8 Halifax Water Board June 23, 2022

| ,                     | Water Sa       | afety Plan Objectives       | 5                                             |                           |
|-----------------------|----------------|-----------------------------|-----------------------------------------------|---------------------------|
|                       | 2              | 021-2022 Q4                 |                                               |                           |
| Objective             | Total<br>Sites | % Sites Achieving<br>Target | All Sites:<br>90th<br>Percentile<br>< 15 µg/L | CBSC<br>Awarded<br>Points |
| Disinfection          | 64             | 97%                         |                                               | 17                        |
| Total Trihalomethanes | 25             | 72%                         |                                               | 0                         |
| Haloacetic Acids      | 21             | 95%                         |                                               | 16                        |
| Particle Removal      | 5              | 97%                         |                                               | 17                        |
| Corrosion Control     | 101            |                             | 3.4                                           | 20                        |
| Summary Total         |                |                             |                                               | 70                        |

Score: 70/100

Bacteriological Results (% Samples absent of Total Coliforms) 99.94%

Each facility is assessed using monthly or quarterly averages, depending on the averaging period specified in its Approval to Operate.

|                         |              |             |              |            |                   |                       |              |      | Wast         | ewater      | r Trea       | tment      | Facility          | 7 Month               | ly Co        | nplian | ce Sur       | nmary       |              |            |                   |                      |              |      |                       |
|-------------------------|--------------|-------------|--------------|------------|-------------------|-----------------------|--------------|------|--------------|-------------|--------------|------------|-------------------|-----------------------|--------------|--------|--------------|-------------|--------------|------------|-------------------|----------------------|--------------|------|-----------------------|
|                         |              |             |              | Janu       | ary-22            |                       |              |      |              |             |              | Febr       | uary-22           | 2                     |              |        |              |             |              | Ma         | rch-22            |                      |              |      |                       |
| Wastewater<br>Treatment | CB<br>(mş    | OD5<br>g/L) | Ti<br>(mg    | SS<br>g/L) | E.<br>(cou<br>100 | coli<br>1nts/<br>)mL) | р            | Н    | CB<br>(mş    | OD5<br>g/L) | T<br>(mş     | SS<br>g/L) | E.<br>(cou<br>100 | coli<br>ints/<br>)mL) | p            | Н      | CB0<br>(mg   | DD5<br>g/L) | T:<br>(mg    | SS<br>;/L) | E.<br>(cou<br>100 | coli<br>ints/<br>mL) | р            | Н    | Toxicity              |
| Facility                | NSE<br>Limit | Avg.        | NSE<br>Limit | Avg.       | NSE<br>Limit      | Avg.                  | NSE<br>Limit | Avg. | NSE<br>Limit | Avg.        | NSE<br>Limit | Avg.       | NSE<br>Limit      | Avg.                  | NSE<br>Limit | Avg.   | NSE<br>Limit | Avg.        | NSE<br>Limit | Avg.       | NSE<br>Limit      | Avg.                 | NSE<br>Limit | Avg. | -                     |
| Halifax                 | 50           | 33          | 40           | 21         | 5000              | 0                     | 6-9          | 6.8  | 50           | 33          | 40           | 19         | 5000              | 0                     | 6-9          | 6.8    | 50           | 32          | 40           | 29         | 5000              | 0                    | 6-9          | 6.8  | Not acutely<br>lethal |
| Dartmouth               | 50           | 37          | 40           | 39         | 5000              | 0                     | 6-9          | 6.8  | 50           | 37          | 40           | 26         | 5000              | 0                     | 6-9          | 6.8    | 50           | 38          | 40           | 25         | 5000              | 0                    | 6-9          | 6.7  | Not acutely<br>lethal |
| Herring Cove            | 50           | 19          | 40           | 12         | 5000              | 0                     | 6-9          | 6.7  | 50           | 30          | 40           | 15         | 5000              | 0                     | 6-9          | 6.8    | 50           | 19          | 40           | 13         | 5000              | 0                    | 6-9          | 6.5  | Not acutely<br>lethal |
| Eastern Passage         | 25           | 17          | 25           | 12         | 200               | 0                     | 6-9          | 7.1  | 25           | 8           | 25           | 8          | 200               | 0                     | 6-9          | 7.0    | 25           | 10          | 25           | 11         | 200               | 0                    | 6-9          | 6.9  | Not acutely<br>lethal |
| Mill Cove               | 25           | 11          | 25           | 14         | 200               | 12                    | 6-9          | 6.8  | 25           | 19          | 25           | 19         | 200               | 12                    | 6-9          | 6.8    | 25           | 25          | 25           | 23         | 200               | 20                   | 6-9          | 6.7  | Not acutely<br>lethal |

|                         |              |             |              |            | Wa                  | stewate              | er Treat     | ment Fa | acility Q      | uarterl       | y Comp        | liance S       | Summar       | у          |                     |                      |                       |
|-------------------------|--------------|-------------|--------------|------------|---------------------|----------------------|--------------|---------|----------------|---------------|---------------|----------------|--------------|------------|---------------------|----------------------|-----------------------|
| Wastewater<br>Treatment | CB0<br>(mg   | DD5<br>g/L) | T<br>(mį     | SS<br>g/L) | E. (<br>(cou<br>100 | coli<br>ints/<br>mL) | p            | H       | Amr<br>(mg     | nonia<br>;/L) | Phospi<br>(mį | horous<br>g/L) | Tl<br>(mg    | RC<br>g/L) | Disso<br>Oxy<br>(mg | olved<br>gen<br>g/L) | Toxicity              |
| Facility                | NSE<br>Limit | Avg.        | NSE<br>Limit | Avg.       | NSE<br>Limit        | Avg.                 | NSE<br>Limit | Avg.    | NSE<br>Limit   | Avg.          | NSE<br>Limit  | Avg.           | NSE<br>Limit | Avg.       | NSE<br>Limit        | Avg.                 |                       |
| Springfield             | 20           | б           | 20           | 5          | 200                 | 10                   | 6-9          | 6.8     | -              | -             |               | -              |              | -          |                     | -                    | -                     |
| Frame                   | 20           | 7           | 20           | 1          | 200                 | 10                   | 6-9          | 6.9     | -              |               |               | -              |              | -          |                     | -                    | -                     |
| Middle Musq.            | 20           | 6           | 20           | 4          | 200                 | 10                   | 6-9          | 7.3     | -              | -             |               | -              |              | -          |                     | -                    | -                     |
| Uplands                 | 20           | 9           | 20           | 6          | 200                 | 10                   | 6-9          | 7.1     | -              | -             |               | -              |              | -          |                     | -                    | -                     |
| Aerotech                | 5            | 2           | 5            | 1          | 200                 | 10                   | 6-9          | 7.0     | 5.7 W<br>1.2 S | 0.2           | 0.13          | 0.07           |              | -          | 6.5                 | 10.3                 | Not acutely<br>lethal |
| North Preston           | 10           | 7           | 10           | 9          | 200                 | 10                   | 6-9          | 6.5     | 3              | 0.9           | 1.5           | 0.7            |              | _          |                     | -                    | -                     |
| Lockview                | 20           | 8           | 20           | 15         | 200                 | 30                   | 6.5-9        | 6.4     | 8.0 S          | 13.3          | 1.2 S         | 0.4            |              | -          |                     | -                    | -                     |
| Steeves (Wellington)    | 20           | 10          | 20           | 1          | 200                 | 10                   | 6.5-9        | 7.1     | 14.4 S         | 0.1           | 1.0 S         | 0.1            |              | -          |                     | -                    | -                     |
| BLT                     | 15           | 9           | 20           | 19         | 200                 | 23                   | 6-9          | 6.8     | 5 W<br>3 S     | 2             | 3 W<br>1 S    | 1              | 0.02 *       | 0.10       |                     | -                    | Not acutely<br>lethal |

NOTES & ACRONYMS: CBOD<sub>5</sub> - Carbonaceous 5-Day Biochemical Oxygen Demand LEGEND

NSECC Compliant

NSECC Non-Compliant

\* TRC - Total Residual Chlorine - Maxxam can only measure 0.10 mg/L residual; results of 0.1 mg/L are compliant

BDL - Below Detection Limit

TSS - Total Suspended Solids

W / S - Winter / Summer compliance limits

NSECC requires monthly averages be less than the NSECC Compliance Limit for each parameter at Dartmouth, En Passage, Halifax, Herring Cove, Mill Cove NSECC requires quarterly averages be less than the NSECC Compliance Limit for each parameter at Aerotech, Lockview, Middle Musquodoboit, Frame, BLT, Uplands and Springfield Lake

NSECC requires annual averages be less than the NSECC Compliance Limit for each parameter at North Preston and Steeves

Continued - Number of compliant parameters remains unchanged since the last report

Improved - One or more parameter(s) became compliant since the last report

Declined - One or more parameters(s) became non-compliant since the last report

#### SEASONAL RULES:

BLT NH3: shall not exceed 3 mg/L between May 1 and October 30; otherwise, shall not exceed 5 mg/L

BLT P (total): shall not exceed 1 mg/L between May 1 and October 30; otherwise, shall not exceed 3 mg/L  $\,$ 

Aerotech NH3: shall not exceed 1.2 mg/L between May 1 and October 30; otherwise, shall not exceed 5.7 mg/L

Lockview NH3: shall not exceed 8 mg/L between May 1 and October 30

Lockview P (total): shall not exceed 1.2 mg/L between May 1 and October 30

Wellington NH3: shall not exceed 14.4 mg/L between May 1 and October 30

Wellington P (total): shall not exceed 1.0 mg/L between May 1 and October 30

### ITEM # 1-I Page 7 of 8 Halifax Water Board June 23, 2022





Rainfall data is from Halifax Water's rain gauge at the Halifax WWTF.

There were forty-seven overflows in Q1 on days when there was no recorded rainfall, as follows:

- 1. January 3: The CSO at Maitland St PS & CSO was due to a tidal surge. The CSO at Duffus St PS was due to a pump restriction from the Halifax WWTF.
- 2. January 4: The CSO at Maitland St PS & CSO was due to a tidal surge.
- 3. January 11: The CSO at Chain Rock PS & CSO was due to a blockage caused by debris.
- 4. January 16: The CSO at Duffus St PS was due to a pump restriction from the Halifax WWTF.
- 5. January 19: The CSO at Duffus St PS was due to a pump restriction from the Halifax WWTF.
- 6. January 21, 22, 26, 27 and 31: The CSOs at Upper Water St CSO were due to blockages caused by debris.
- 7. February 1 and 2: The CSOs at Upper Water St CSO were due to blockages caused by debris.
- 8. February 6: The CSO at Duffus St PS was due to a pump restriction from the Halifax WWTF.
- February 9: The CSOs at Chain Rock PS & CSO and Upper Water St CSO were due to blockages caused by debris. The CSO's at Maitland St PS & CSO, Old Ferry Rd PS & CSO and Jamieson St PS & CSO were due to rain on the previous day.
- 10. February 10: The CSOs at Chain Rock PS & CSO and Upper Water St CSO were due to blockages caused by debris.
- 11. February 11: The CSO at Chain Rock PS & CSO was due to a blockage caused by debris.
- 12. February 12: The CSO at Chain Rock PS & CSO was due to a blockage caused by debris. The SSO at Mill

Cove Surge Tank was due to rain on a previous day.

- 13. February 17: The CSO at Duffus St PS was due to a pump restriction from the Halifax WWTF.
- 14. February 19: The CSO at Chain Rock PS & CSO was due to a blockage caused by debris. The CSOs at Old Ferry Rd PS & CSO and Jamieson St PS & CSO were due to rain on the previous day.
- 15. February 21: The CSO at Chain Rock PS & CSO was due to a blockage caused by debris. The CSO at Duffus St PS was due to a pump restriction from the Halifax WWTF. The SSO at Mill Cove Surge Tank was due to rain on the previous day.
- 16. February 24: The CSO at Chain Rock PS & CSO was due to a blockage caused by debris. The SSOs at Mill Cove Surge Tank were due to rain on the previous day.
- 17. March 11: The CSO at Duffus St PS was due to a pump restriction from the Halifax WWTF. The CSO at Chain Rock PS & CSO was due to a blockage caused by debris.
- 18. March 14: The CSOs at Chain Rock PS & CSO and Jamieson St PS & CSO were due to blockages caused by debris. The SSO at Mill Cove Surge Tank was due to rain on the previous day.
- 19. March 24: The CSO at Chain Rock PS & CSO was due to a blockage caused by debris.
- 20. March 30: The CSO at Duffus St PS was due to a pump restriction from the Halifax WWTF.



June 23, 2022

| TO:           | Becky Kent, B.A., Chair, and Members of the Halifax Regional Water<br>Commission Board                                                                 |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| SUBMITTED BY: | ReidDigitally signed by Reid<br>CampbellDate: 2022.06.14<br>14:27:38 -03:00'Reid Campbell, M.Eng., P.Eng.Director, Engineering and Technology Services |
|               | Louis de Digitally signed by Louis<br>de Montbrun<br>Date: 2022.06.15<br>20:22:07 -03'00'<br>Louis de Montbrun, CPA, CA                                |
|               | Director, Corporate Services/CFO                                                                                                                       |
| APPROVED:     | O'Toole Date: 2022.06.16<br>20:53:41 -03:00'                                                                                                           |
|               | Cathie O'Toole, MBA, FCPA, FCGA, ICD.D<br>General Manager                                                                                              |
| DATE:         | June 17, 2022                                                                                                                                          |
| SUBJECT:      | Capital Expenditures for the fiscal year ended March 31, 2022                                                                                          |

#### **ORIGIN**

The Corporate Balanced Scorecard identifies the percentage of capital budget spent by the end of the fiscal year as a critical success factor and sets a target of 70-80%.

### BACKGROUND

The Halifax Regional Water Commission (Halifax Water) Board is required to review periodic financial information throughout the year. Halifax Water's 2019 *Integrated Resource Plan* (IRP) identifies a 30-year capital investment plan valued at \$2.7 Billion (net present value). In relation to the IRP, the capital budget program focuses on providing required infrastructure for asset renewal, regulatory compliance, and growth. The IRP calls for delivery of an average of \$135 million dollars in capital projects per year. Halifax Water's annual capital budget, and capability to deliver capital projects, has not yet reached this level.

#### DISCUSSION

Below is the breakdown by asset class and project status of the expenditures for the fiscal year ended March 31, 2022. As of year-end, Halifax Water delivered 28.62% of the budgeted capital for 2021/22 (2020/21 - 30.78%). Capital spend for 2021/22 was over \$65.3 million, of this \$36.1 million relates to spend specifically on the 2021/22 capital budget of \$126.2 million resulting in the 28.62% delivery rate. There is

a lag from when work is conducted, billed to Halifax Water, progress claims are reviewed, processed for payment, then appear in actual expenditures. At year end close, there is a significant focus on ensuring all work conducted during the fiscal year is invoiced to Halifax Water and recorded as accounts payable. As a result of the year end activities, the % delivery rate increased significantly from the 18.93% presented in March 2022. There are several significant projects in this year's capital budget for which construction has been delayed or extended into the next construction season for reasons including, construction market conditions, land acquisition, planning consideration or issues that arose during the planning phase which required a scope change.

### **Capital Expenditure Report**

| Budget Category | Total Budget   | Ex<br>to | penditures<br>March 31, | Ex<br>Api | penditures<br>ril 1, 2021 to<br>March 31,<br>2022 | Ex<br>to | Total<br>penditures<br>March 31,<br>2022 | l<br>Av | Remaining<br>Budget<br>ailable as of<br>March 31,<br>2022 | Total<br>Expenditures<br>to March 31,<br>2022 as a<br>Percentage of<br>Total Budget |
|-----------------|----------------|----------|-------------------------|-----------|---------------------------------------------------|----------|------------------------------------------|---------|-----------------------------------------------------------|-------------------------------------------------------------------------------------|
| Active          | Available      |          | 2021                    |           | 2022                                              |          | 2022                                     |         | 2022                                                      | Available                                                                           |
| Water           | \$ 84,736,236  | \$       | 10,133,727              | \$        | 17,470,932                                        | \$       | 27,604,659                               | \$      | 57,131,577                                                | 32.6%                                                                               |
| Wastewater      | 87,931,636     |          | 5,689,389               |           | 14,646,524                                        |          | 20,335,913                               |         | 67,595,723                                                | 23.1%                                                                               |
| Stormwater      | 8,179,079      |          | 596,082                 |           | 1,858,660                                         |          | 2,454,742                                |         | 5,724,337                                                 | 30.0%                                                                               |
|                 | 180,846,951    |          | 16,419,198              |           | 33,976,116                                        |          | 50,395,314                               |         | 130,451,637                                               | 27.9%                                                                               |
| Pending         |                |          |                         |           |                                                   |          |                                          |         |                                                           |                                                                                     |
| Water           | 11,382,277     |          | 28,280                  |           | (392)                                             |          | 27,888                                   |         | 11,354,389                                                | 0.2%                                                                                |
| Wastewater      | 24,011,627     |          | 465                     |           | 4,163                                             |          | 4,628                                    |         | 24,006,999                                                | 0.0%                                                                                |
| Stormwater      | 784,238        |          | -                       |           | -                                                 |          | -                                        |         | 784,238                                                   | 0.0%                                                                                |
|                 | 36,178,142     |          | 28,745                  |           | 3,771                                             |          | 32,516                                   |         | 36,145,626                                                | 0.1%                                                                                |
| Closed          |                |          |                         |           |                                                   |          |                                          |         |                                                           |                                                                                     |
| Water           | 16,322,938     |          | 4,009,304               |           | 12,313,634                                        |          | 16,322,938                               |         | -                                                         | 100.0%                                                                              |
| Wastewater      | 20,686,768     |          | 9,153,189               |           | 11,533,579                                        |          | 20,686,768                               |         | -                                                         | 100.0%                                                                              |
| Stormwater      | 8,245,937      |          | 765,279                 |           | 7,480,658                                         |          | 8,245,937                                |         | -                                                         | 100.0%                                                                              |
|                 | 45,255,643     |          | 13,927,772              |           | 31,327,871                                        |          | 45,255,643                               |         | -                                                         | 100.0%                                                                              |
|                 | \$ 262,280,736 | \$       | 30,375,715              | \$        | 65,307,758                                        | \$       | 95,683,473                               | \$      | 166,597,263                                               | 36.5%                                                                               |

The Total Budget Available of \$262.3 million represents total approved budgets for pending, active, and closed projects as at the end of March 31, 2022.

Total Expenditures to March 31, 2022 of \$95.7 million include expenditures of \$30.4 million incurred prior to April 1, 2021 and expenditures of \$65.3 million in the current fiscal year. This results in a Remaining Budget Available as of March 31, 2022 of \$166.6 million.

In the Pending project category, there is \$28.4 million that has been deferred or cancelled. In addition, there is \$28.2 million that has been made available from surpluses on closed projects, of which \$6.4 million relates to projects closed in fiscal 2021/22. In the fiscal year, \$9.7 million from surpluses on closed projects had been allocated to projects, this has been excluded from the \$28.2 million, as that is what remains after the allocations. This funding is available to be reallocated to existing projects, if required, or used to fund future capital budgets.

### **ATTACHMENT**

Capital Expenditure Report March 31, 2022

| Report prepared by: | Alicia<br>Scallion | Digitally signed by Alicia<br>Scallion<br>Date: 2022.06.14<br>15:22:27 -03'00' |
|---------------------|--------------------|--------------------------------------------------------------------------------|
|                     | Alicia Scallion, C | CPA, CA, Manager, Accounting, (902)-497-9785                                   |

### Halifax Water Compliance Statement Quarterly Certification

### For the period of January 1, 2022 to March 31, 2022

We hereby certify that the Halifax Regional Water Commission is current in making all statutory remittances for payroll taxes, Harmonized Sales Tax and other remittances as required under the laws of the Government of Canada and its Provinces (the significant remittances are noted in the appendix) and that all significant legal claims have been disclosed.

Cathie O'Toole Digitally signed by Cathie O'Toole Date: 2022.06.17 13:33:11 -03'00'

Cathie O'Toole, MBA, FCPA, FCGA, ICD.D General Manager

| Louis de | Digitally signed by Louis de Montbrun |
|----------|---------------------------------------|
| Montbrun | Date: 2022.06.17<br>12:15:05 -03'00'  |

Louis de Montbrun, CPA, CA Director, Corporate Services/CFO and Corporate Treasurer

Heidi Schedler Digitally signed by Heidi Schedler Date: 2022.06.17 14:54:23 -03'00'

Heidi Schedler General Counsel and Corporate Secretary

Dated:

June 17, 2022

### Halifax Water Compliance Statement Quarterly Certification Appendix I

Significant statutory remittances for payroll taxes, Harmonized Sales Tax and other remittances as required under the laws of the Government of Canada and its Provinces for the Halifax Regional Water Commission.

### **Statutory Payroll Remittances**

Canada Revenue Agency (CRA) - Statutory employee payroll deductions and employer related contributions for:

- Income Tax
- Canada Pension Plan (CPP)
- Employment Insurance (EI)

**Workers' Compensation Board of Nova Scotia (WCB)** – Employer remittance based on employee payroll

### **Other Payroll Remittances**

**Northern Trust** - Employee payroll deductions and employer contributions to Halifax Water and HRM defined benefit pension plans

**Industrial Alliance** – employer and employee contributions to defined contribution pension plan

Medavie Blue Cross & SSQ – employee payroll deductions and employer related contributions for Health & dental, LTD, and Life benefit coverage, and payroll deductions for AD&D

**Canadian Union of Public Employees** – Employee payroll deductions of union dues

CUPE Local 227
CUPE Local 1431

### **HST and Other Remittances**

Canada Revenue Agency (CRA) - Harmonized Sales Tax (HST) is filed online and a refund issued as HST paid is greater than HST collected

**Workers' Compensation Board of Nova Scotia (WCB)** – Remittance for sub-contractors



| TO:           | Becky Kent, B.A., Chair, and Members of the Halifax Regional Water<br>Commission Board as Trustees of the Halifax Regional Water<br>Commission Employees' Pension Plan |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SUBMITTED BY: | Louis de Digitally signed by Louis de Montbrun<br>Date: 2022.06.17<br>11:04:16 -03'00'                                                                                 |
|               | Louis de Montbrun, CPA, CA,<br>Director, Corporate Services / CFO                                                                                                      |
| APPROVED:     | Cathie<br>O'Toole<br>Date: 2022.06.17<br>13:33:43 -03'00'                                                                                                              |
|               | Cathie O'Toole, MBA, FCPA, FCGA, ICD.D<br>General Manager                                                                                                              |
| DATE:         | June 10, 2022                                                                                                                                                          |
| SUBJECT:      | Halifax Regional Water Commission Employees' Pension Plan<br>Financial Report First Quarter, 2022                                                                      |

### **ORIGIN**

Financial reporting for the Halifax Regional Water Commission Employees' Pension Plan (the "Plan").

### BACKGROUND

The Board is required to review the periodic (quarterly) financial results of the Plan throughout the year.

### DISCUSSION

The attached statement of changes in net assets available for benefits (Appendix A) outlines the annual budget for the Plan and actual financial performance for the First Quarter (January 1 to March 31, 2022). Favourable or unfavourable variances reported compare actual results to annual budget amounts, for the three (3) month period ending March 31, 2022. Yearend audited results for 2020 and un-audited results for 2021 are shown for comparative purposes. 2021 results are reported as un-audited until approved by the Halifax Water Board.

As shown on the statement of changes in net assets available for benefits, net assets available for benefits have decreased by \$4.2 million for the three (3) month period ending March 31, 2022. The budget for the period forecasted an increase in net assets available of \$4.1 million. Actual results for the period is a decrease in net assets available for benefits of \$4.2 million as compared to the pro-rated budget of a \$4.1 million increase, an unfavourable variance of \$8.2 million.

The annual budget forecasted revenue of \$15.2 million. Revenue for the period was a loss of \$4.9 million, which when compared to the pro-rated revenue budget of \$3.8 million results in an unfavourable variance of \$8.7 million. Performance of the HRM Master Trust directly drives the revenue figures reported and change in the fair value of investment assets tends to be more volatile compared to contributions and expenses of the Plan. This variance is attributed directly to a decrease in the fair value of investment assets of \$5.3 million. Investment income for the period was \$0.5 million compared to a pro-rated budget of \$0.9 million, resulting in an unfavourable variance of \$0.4 million or - 42%.

Contributions of \$2.1 million are over the pro-rated budget of \$1.8 million by \$0.3 million. This results in a favourable variance of 17% and is mostly due to a transfer in from another pension plan.

Expenses of \$1.3 million for the period are lower than the pro-rated budget of \$1.5 million by \$0.2 million or -12%. The main contributor to this variance is termination payments which are lower than the pro-rated budget estimate by \$0.1 million. The remainder of the variance is due to the timing of expenses. Benefit payments for the period are comparable to budget.

### SERVICE STANDARDS

Tracking of Regulatory Filing Requirements, Administrative Reporting Requirements and Service Standards for actuarial calculation requests is ongoing. The reports for Regulatory Filing Requirements and Administrative Reporting Requirements are attached as Appendix B and Appendix C respectively, and document administrative compliance within the various levels of reporting for the period.

Service Standard results for the First Quarter (January 1st to March 31<sup>st</sup>, 2022) have been attached as Appendix D. The primary purpose of the service standard report is to report on the administrative compliance with the Pension Benefits Act of Nova Scotia (the "Act") respecting the timing of statements or notifications required under the Act, such as:

- Retirement statement to member;
- Notification of options to retiring member;
- Death benefits statement; and
- Statement on termination

A secondary purpose of the report is to provide performance reporting respecting the Plan's actuaries, for required deliverables based on pre-determined standards. These standards are internal in nature, and mutually agreed upon by the actuary and Halifax Water.

First Quarter results reported in Appendix D show, out of 3 requests submitted for retirement estimates (with options), the retirement package was provided to the member within the prescribed timelines under the Act, 60 days prior to the Member's intended retirement date. There was 1 termination during the period, with the terminated employee provided a termination package (with options) within the prescribed timelines under the Act, within 60 days after their termination date.

Performance of the actuary, also reported in Appendix D, shows out of 4 requests in total, the actuary met the pre-determined standard in 2 instances, with average response times for retirement and termination calculation estimates of 15 days and 11 days respectively. The Manager of Client Administration at Eckler contacted our office directly to advise of expected delays with some retirement and termination calculation requests. The advance notice was provided as the team dedicated to our account was focused on preparing all calculations, analysis and reports for the Actuarial Valuation as at January 1, 2022. The response time of the actuaries is continuously monitored to ensure required service standards are maintained.

### **ATTACHMENTS**

APPENDIX A – Financial Report: Statement of changes in net assets available for benefits, for the three (3) month period ended March 31, 2022

APPENDIX B – Regulatory Filing Requirements – Q1 2022

APPENDIX C – Administrative Reporting Requirements – Q1 2022

APPENDIX D – Service Standards Report – Q1 2022

| Report Prepared by: | Heather<br>Britten | Digitally signed by<br>Heather Britten<br>Date: 2022.06.17<br>09:47:52 -03'00' |
|---------------------|--------------------|--------------------------------------------------------------------------------|
|                     | Heather Britter    | n, Quality Assurance Officer 902-490-1895                                      |

#### Halifax Regional Water Commission Employees' Pension Plan Statement of changes in net assets available for benefits For the three (3) month period ended March 31, 2022

Benchmark 25%

|                 |                                                                |                      |               | March 31       | , 2022        |         |                  |                  |
|-----------------|----------------------------------------------------------------|----------------------|---------------|----------------|---------------|---------|------------------|------------------|
|                 |                                                                |                      |               | Prorated       | Actual versus | Budget  | Actual           | Actual           |
|                 |                                                                | 2022                 |               | Budget         | Chang         | е       | (Un-Audited)     | (Audited)        |
|                 |                                                                | Budget               | Actual        | 25%            | \$            | %       | 2021             | 2020             |
| Revenue         |                                                                |                      |               |                |               |         |                  |                  |
| Net investme    | ent income:                                                    |                      |               |                |               |         |                  |                  |
|                 | Total investment income                                        | \$3,400,000          | \$491,558     | \$850,000      | (\$358,442)   | (42%)   | \$3,657,805      | \$3,763,614      |
|                 | Investment manager fees                                        | (\$200,000)          | (\$75,738)    | (\$50,000)     | \$25,738      | 51%     | (\$301,176)      | (\$194,968)      |
| Increase (de    | crease) in the fair value of investment assets                 | \$12,000,000         | (\$5,337,062) | \$3,000,000    | (\$8,337,062) | (278%)  | \$15,414,684     | \$8,630,589      |
|                 |                                                                | \$15,200,000         | (\$4,921,242) | \$3,800,000    | (\$8,721,242) | (230%)  | \$18,771,312     | \$12,199,235     |
| Oantributiana   |                                                                |                      |               |                |               |         |                  |                  |
| Dortining       |                                                                |                      |               |                |               |         |                  |                  |
| Fanicipants.    | Current convice (including Additional Voluntary Contributions) | \$2 560 500          | \$062.012     | \$902.275      | \$70.629      | 00/     | \$2 201 224      | ¢2 210 112       |
|                 | Posiprocal Transfor                                            | \$3,309,300<br>¢0    | \$166 029     | φ092,373<br>¢0 | \$166 029     | 076     | φ3,391,324<br>¢0 | φ3,310,113<br>¢0 |
| Sponsors:       | Recipiocal transier                                            | <b>\$</b> 0          | \$100,930     | <b>Ф</b> О     | \$100,930     |         | <b>Φ</b> 0       | ΦŪ               |
| oponicoro.      | Current service                                                | \$3,472,000          | \$937,219     | \$868,000      | \$69,219      | 8%      | \$3,301,346      | \$3,230,131      |
|                 |                                                                | \$7,041,500          | \$2,067,169   | \$1,760,375    | \$306,794     | 17%     | \$6,692,670      | \$6,540,244      |
|                 |                                                                |                      |               |                |               |         |                  |                  |
| Expenses        |                                                                |                      |               |                |               |         |                  |                  |
| Benefit payn    | nents:                                                         |                      |               |                |               |         |                  |                  |
|                 | Benefit payments                                               | \$5,071,000          | \$1,244,054   | \$1,267,750    | (\$23,696)    | (2%)    | \$4,739,794      | \$4,552,474      |
|                 | Termination payments                                           | \$700,000            | \$29,853      | \$175,000      | (\$145,147)   | (83%)   | \$783,885        | \$677,237        |
|                 | Death benefit payments                                         | \$0                  | \$0           | \$0            | \$0           | n/a     | \$63,848         | \$0              |
| Administrativ   | /e:                                                            |                      |               |                |               |         |                  |                  |
|                 | Actuarial & consulting fees                                    | \$130,000            | \$16,171      | \$32,500       | (\$16,329)    | (50%)   | \$83,773         | \$42,143         |
|                 | Audit & accounting fees                                        | \$9,000              | \$3,129       | \$2,250        | \$879         | 39%     | \$10,027         | \$8,648          |
|                 | Bank custodian fees                                            | \$30,450             | \$5,290       | \$7,613        | (\$2,323)     | (31%)   | \$27,576         | \$30,479         |
|                 | Insurance                                                      | \$9,700              | \$0           | \$2,425        | (\$2,425)     | (100%)  | \$10,600         | \$9,636          |
|                 | Miscellaneous                                                  | \$22,050             | \$6,099       | \$5,513        | \$586         | 11%     | \$18,083         | \$16,724         |
|                 | Professional fees                                              | \$33,000             | \$17,960      | \$8,250        | \$9,710       | 118%    | \$43,529         | \$23,151         |
|                 | Registration fees                                              | \$2,940              | \$0           | \$735          | (\$735)       | (100%)  | \$2,662          | \$2,645          |
|                 | Training (Trustees/ Administration/ Pension Committee)         | \$1,000              | \$0           | \$250          | (\$250)       | (100%)  | \$0              | \$0              |
|                 |                                                                | \$6,009,140          | \$1,322,555   | \$1,502,285    | (\$179,730)   | (12%)   | \$5,783,778      | \$5,363,136      |
| Increase in net | t assets available for benefits                                | \$16.232.360         | (\$4.176.628) | \$4.058.090    | (\$8,234,718) | (203%)  | \$19.680.205     | \$13.376.343     |
|                 |                                                                | ···;;;               | (+ -,,)       | + .,,          | (++;-+;++++)  | (20070) |                  | <i></i>          |
|                 |                                                                |                      |               |                |               |         |                  |                  |
| Not constant    | ilable for boundity, bouissing of novied                       | A174 000 000         | A174 000 000  |                |               |         | ALE4 050 450     |                  |
| INET ASSETS AVA | mable for benefits, beginning of period                        | <b>\$174,636,360</b> | ə174,636,360  |                |               |         | ə154,950,156     | \$141,579,813    |
| Increase (decre | ease) in net assets available for benefits                     | \$16,232,360         | (\$4,176,628) |                |               |         | \$19,680,205     | \$13,376,343     |
| Net assets ava  | ilable for benefits, end of period                             | \$190,868,720        | \$170,459,733 |                |               |         | \$174,636,360    | \$154,956,156    |
|                 | · ·                                                            |                      | , ,           |                |               |         |                  |                  |

Expenses on this statement are reported on a cash basis.

| Halifax Regional Water Commission Empl<br>Regulatory Filing Requirements - 2022<br>as at March 31, 2022 | oyees' Pension Plan                                                          |                                                   |                                          |                    | APPENDIS                                                                                                                                                                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|---------------------------------------------------|------------------------------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Report                                                                                                  | Regulatory Body                                                              | Filing Deadline                                   | Date last filed                          |                    | Comments                                                                                                                                                                                                                                                                                                     |
| 1 Annual Form 3 - Summary of Contributions                                                              | Superintendent of Pensions                                                   | 60 days after the beginning of each fiscal year   | February 22, 2022<br>February 22, 2022   | DB Plan<br>DC Plan | Filed directly with the Trustee, Northern Trust, for the DB Plan.<br>Filed directly with the Trustee, Industrial Alliance, for the DC Plan.                                                                                                                                                                  |
| 2 Pension Plan Income Tax Return (T3)                                                                   | Canada Revenue Agency                                                        | March 31st                                        | March 3, 2022                            | DB Plan            | CRA requires Northern Trust as the custodian to prepare and file<br>T3 Income Tax Returns each year. Information obtained from<br>HRM Pension Plan quarterly report.                                                                                                                                         |
| 3 Pension Plan Audited Financial Statements                                                             | Superintendent of Pensions                                                   | 6 months after the Plan's fiscal year end         | June 30, 2021<br>June 30, 2021           | DB Plan<br>DC Plan | Audited financial statements were completed and approved by<br>the HW Board on June 17th, 2021.<br>Audited financial statements are not prepared for this pension<br>plan. However, Industrial Alliance provides a Financial Report<br>detailing all pertinent details of the plan. This report is submitted |
| 4 Annual Information Returns (AIR)                                                                      | Superintendent of Pensions                                                   | June 30th                                         | June 15, 2021<br>June 15, 2021           | DB Plan<br>DC Plan | to the regulatory body prior to June 30th each year.                                                                                                                                                                                                                                                         |
| 5 Actuarial Valuation*                                                                                  | Superintendent of Pensions<br>Canada Revenue Agency                          | September 30th                                    | September 27, 2019<br>September 27, 2019 |                    | Actuarial Valuation was conducted as of January 1, 2019.                                                                                                                                                                                                                                                     |
| 6 Plan Amendments                                                                                       | Superintendent of Pensions                                                   | 60 days after the amendment approved by the Board | March 10, 2022                           | DB Plan            | Plan Rules were Amended and Consolidated effective January 1, 2021 and approved by the Halifax Water Board on January 27, 2022. This included amendments 9 through 12, implemented                                                                                                                           |
|                                                                                                         | Canada Revenue Agency<br>Superintendent of Pensions<br>Canada Revenue Agency | 60 days after the amendment approved by the Board | March 10, 2022<br>n/a                    | DC Plan            | since 2011.<br>All documents relating to the registration of the DC Plan were<br>received by the Superintendent October 6, 2017.                                                                                                                                                                             |
| Actuarial Valuations are required at a minimu                                                           | im every three (3) years.                                                    |                                                   |                                          |                    |                                                                                                                                                                                                                                                                                                              |

\*\* Notional Agreements were implemented during 2017 with an effective date for January 1, 2017. Notional Agreements are not registered therefore not subject to reporting requirements to a regulatory body.

### **Item 4-I** Halifax Water Board June 23, 2022 APPENDIX B

| Halifax Regional Water Commission Emp<br>Administrative Reporting Requirements -<br>as at March 31, 2022 | loyees' Pension Plan<br>2022 |                               |                     | Item 4-I<br>Halifax Water Board<br>June 23, 2022<br>APPENDIX C                                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------|------------------------------|-------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Report                                                                                                   | Filing Deadline/ Recurrence  | Date last filed/<br>Performed |                     | Comments                                                                                                                                                                                                                                                                                                                                                 |
| 1 Pensioners' Payroll                                                                                    | Monthly                      | June 1, 2022                  |                     | Pensioners are paid the 1st of each month; no exceptions to report for the First Quarter 2022.                                                                                                                                                                                                                                                           |
| 2 Contributions to the Trustee                                                                           | Monthly                      | May 10, 2022                  | DB Plan             | Remittances due to Northern Trust within 30 days of month end; no exceptions to report for First Quarter 2022.                                                                                                                                                                                                                                           |
|                                                                                                          |                              | January 5, 2022               | DC Plan             | Remittances due to Industrial Alliance within 30 days of month end; no exceptions to report for First Quarter 2022.                                                                                                                                                                                                                                      |
|                                                                                                          |                              | n/a                           | Notional Agreement* |                                                                                                                                                                                                                                                                                                                                                          |
| 3 Pension Plan Financial Statements                                                                      | Quarterly                    | June 23, 2022                 | DB Plan             | First Quarter (January - March 2022)                                                                                                                                                                                                                                                                                                                     |
|                                                                                                          |                              | n/a                           | DC Plan             | Quarterly statements are not prepared for the Defined Contribution (DC) Plan. A financial report is prepared by Industrial Alliance and that report is filed with the Annual Information Return (AIR) to the regulator annually.                                                                                                                         |
|                                                                                                          |                              | n/a                           | Notional Agreement* | Financial statements not required.                                                                                                                                                                                                                                                                                                                       |
| 4 Investment Performance Review & Compliance with SIP&P                                                  | Quarterly                    | June 9, 2022                  | DB Plan             | First Quarter (January - March 2022)<br>Report prepared quarterly by administration staff for the HW Board of Directors, in<br>conjunction with the quarterly HRM Pension Plan Committee meeting documentation.<br>Statement of Investment Policies & Procedures (SIP&P) is reviewed annually and was<br>last reviewed and approved on December 9, 2021. |
| 5 Annual Pension Statements to Members                                                                   | June 30th                    | June 18, 2021                 | DB Plan             | Statements issued annually by June 30th.                                                                                                                                                                                                                                                                                                                 |
|                                                                                                          |                              | June 18, 2021                 | DC Plan             | Statements issued annually in conjunction with the Defined Benefit (DB) Plan statements. Members also have access to online, real-time reporting.                                                                                                                                                                                                        |
|                                                                                                          |                              | June 18, 2021                 | Notional Agreement* | Statements issued annually in conjunction with the DB Plan statements.                                                                                                                                                                                                                                                                                   |
| 6 Fiduciary Liability Insurance                                                                          | Annually                     | October 20, 2021              | DB Plan             | Reviewed and renewed annually by administration staff. The policy period expires<br>November 30 each year.                                                                                                                                                                                                                                               |
|                                                                                                          |                              |                               |                     |                                                                                                                                                                                                                                                                                                                                                          |

\* Notional Agreements were implemented during 2017 with an effective date for January 1, 2017. Notional Agreements are not registered therefore not subject to reporting requirements to a regulatory body.

Halifax Regional Water Commission Employees' Pension Plan Service Standards Report - 2022

(

**Item 4-I** Halifax Water Board June 23, 2022 APPENDIX D

| Quarter 1 (as at March 31, 2022)  |                   |                      |                 |                      |                         |                      |                         |                               |                        |
|-----------------------------------|-------------------|----------------------|-----------------|----------------------|-------------------------|----------------------|-------------------------|-------------------------------|------------------------|
|                                   |                   |                      | Actuary         |                      |                         | МН                   | Staff                   |                               |                        |
| Transaction                       | Standard          | Total #<br>Completed | # Past Standard | % within<br>Standard | Average Service<br>Days | Total #<br>Completed | Average Service<br>Days | Total Average<br>Service Days | Compliance<br>with PBA |
|                                   |                   |                      |                 |                      |                         |                      |                         |                               |                        |
| Retirement Estimates              | 11 Business Days  | с                    | 0               | 33%                  | 15                      | ო                    | 21                      | 36                            | Yes                    |
| Marriage Breakdown Calculations   | 15 Business Days  |                      |                 |                      |                         |                      |                         |                               |                        |
| Post-Retirement Death Letter      | 15 Business Days  |                      |                 |                      |                         |                      |                         |                               |                        |
| Pre-Retirement Death Benefit      | 15 Business Days  |                      |                 |                      |                         |                      |                         |                               |                        |
| Termination Estimate Calculations |                   |                      |                 |                      |                         |                      |                         |                               |                        |
| - Standard                        | 11 Business Days  | -                    | 0               | 100%                 | +<br>+                  | -                    | 22                      | 33                            | Yes                    |
| - Non Standard (Incl RTAs)        | 15 Business Days  |                      |                 |                      |                         |                      |                         |                               |                        |
|                                   | Total for Actuary | 4                    | 2               | 20%                  |                         | 4                    |                         |                               |                        |



June 23, 2022

| TO:           | Becky Kent, B.A., Chair and Members of the Halifax Regional<br>Water Commission Board                                                           |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| SUBMITTED BY: | E. Jeff Myrick<br>Date: 2022.06.17<br>12:55:31 -03'00'<br>Jeff Myrick, Communications and Public Affairs Manager                                |
| APPROVED:     | CathieDigitally signed by Cathie<br>O'TooleO'TooleDate: 2022.06.17<br>13:41:29 -03:00'Cathie O'Toole, MBA, FCPA, FCGA, ICD.D<br>General Manager |
| DATE:         | June 17, 2022                                                                                                                                   |
| SUBJECT:      | 2022/23 Communications & Stakeholder Engagement Plan on a Page                                                                                  |

### **INFORMATION REPORT**

### <u>ORIGIN</u>

2022/23 Annual Business Plan

### BACKGROUND

Halifax Water's business plan for 2022/23 addresses the challenges of growth, aging infrastructure, and the increasing demands of customers. In addition to addressing these challenges, this plan focuses on ensuring Halifax Water customers continue to receive quality service and that the utility's employees are supported and empowered with the resources needed to achieve this.

### DISCUSSION

The 2022/23 Communications & Stakeholder Engagement Plan on a page reflects the challenges and opportunities outlined 2022/23 Annual Business Plan and provides a highlevel overview of the main projects, programs and services that will be the focus of communications efforts for this fiscal year. Along with a number of significant capital projects, Halifax Water will be continuing the development and rollout of a comprehensive stakeholder engagement strategy; continuing communications with potential new stormwater customers within the recently expanded stormwater service boundary; engaging with customers and stakeholders regarding the 2022 General Rate Application, and much more. Separate, detailed communications plans have already been developed for a number of the strategic items listed in the Plan.

### **ATTACHMENTS**

1. Communications and Stakeholder Engagement - Plan on a Page

| Report Prepared by: | Jacob Fulton<br>Date: 2022.06.17<br>14:43:18 -03'00'   |
|---------------------|--------------------------------------------------------|
|                     | Jeff Myrick, Communications and Public Affairs Manager |

| mber) Q4 (January – March)        | ance Program e Stormwater Customer Education<br>tion e Annual business plan<br>e Annual operating & capital budget<br>cele education • Cost of Service Application<br>anning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <ul> <li>Communicate Annual Customer Survey Results<br/>basin cleaning</li> <li>Halifax Water NSCC Spring Bursary Applications<br/>Games</li> </ul>                                                      | al Replacement Assistance Program (The Lateral Loan), and Lead Service                                                                                                                                 | Benefits)     • Communicate Annual Employee Survey Results       vey     • Employee Appreciation Day       ovey     • Any compensation or benefit changes for the       e, Purple     coming fiscal year       uet                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | intranet                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | tt - Present annual & five-year business plans to<br>ssions Halifax Council<br>• Online Public Information Sessions (Storrmwater,<br>ogram Review GRA, etc.)                               | STRAIGHT from UL Hali |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------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| - September) Q3 (October – Decerr | ion Customer<br>ergy System Developers<br>ergy System Developers<br>ign and longer-term billing<br>2023/24 Communications Pla                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | eting eting • Annual Customer Survey<br>• Storm preparedness & catch I<br>• North American Indigenous G<br>Fall Bursary Applications<br>orship & Parade                                                  | <u>On-Going</u><br>planned and unplanned events, etc.<br>420 Fund), Stormwater Credit, Wastewater Rebate, Private Laters                                                                               | ent focus groups     GM Roadshow (Pension and E cognition program       ecognition program     Launch Annual Employee Sun porate Balanced Scorecard       porate Balanced Scorecard     Employee Engagement (Flu Si the structure Way, Angel Tree tests, United Way, Angel Tree Ribbon)       rd     Employee Engagement (Flu Si the structure Way, Angel Tree tests, United Way, Angel Tree Ribbon)       ased on 2021 Employee     Long Service Awards & Banque       of ment Communications     I&l compliance program                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <u>On-Going</u><br>al communications, updates to safety screens and updates to the i<br>g learning, fitness incentive, etc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | gagement     • RDC Stakeholder Engagement<br>munity Program       • Online Public Information Ses<br>(Stormwater, GRA, etc.)       • Water Station Community Prc<br>& Planning for 2023/24 |                       |
| 21 (April – June) Q2 (July –      | Rate Application     •     Stormwater Expansi-<br>incations       nication     •     Communications       er Portal     •     Cogswell District Ene-<br>package       ater Expansion     •     Customer bill redesi       nications     •     Customer bill redesi       Lake Major Clarifier     strategy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <ul> <li>nn CSR, Diversity &amp; Inclusion</li> <li>Annual General Mee</li> <li>Annual Report</li> <li>B communications for capital</li> <li>Halifax Water NSCC</li> <li>Halifax Pride Sponso</li> </ul> | tinue to support capital projects, day-to-day operations, f<br>motion of Halifax Water programs: Financial Assistance (H<br>Replacement Program (Get the Lead Out).<br>motion of Public Board Meetings | dshow (Business Plan and<br>cesults)employee engagemdesults)Update employee re<br>0pdate employee re<br>MeekUpdate employee re<br>GM Roadshow (Corp<br>e GM Roadshow (Corp<br>e GM Roadshow (Corp<br>n (corp<br>ersity & Inclusion InitiativesweekOff Roadshow (Corp<br>GM Roadshow (Corp<br>ersity & Inclusion InitiativesweekOff Roadshow (Corp<br>BM Roadshow (Corp<br>ersity & Inclusion InitiativesweekOff Roadshow (Corp<br>ersity & In | nthly Pipeline Post Newsletter<br>porting projects, programs or policy changes with interna<br>motion of employee services and benefits such as lifelong                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <ul> <li>RDC Stakeholder English</li> <li>RDC Stakeholder English</li> <li>Water Station Commutation Community Program</li> </ul>                                                          | 函 One Team,           |
|                                   | Strategic<br>Communication<br>Focus<br>Replace<br>Replace<br>Phase<br>Communication<br>Stormwin<br>Replace<br>Phase<br>Communication<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin<br>Stormwin | stiernal<br>cations<br>ties<br>project s                                                                                                                                                                 | Regular E<br>Comumo<br>Activi<br>3 2 1<br>2 Co<br>7 Co<br>7 Co                                                                                                                                         | ular Internal<br>Survey F<br>Anti-Idlin<br>Alignme<br>Anti-Idlin<br>Anti-Idlin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | αnmmon<br>3) Sup<br>2) Sup<br>2) Sup<br>2) Sup<br>2) Sup<br>2) Sup<br>3) Sup<br>3 | Stakeholder<br>Engagement<br>Activities<br>• •                                                                                                                                             |                       |

Halifax Water Communications and Stakeholder Engagement 2022/23



| TO:           | Becky Kent, B.A., Chair, and Members of the Halifax Regional Water<br>Commission Board as Trustees of the Halifax Regional Water Commission<br>Employees' Pension Plan |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SUBMITTED BY: | Louis de<br>MontbrunDigitally signed by Louis<br>de MontbrunDate: 2022.06.17<br>11:10:07 -03'00'                                                                       |
|               | Louis de Montbrun, CPA, CA, Director, Corporate Services/CFO                                                                                                           |
| APPROVED:     | CathieDigitally signed by Cathie<br>O'TooleO'TooleDate: 2022.06.17<br>13:35:45 -03'00'                                                                                 |
|               | Cathie O'Toole, MBA, FCPA, FCGA, ICD.D, General Manager                                                                                                                |
| DATE:         | June 10, 2022                                                                                                                                                          |
| SUBJECT:      | Halifax Regional Municipality Master Trust<br>Investment Performance, Fourth Quarter, 2021                                                                             |

### **INFORMATION REPORT**

### <u>ORIGIN</u>

The Halifax Regional Municipality Master Trust (the "Master Trust") investment performance is reported to the Halifax Regional Water Commission Board as Trustees of the Halifax Regional Water Commission Employees' Pension Plan periodically throughout the year.

### **BACKGROUND**

None

### DISCUSSION

The tables below and the attached Investment Report provide a performance update for the Fourth Quarter of 2021 (October to December) for the Master Trust, of which Halifax Regional Water Commission Employees' Pension Plan (the "Plan") is a part. The fair value of the investment in the Master Trust is determined and updated at year-end, and the Plan's share in the Master Trust at December 31, 2021 was 6.5%, totaling \$173.0 million.

The Master Trust returned 4.76% in the Fourth Quarter, which outperformed the policy benchmark of 2.56% by 2.20%. The return for the 1-year period ended December 31, 2021, is 11.98%,

outperforming the policy benchmark of 6.90% by 5.08%. Other historical returns are provided in Table 1 below.

#### **Table 1 – Returns**

|                  | Current      |        |            |            | Since      |
|------------------|--------------|--------|------------|------------|------------|
|                  | Quarter      |        | 3 - Year   | 4 - Year   | Inception  |
|                  | (Oct to Dec) | 1-Year | Annualized | Annualized | (Oct 1999) |
| Fund Return      | 4.76%        | 11.98% | 10.07%     | 8.47%      | 7.41%      |
| Policy Benchmark | 2.56%        | 6.90%  | 8.33%      | 6.42%      | 5.85%      |
| Excess Return    | 2.20%        | 5.08%  | 1.74%      | 2.05%      | 1.56%      |

The total fund returns are subject to investment management fees and plan expenses.

As at December 31, 2021, the Master Trust was in compliance with the Statement of Investment Policies and Procedures (SIP&P), and a summary of the asset mix is provided in Table 2 below:

### Table 2– Asset Mix, as at December 31, 2021

|                       |        | Policy    |
|-----------------------|--------|-----------|
| Asset:                | Actual | Benchmark |
| Cash & Equivalents    | 0.6%   | 0.0%      |
| Canadian Equity       | 4.0%   | 4.2%      |
| Global Equity         | 35.1%  | 29.6%     |
| Fixed Income          | 27.7%  | 37.3%     |
| Minimum Target Return | 32.6%  | 28.9%     |

### ATTACHMENT

2021 Fourth Quarter Halifax Regional Municipality Master Trust Investment Report

| Report Prepared by: | Heather<br>Britten | Digitally signed by<br>Heather Britten<br>Date: 2022.06.17<br>10:30:14 -03'00' |
|---------------------|--------------------|--------------------------------------------------------------------------------|
|                     | Heather S. Brit    | tten, Quality Assurance Officer (902) 490 1895                                 |

Consent Agenda Item No. 1



# **Investment Report**

Q4 2021

## **Executive Summary**

### **Compliance**

• As at December 31, 2021, the Master Trust (MT) was in compliance with the SIP&P.

### **Funded Status**

• As at December 31, 2020, the going concern funded ratio and transfer ratio were 94.1% and 62.1% respectively.

### Master Trust Performance (net of fees)

- In Q4, the MT earned 4.76%, outperforming the policy benchmark return by 2.20%.
- For the one-year period ending December 31, 2021, the MT earned 11.98% outperforming the policy benchmark by 5.08%.
- The MT earned an annualized return of 8.47% over the 4-year period ending December 31, 2021, outperforming the policy benchmark by 2.05% annualized.
- Since inception (October 1999), the MT earned 7.41% annualized, outperforming the Plan's discount rate of 6.45%. The table on the next slide summarizes the calendar year returns for the MT.



### **Executive Summary – Cont.**



|                  | 2000   | 2001   | 2002   | 2003   | 2004   | 2005   | 2006   | 2007  | 2008    | 2009   | 2010   | 2011   | 2012   | 2013   | 2014  | 2015   | 2016   | 2017   | 2018  | 2019   | 2020   | 2021   |
|------------------|--------|--------|--------|--------|--------|--------|--------|-------|---------|--------|--------|--------|--------|--------|-------|--------|--------|--------|-------|--------|--------|--------|
| Fund Return      | 10.71% | -0.56% | -5.21% | 12.60% | 10.27% | 12.38% | 12.88% | 2.60% | -14.83% | 14.47% | 10.12% | 2.11%  | 12.01% | 10.94% | 9.27% | 10.59% | 5.13%  | 10.85% | 3.81% | 10.69% | 7.59%  | 11.98% |
| Policy Benchmark | 7.12%  | -2.64% | -4.50% | 13.91% | 9.50%  | 11.76% | 12.85% | 1.58% | -15.20% | 10.92% | 10.08% | 2.71%  | 7.12%  | 7.01%  | 7.24% | 5.27%  | 5.55%  | 8.91%  | 0.96% | 10.28% | 7.92%  | 6.90%  |
| Excess Return    | 3.59%  | 2.08%  | -0.71% | -1.31% | 0.77%  | 0.62%  | 0.03%  | 1.02% | 0.37%   | 3.55%  | 0.04%  | -0.60% | 4.89%  | 3.93%  | 2.03% | 5.32%  | -0.42% | 1.94%  | 2.85% | 0.41%  | -0.33% | 5.08%  |



### **Executive Summary – Cont.**

### Added Value

• In Q4 of 2021, the MT outperformed its policy benchmark by 2.20%.

Attribution: Private Investments +2.26%, US Equity +0.09%, International Equity +0.08%, ACWI Equity +0.08%, World Equity +0.07%, Global Credit +0.05%, Small Cap Equity -0.01%, Canadian Equity -0.04%, EAFE Equity -0.08%, Universe Bonds -0.12% and Emerging Equity -0.18%.



### **Total Fund Net Returns**

#### As of December 31, 2021

|                   | Q4    | 1-Year | 3-Year<br>Annualized | 4-Year<br>Annualized | Since Inception<br>(Oct 1999) |
|-------------------|-------|--------|----------------------|----------------------|-------------------------------|
| Fund Return       | 4.76% | 11.98% | 10.07%               | 8.47%                | 7.41%                         |
| Policy Benchmark* | 2.56% | 6.90%  | 8.33%                | 6.42%                | 5.85%                         |
| Excess Return     | 2.20% | 5.08%  | 1.74%                | 2.05%                | 1.56%                         |

\* Effective December 31, 2021, the Policy Benchmark is 4.2% S&P/TSX Index + 5.1% S&P 500 Hedged Index (\$CAD) + 2.4% MSCI EAFE Index (\$CAN) + 4.4% MSCI Emerging Markets (\$CAN) + 8.2% MSCI World (\$CAN) + 16.8% FTSE TMX Canada Universe Bond + 20.5% 3 Month Bankers Acceptance + 28.9% Private Investments + 3.2% MSCI ACWI ex USA (\$CAD) + 4.4% MSCI ACWI (\$CAD) + 1.9% MSCI World Small Cap (\$CAD)

Fund returns are shown net of fees and expenses



### **Asset Mix**



\* Effective December 31, 2021, the Policy Benchmark is 4.2% S&P/TSX Index + 5.1% S&P 500 Hedged Index (\$CAD) + 2.4% MSCI EAFE Index (\$CAN) + 4.4% MSCI Emerging Markets (\$CAN) + 8.2% MSCI World (\$CAN) + 16.8% FTSE TMX Canada Universe Bond + 20.5% 3 Month Bankers Acceptance + 28.9% Private Investments + 3.2% MSCI ACWI ex USA (\$CAD) + 4.4% MSCI ACWI (\$CAD) + 1.9% MSCI World Small Cap (\$CAD)

Fund returns are shown net of fees and expenses



## **Equity Market Returns**

### As of December 31, 2021

| to tax                                             | ~      | <b>4</b> Maran | 3-Year     | 4-Year     |
|----------------------------------------------------|--------|----------------|------------|------------|
| Index                                              | Q4     | 1-Year         | Annualized | Annualized |
| Canadian Equity (S&P/TSX Composite Index)          | 6.47%  | 25.09%         | 17.52%     | 10.28%     |
| US Equity (S&P 500 Hedged 100% C\$)                | 10.76% | 28.29%         | 24.49%     | 16.14%     |
| EAFE Equity (MSCI EAFE C\$)                        | 2.39%  | 10.32%         | 10.62%     | 6.20%      |
| Emerging Markets (MSCI EM C\$)                     | -1.60% | -3.37%         | 8.09%      | 4.14%      |
| World Equity (MSCI World C\$)                      | 7.45%  | 20.78%         | 18.57%     | 13.49%     |
| International Equity (MSCI ACWI ex US C\$)         | 1.52%  | 6.91%          | 10.27%     | 5.82%      |
| ACWI Equity (MSCI ACWI C\$)                        | 6.36%  | 17.53%         | 17.29%     | 12.35%     |
| Global Small Cap Equity (MSCI World Small Cap C\$) | 1.93%  | 14.77%         | 16.14%     | 10.13%     |

Global equities were stronger in Q4 as investors focused on economic resilience and corporate earnings.
 Emerging market equities were weak as the US dollar strengthened, and poor economic performance in Turkey weighed on sentiment.

\*Source: Northern Trust



## Public Equity – Q4 Summary

• The MT's Equity portfolio returned 5.17% during the quarter, underperforming the equity policy benchmark return of 5.35% by 0.18%, primarily due to underperformance of Emerging and EAFE equities.

|                           |        | Q4        |                         |         | One year  |                         |
|---------------------------|--------|-----------|-------------------------|---------|-----------|-------------------------|
| Equity Mandate            | Plan   | Benchmark | Relative<br>Performance | Plan    | Benchmark | Relative<br>Performance |
| Canadian Equity           | 6.06%  | 6.47%     | -0.41%                  | 24.77%  | 25.09%    | -0.32%                  |
| US Equity                 | 10.37% | 10.76%    | -0.39%                  | 29.74%  | 28.29%    | 1.45%                   |
| EAFE Equity               | 0.03%  | 2.39%     | -2.36%                  | 7.19%   | 10.32%    | -3.13%                  |
| Emerging Equity           | -5.49% | -1.60%    | -3.89%                  | -11.50% | -3.37%    | -8.13%                  |
| World Equity              | 7.18%  | 7.45%     | -0.27%                  | 20.26%  | 20.78%    | -0.52%                  |
| International Equity**    | 4.31%  | 1.52%     | 2.79%                   | 9.95%   | 5.26%     | 4.69%                   |
| Global Small Cap Equity** | 1.90%  | 1.93%     | -0.03%                  | 8.48%   | 7.98%     | 0.50%                   |
| ACWI Equity**             | 8.22%  | 6.36%     | 1.86%                   | 12.68%  | 12.60%    | 0.08%                   |
| Total                     | 5.17%  | 5.35%     | -0.18%                  | 15.70%  | 16.41%    | -0.71%                  |

### As of December 31, 2021 (C\$ returns)

\*Source: Northern Trust

\*\*Inception since March 17, 2021 (International Equity), May 25, 2021 (ACWI Equity), and May 19, 2021 (Global Small Cap Equity).



## **Bond Market Returns**

#### As of September 30, 2021

| Index                                                              | Q4    | 1-Year | 3-Year<br>Annualized | 4-Year<br>Annualized |
|--------------------------------------------------------------------|-------|--------|----------------------|----------------------|
| Canadian Universe Bonds (FTSE TMX Canada<br>Universe Bond)         | 1.47% | -2.54% | 4.22%                | 3.51%                |
| Canadian Government Bonds (FTSE TMX Canada<br>Universe Government) | 1.62% | -2.97% | 3.92%                | 3.32%                |
| Canadian Corporate Bonds (FTSE TMX Canada<br>Universe Corporate)   | 1.08% | -1.34% | 5.05%                | 4.04%                |

- Government bonds have outperformed Corporate bonds and the broader Universe over the Q4 period.
- Corporate bonds have outperformed Government bonds and the broader Universe over 1-year periods, 3-year periods and 4-year periods.

\*Source: Northern Trust



## **Public Fixed Income – Q4 Summary**

• The MT's diversified Fixed Income portfolio earned 0.21%, which underperformed its benchmark return of 0.70% by 0.49%, primarily due to underperformance of Canadian Corporate Bonds.

|                               | Q4     |           |                         | One year |           |                         |
|-------------------------------|--------|-----------|-------------------------|----------|-----------|-------------------------|
|                               | Plan   | Benchmark | Relative<br>Performance | Plan     | Benchmark | Relative<br>Performance |
| Canadian Corporate Bond       | 0.45%  | 1.08%     | -0.63%                  | 7.10%    | -1.34%    | 8.44%                   |
| Government Bond               | 1.15%  | 1.62%     | -0.47%                  | -2.63%   | -2.97%    | 0.34%                   |
| Global Credit Absolute Return | -0.36% | 0.12%     | -0.48%                  | -0.37%   | 0.45%     | -0.82%                  |
| Total                         | 0.21%  | 0.70%     | -0.49%                  | 1.47%    | -0.85%    | 2.32%                   |

### As of December 31, 2021 (C\$ returns)

\*Source: Northern Trust



### **Private Investments – Q4 Summary**

• Private Investments returned 9.00% in Q4, versus a benchmark of 1.61%, outperforming by 7.39%.

### As of December 31, 2021 (C\$ returns)

|                     |       |        | 3-Year     | 4-Year     | Since Inception |
|---------------------|-------|--------|------------|------------|-----------------|
|                     | Q4    | 1-Year | Annualized | Annualized | (Oct 1999)      |
| Private Investments | 9.00% | 19.89% | 11.34%     | 12.35%     | 12.87%          |
| Policy Benchmark    | 1.61% | 6.45%  | 6.27%      | 6.26%      | 6.47%           |
| Excess Return       | 7.39% | 13.44% | 5.07%      | 6.09%      | 6.40%           |

The policy benchmark for the private investment portfolio is the Going Concern Discount rate. The 2021 rate is 6.45%, 2020 rate is 6.25%, 2019 is 6.1%, 2018 is 6.2%, 2017 is 6.4%, 2016 is 6.5%, 2015 is 6.55%, 2014 is 6.55%, 2013 is 6.25%, 2007-2012 is 6.75% and prior to 2007 is 7.4% respectively.



## Liquidity

|                                                                       | Act<br>Am<br>mlr | ual 2021<br>ounts (\$<br>n) |
|-----------------------------------------------------------------------|------------------|-----------------------------|
| Contributions                                                         | \$               | 111.2                       |
| Dividend & Distribution Income                                        | \$               | 11.0                        |
| Interest Income                                                       | \$               | 11.5                        |
| Other Income                                                          | \$               | 0.3                         |
| Benefit Payments                                                      | -\$              | 135.8                       |
| Expenses                                                              | -\$              | 10.5                        |
| Total Annual Net CF                                                   | -\$              | 12.3                        |
| Liquid Investments*                                                   | \$               | 1,566.7*                    |
| Actual Net Distributions                                              | \$               | 158.0                       |
| Actual Net Capital Calls                                              | -\$              | 163.0                       |
| <u> Total CF + Liquid Investments + Private Sales – Capital Calls</u> | \$               | 1,549.4                     |

\* Liquid investments as at March 1, 2022. Includes all publicly traded equity and fixed income investments





| TO:           | Becky Kent, B.A., Chair, and Members of the Halifax Regional Water<br>Commission Board as Trustees of the Halifax Regional Water Commission<br>Employees' Pension Plan |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SUBMITTED BY: | Louis de<br>Montbrun<br>Louis de Montbrun<br>Date: 2022.06.17<br>11:11:21 -03'00'                                                                                      |
|               | Louis de Montbrun, CPA, CA, Director, Corporate Services/CFO                                                                                                           |
| APPROVED:     | Cathie<br>O'Toole<br>Date: 2022.06.17<br>13:37:49 -03'00'<br>Cathie O'Toole, MBA, FCPA, FCGA, ICD.D, General Manager                                                   |
| DATE:         | June 10, 2022                                                                                                                                                          |
| SUBJECT:      | Halifax Regional Municipality Master Trust<br>Investment Performance, First Quarter, 2022                                                                              |

### **INFORMATION REPORT**

### <u>ORIGIN</u>

The Halifax Regional Municipality Master Trust (the "Master Trust") investment performance is reported to the Halifax Regional Water Commission Board as Trustees of the Halifax Regional Water Commission Employees' Pension Plan periodically throughout the year.

### **BACKGROUND**

None

### **DISCUSSION**

The tables below and the attached Investment Report provide a performance update for the First Quarter of 2022 (January to March) for the Master Trust, of which Halifax Regional Water Commission Employees' Pension Plan (the "Plan") is a part. The fair value of the investment in the Master Trust is determined and updated at year-end, and the Plan's share in the Master Trust at December 31, 2021 was 6.5%, totaling \$173.0 million.

The Master Trust earned -2.90% in the First Quarter, which underperformed the First Quarter policy benchmark of -2.88% by 0.02%. The return for the 1-year period ended March 31, 2022, is

7.04%, outperforming the 1-year policy benchmark of 2.88% by 4.16%. Other historical returns are provided in Table 1 below.

#### Table 1 – Returns

|                  | Quarter      |        | 3 - Year   | 4 - Year   | Inception  |
|------------------|--------------|--------|------------|------------|------------|
|                  | (Jan to Mar) | 1-Year | Annualized | Annualized | (Oct 1999) |
| Fund Return      | -2.90%       | 7.04%  | 7.65%      | 7.29%      | 7.19%      |
| Policy Benchmark | -2.88%       | 2.88%  | 5.67%      | 5.45%      | 5.64%      |
| Excess Return    | -0.02%       | 4.16%  | 1.98%      | 1.84%      | 1.55%      |
|                  |              |        |            |            |            |

The total fund returns are subject to investment management fees and plan expenses.

As at March 31, 2022, the Master Trust was in compliance with the Statement of Investment Policies and Procedures (SIP&P), and a summary of the asset mix is provided in Table 2 below:

#### Table 2– Asset Mix, as at March 31, 2022

|                            |        | Policy    |
|----------------------------|--------|-----------|
| Asset:                     | Actual | Benchmark |
| Cash & Equivalents         | 0.5%   | 0.0%      |
| Canadian Equity            | 4.2%   | 3.7%      |
| Global Equity              | 35.2%  | 37.2%     |
| Fixed Income               | 22.2%  | 27.7%     |
| Public Market Alternatives | 3.3%   | 2.2%      |
| Private Investments        | 34.6%  | 29.2%     |

### ATTACHMENT

2022 First Quarter Halifax Regional Municipality Master Trust Investment Report

| Report Prepared by: | Heather<br>Britten | Digitally signed by<br>Heather Britten<br>Date: 2022.06.17<br>10:31:48 -03'00' |
|---------------------|--------------------|--------------------------------------------------------------------------------|
|                     | Heather S. Britt   | en, Quality Assurance Officer (902) 490 1895                                   |

Consent Agenda Item No. 1



# **Investment Report**

Q1 2022
# **Executive Summary**

### **Compliance**

• As at March 31, 2022, the Master Trust (MT) was in compliance with the SIP&P.

### **Funded Status**

• As at December 31, 2020, the going concern funded ratio and transfer ratio were 94.1% and 62.1% respectively.\*

### Master Trust Performance (net of fees)

- In Q1, the MT earned -2.90%, underperforming the policy benchmark return by 0.02%.
- For the one-year period ending March 31, 2022, the MT earned 7.04% outperforming the policy benchmark by 4.16%.
- The MT earned an annualized return of 7.29% over the 4-year period ending March 31, 2022, outperforming the policy benchmark by 1.84% annualized.
- Since inception (October 1999), the MT earned 7.19% annualized, outperforming the Plan's discount rate of 6.45%. The table on the next slide summarizes the calendar year returns for the MT.

\* Eckler to provide an update on the Plan's funded ratio as at December 31, 2021 during the June Pension Committee meeting.



## **Executive Summary – Cont.**



|                  | 2000   | 2001   | 2002   | 2003   | 2004   | 2005   | 2006   | 2007  | 2008    | 2009   | 2010   | 2011   | 2012   | 2013   | 2014  | 2015   | 2016   | 2017   | 2018  | 2019   | 2020   | 2021   |
|------------------|--------|--------|--------|--------|--------|--------|--------|-------|---------|--------|--------|--------|--------|--------|-------|--------|--------|--------|-------|--------|--------|--------|
| Fund Return      | 10.71% | -0.56% | -5.21% | 12.60% | 10.27% | 12.38% | 12.88% | 2.60% | -14.83% | 14.47% | 10.12% | 2.11%  | 12.01% | 10.94% | 9.27% | 10.59% | 5.13%  | 10.85% | 3.81% | 10.69% | 7.59%  | 11.98% |
| Policy Benchmark | 7.12%  | -2.64% | -4.50% | 13.91% | 9.50%  | 11.76% | 12.85% | 1.58% | -15.20% | 10.92% | 10.08% | 2.71%  | 7.12%  | 7.01%  | 7.24% | 5.27%  | 5.55%  | 8.91%  | 0.96% | 10.28% | 7.92%  | 6.90%  |
| Excess Return    | 3.59%  | 2.08%  | -0.71% | -1.31% | 0.77%  | 0.62%  | 0.03%  | 1.02% | 0.37%   | 3.55%  | 0.04%  | -0.60% | 4.89%  | 3.93%  | 2.03% | 5.32%  | -0.42% | 1.94%  | 2.85% | 0.41%  | -0.33% | 5.08%  |



# **Executive Summary – Cont.**

### Added Value

• In Q1 of 2022, the MT underperformed its policy benchmark by 0.02%.

Attribution: Universe Bonds +0.48%, US Equity +0.13%, ACWI Equity -0.02%, Private Investments -0.04%, Canadian Equity -0.04%, Emerging Market Equity -0.04%, World Equity -0.04%, International Equity -0.16%, and Global Credit -0.29%.



# **Total Fund Net Returns**

#### As of March 31, 2022

|                   | 01     | 1-Vear | 3-Year<br>Annualized | 4-Year<br>Annualized | Since Inception |
|-------------------|--------|--------|----------------------|----------------------|-----------------|
|                   | Q_     |        | Annualized           | Annaulzea            | (000 1999)      |
| Fund Return       | -2.90% | 7.04%  | 7.65%                | 7.29%                | 7.19%           |
|                   | 2.222/ | 0.000/ | 5.670/               | E 450/               | F 6 494         |
| Policy Benchmark* | -2.88% | 2.88%  | 5.67%                | 5.45%                | 5.64%           |
| Excess Return     | -0.02% | 4.16%  | 1.98%                | 1.84%                | 1.55%           |

\* Effective March 31, 2022, the Policy Benchmark is 3.7% S&P/TSX Index + 7.5% S&P 500 (\$CAD) + 3.4% MSCI EAFE Index (\$CAN) + 3.8% MSCI Emerging Markets (\$CAN) + 10.9% MSCI World (\$CAN) + 15.9% FTSE TMX Canada Universe Bond + 11.8% 3 Month Bankers Acceptance + 29.2% Private Investments + 3.7% MSCI ACWI ex USA (\$CAD) + 4.8% MSCI ACWI (\$CAD) + 3.1% MSCI World Small Cap (\$CAD) + 2.2% 3 Month Bankers Acceptance

Fund returns are shown net of fees and expenses



### **Asset Mix**



\* Effective March 31, 2022, the Policy Benchmark is 3.7% S&P/TSX Index + 7.5% S&P 500 (\$CAD) + 3.4% MSCI EAFE Index (\$CAN) + 3.8% MSCI Emerging Markets (\$CAN) + 10.9% MSCI World (\$CAN) + 15.9% FTSE TMX Canada Universe Bond + 11.8% 3 Month Bankers Acceptance + 29.2% Private Investments + 3.7% MSCI ACWI ex USA (\$CAD) + 4.8% MSCI ACWI (\$CAD) + 3.1% MSCI World Small Cap (\$CAD) + 2.2% 3 Month Bankers Acceptance

Fund returns are shown net of fees and expenses



# **Equity Market Returns**

#### As of March 31, 2022

| Index                                              | Q1     | 1-Year  | 3-Year<br>Annualized | 4-Year<br>Annualized |
|----------------------------------------------------|--------|---------|----------------------|----------------------|
| Canadian Equity (S&P/TSX Composite Index)          | 3.82%  | 20.19%  | 14.15%               | 10.28%               |
| US Equity (S&P 500 C\$)                            | -5.66% | 14.93%  | 16.29%               | 15.58%               |
| EAFE Equity (MSCI EAFE C\$)                        | -6.96% | 0.54%   | 5.39%                | 3.96%                |
| Emerging Markets (MSCI EM C\$)                     | -8.01% | -11.92% | 2.61%                | 0.90%                |
| World Equity (MSCI World C\$)                      | -6.21% | 9.44%   | 12.43%               | 11.25%               |
| International Equity (MSCI ACWI ex US C\$)         | -6.50% | -2.10%  | 5.13%                | 3.63%                |
| ACWI Equity (MSCI ACWI C\$)                        | -6.42% | 6.61%   | 11.23%               | 9.98%                |
| Global Small Cap Equity (MSCI World Small Cap C\$) | -7.54% | -1.71%  | 9.20%                | 7.37%                |

• All equities were broadly negative in the first quarter due to Russia's invasion of Ukraine and rising inflationary pressures. The commodity-heavy Canadian equity market was one of the notable exceptions yielding a positive return.

\*Source: Northern Trust



# **Public Equity – Q1 Summary**

The MT's Equity portfolio returned -6.15% during the quarter, • underperforming the equity policy benchmark return of -5.69% by 0.46%, primarily due to underperformance of International and Canadian equities.

| As of March 31, 2022 (C\$ returns) |         |           |                         |          |           |                 |  |  |  |
|------------------------------------|---------|-----------|-------------------------|----------|-----------|-----------------|--|--|--|
|                                    |         | Q1        |                         | One year |           |                 |  |  |  |
| Equity Mandate                     | Plan    | Benchmark | Relative<br>Performance | Plan     | Benchmark | Rela<br>Perfori |  |  |  |
| Canadian Equity                    | 2.30%   | 3.82%     | -1.52%                  | 17.99%   | 20.19%    |                 |  |  |  |
| US Equity                          | -4.53%  | -6.33%    | 1.80%                   | 16.71%   | 13.25%    |                 |  |  |  |
| EAFE Equity                        | -7.42%  | -6.96%    | -0.46%                  | -2.66%   | 0.54%     |                 |  |  |  |
| Emerging Equity                    | -8.52%  | -8.01%    | -0.51%                  | -17.64%  | -11.92%   |                 |  |  |  |
| World Equity                       | -6.29%  | -6.21%    | -0.08%                  | 8.05%    | 9.44%     |                 |  |  |  |
| International Equity               | -12.68% | -6.50%    | -6.18%                  | -4.74%   | -2.10%    |                 |  |  |  |
| Global Small Cap Equity**          | -7.86%  | -7.54%    | -0.32%                  | -0.05%   | -0.16%    |                 |  |  |  |
| ACWI Equity**                      | -6.98%  | -6.42%    | -0.56%                  | 4.82%    | 5.38%     |                 |  |  |  |
| Total                              | -6.15%  | -5.69%    | -0.46%                  | 4.67%    | 5.62%     |                 |  |  |  |

#### Α

\*Source: Northern Trust

\*\*Inception since May 25, 2021 (ACWI Equity) and May 19, 2021 (Global Small Cap Equity).



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-0.95%

tive nance

-2.20% 3.46% -3.20% -5.72% -1.39% -2.64% 0.11% -0.56%

# **Bond Market Returns**

#### As of March 31, 2022

| Index                                                              | Q1     | 1-Year | 3-Year<br>Annualized | 4-Year<br>Annualized |
|--------------------------------------------------------------------|--------|--------|----------------------|----------------------|
| Canadian Universe Bonds (FTSE TMX Canada<br>Universe Bond)         | -6.97% | -4.52% | 0.45%                | 1.63%                |
| Canadian Government Bonds (FTSE TMX<br>Canada Universe Government) | -7.16% | -4.58% | 0.10%                | 1.41%                |
| Canadian Corporate Bonds (FTSE TMX Canada<br>Universe Corporate)   | -6.45% | -4.36% | 1.39%                | 2.25%                |

 Corporate bonds have outperformed Government bonds and the broader Universe over the Q1 period, 1-year periods, 3-year periods and 4-year periods.

\*Source: Northern Trust



# **Public Fixed Income – Q1 Summary**

• The MT's diversified Fixed Income portfolio earned -2.93%, which outperformed its benchmark return of -3.61% by 0.68%, primarily due to outperformance of North American Credit.

|                           |        | Q1        |            |        | One year  |              |
|---------------------------|--------|-----------|------------|--------|-----------|--------------|
|                           |        |           | Deletive   |        |           | Deletive     |
|                           | Dlan   | Bonchmark | Relative   | Dlan   | Bonchmark | Relative     |
|                           | гіан   | Denemiark | renormanee | гіан   | Denemiark | r chronnance |
| Cash & Cash Equivalents   | 0.10%  | 0.25%     | -0.15%     | 0.19%  | 0.59%     | -0.40%       |
| North American Credit     | -1.76% | -6.45%    | 4.69%      | 2.25%  | -4.36%    | 6.61%        |
| Canadian Government Bonds | -6.42% | -7.16%    | 0.74%      | -4.18% | -4.58%    | 0.40%        |
| Global Bonds              | -1.73% | 0.25%     | -1.98%     | -2.02% | 0.59%     | -2.61%       |
| Total                     | -2.93% | -3.61%    | 0.68%      | -1.41% | -2.33%    | 0.92%        |

#### As of March 31, 2022 (C\$ returns)

\*Source: Northern Trust



## **Private Investments – Q1 Summary**

• Private Investments returned 0.97% in Q1, versus a benchmark of 1.61%, underperforming by 0.64%.

#### As of March 31, 2022 (C\$ returns)

|                     | Q1     | 1-Year | 3-Year<br>Annualized | 4-Year<br>Annualized | Since Inception<br>(Oct 1999) |
|---------------------|--------|--------|----------------------|----------------------|-------------------------------|
| Private Investments | 0.97%  | 19.97% | 11.94%               | 11.71%               | 12.69%                        |
| Policy Benchmark    | 1.61%  | 6.45%  | 6.30%                | 6.27%                | 6.47%                         |
| Excess Return       | -0.64% | 13.52% | 5.64%                | 5.44%                | 6.22%                         |

The policy benchmark for the private investment portfolio is the Going Concern Discount rate. The 2022 and 2021 rate is 6.45%, 2020 rate is 6.25%, 2019 is 6.1%, 2018 is 6.2%, 2017 is 6.4%, 2016 is 6.5%, 2015 is 6.55%, 2014 is 6.5%, 2013 is 6.25%, 2007-2012 is 6.75% and prior to 2007 is 7.4% respectively.



# Liquidity

|                                                                       | Estimated<br>Amounts | 2022<br>(\$ mln) |
|-----------------------------------------------------------------------|----------------------|------------------|
| Contributions**                                                       | \$                   | 99.90            |
| Dividend & Distribution Income**                                      |                      | 3.70             |
| Interest Income**                                                     |                      | 10.00            |
| Other Income**                                                        |                      | 0.20             |
| Benefit Payments**                                                    |                      | (130.10)         |
| Expenses**                                                            |                      | (4.90)           |
| Total Annual Net CF                                                   | \$                   | (21.20)          |
| Liquid Investments*                                                   |                      | 1,392.40         |
| Actual Net Distributions                                              |                      | 23.90            |
| Projected Net Distributions***                                        |                      | 260.00           |
| Actual Net Capital Calls                                              |                      | (35.80)          |
| Projected Net Capital Calls***                                        |                      | (121.00)         |
| <u> Total CF + Liquid Investments + Private Sales – Capital Calls</u> | \$                   | 1,498.30         |

\* Liquid investments as at May 10, 2022. Includes all publicly traded equity and fixed income investments \*\* Contributions, Benefit Payments, Income, and Expense estimates based on actual amounts from January to March 2022, annualized for full year \*\*\*Forecasted based on 2021 numbers

