VOLUME 1:
INTEGRATED RESOURCE PLAN

Executive Summary

Report

Appendices:

Appendix A IRP Terms of Reference

Appendix B Five Year Business Plan Cost Tables

Appendix C Corporate Balanced Scorecard Public Version

Appendix D Maps

- Water System
- Wastewater System including WWTFs
- Separated/Combined Sewer Areas including CSOs
- HRM Overview
- Growth Areas

Appendix E RWWFP Master Project/Cost Table

Appendix F New and Existing Programs

Appendix G NSUARB Section 9 Detailed Compliance Tables

Appendix H Recommended IRP Financial Model

Appendix I Tellus Statement

VOLUME 2:
STAKEHOLDER CONSULTATION RECORD

VOLUME 3:
TECHNICAL APPENDICES

HALIFAX WATER
INTEGRATED RESOURCE PLAN

ES 1. INTEGRATED RESOURCE PLANNING

The Halifax Regional Water Commission (HWRC) known as Halifax Water is a publicly owned utility charged with providing water, wastewater and stormwater services to the residents of Halifax Regional Municipality (HRM). Halifax Water embarked on the preparation of an Integrated Resource Plan (IRP) in order to define its overall program and resource needs for the next thirty years (2013 - 2043). The IRP responds to the combined requirements of regional growth, present and expected regulatory compliance and asset renewal. The IRP is being prepared at the direction of the Nova Scotia Utility and Review Board (NSUARB) in collaboration with the Tellus Institute who are helping guide the preparation of the IRP.

The IRP is a high level plan prepared under considerable time constraint. Plan development strove for completeness. Where data or other information was not available, the best professional judgment of the study team was employed. This resulted in a number of assumptions, which are documented throughout the report. The lack of data in some cases does represent a risk that new information may require adjustments to proposed programs and costs. This is an invariable aspect of all major planning undertakings, particularly those that look 30 years into the future.

Halifax Water has a talented and highly professional staff with demonstrated capacity to adapt to changing circumstances. An adaptive management approach will certainly be needed as changing regulations, growth estimates and new information about asset condition and performance is considered. The recommended IRP should therefore be considered the first step in an on-going and evolving process of continuous improvement.

The IRP represents an important component of Halifax Water's financial planning. It feeds into subsequent studies that examine debt requirements to meet capital programs and into utility ratemaking. It was not designed to undertake the analysis of debt or rates as part of IRP preparation. Rather the focus of the IRP preparation was as follows:

- Capital and additional O&M costs to meet the program and project requirements of the Recommended IRP for the 30-year planning period from 2013 to 2043
- Development of an overall planning framework integrating the IRP into Halifax Water's business processes
- Identification of institutional constraints required to implement the Recommended IRP
- Recommendations for additions and refinements of Halifax water's Levels of Service (LOS) to facilitate the measurement of program success.

ES 2. STAKEHOLDER OUTREACH

A comprehensive program of public consultation was undertaken as a key component of the IRP development process, seeking input, ideas and feedback from the public, non-governmental organizations, and the municipal and provincial government as per the IRP Terms of Reference.

The project team met with various stakeholder groups for one-on-one meetings in parallel with the technical review from July to September 2011.

A series of five Technical Conferences were held for the stakeholders to review the IRP process covering review of the Terms of Reference, model assumptions and plan considerations, analysis results, selection of the preferred resource plan, action plan, and the IRP recommendations.

Halifax Water has addressed relevant stakeholder comments from the one-on-one meetings and Technical Conferences through the implementation of a broad IRP analysis framework.

ES 3. PLANNING CONTEXT

Halifax Water presently operates and manages all elements of the water and wastewater system but only specific portions of the stormwater system. Halifax Water is responsible for operating and maintaining existing stormwater infrastructure located within the street right-of-way (ROW) or easements owned by Halifax Water.

Two provincial bodies have responsibility for oversight of Halifax Water – Nova Scotia Utility and Review Board (NSUARB) and Nova Scotia Environment (NSE). Federal departments including Department of Fisheries and Oceans (DFO), Environment Canada (EC) and Health Canada (HC) may also play an oversight role for specific projects and activities.

The NSUARB is the critical body that approves business plans, significant projects and sets rates. Any new projects or programs would be subject to Board approval, for example a specific project fulfilling a regulatory requirement.

NSE is the environmental regulator ensuring public health and environmental quality. NSE specifically regulates drinking water quality as well as municipal and industrial discharges from wastewater treatment plants and other sources such as overflows. NSE key roles in relation to this can be summarized as:

- Setting drinking water and ambient water quality standards;
- Issuing approvals for water, wastewater and stormwater systems;
- Inspection and monitoring of permits and approvals; and,
- Enforcement activities and response to public issues and complaints.

NSE, while mindful of the fiscal impacts of regulatory programs, is nonetheless mandated to enforce provincial and federal legal requirements and hence the direction to Halifax Water from the two provincial bodies can at times be a challenge to reconcile.

ES 4. HALIFAX INFRASTRUCTURE

Halifax Water owns and operates a total of nine water supply plants (WSP). Three are considered large facilities – J.D. Kline WSP, Lake Major WSP, and Bennery Lake WSP serving the core area of HRM and the Airport and Aerotech Business Park. Six small water supply plants service the rural/suburban area of HRM.

Halifax Water also owns and operates 15 wastewater treatment facilities (WWTFs) that provide varying levels of treatment, from primary to tertiary. Five are considered large facilities and serve the core area - the three Halifax Harbour Solutions Plants: Halifax, Dartmouth, and Herring Cove, plus Mill Cove and Eastern Passage. Eleven smaller facilities provide wastewater treatment service to suburban and outlying areas. NSE regulates the quality and quantity of effluent discharged from each WWTF.

Six of the WWTFs presently discharge to salt water receiving environments while the remainder discharge to small freshwater lakes or streams. The freshwater bodies place significant restrictions on assimilative capacity and hence limit the ability for continued population growth and WWTF expansion.

Based on data collected by Halifax Water there are presently a total of 216 potential overflow locations including 29 combined sewer overflows (CSOs) within the wastewater system. It is believed that about half (105) of the overflow locations are ever active and a much smaller sub-set is active with any significant frequency.

Prior to 2007, stormwater management was entirely the responsibility of HRM. On August 1, 2007 Halifax Water's mandate was expanded with the transfer of certain wastewater and stormwater assets from HRM. Management of stormwater in the Greater Halifax area is a multi-jurisdictional undertaking. Ownership, operations, and maintenance of the stormwater management infrastructure within the public right-of-way including stormwater easements (pipes, culverts, and retention facilities) is the responsibility of Halifax Water. Stormwater runoff is managed by a combination of piped systems (some deep, some shallow), overland flow and ditches, discharging to area watercourses.

Figure ES-1 shows the major water and wastewater systems for the urban Halifax area.

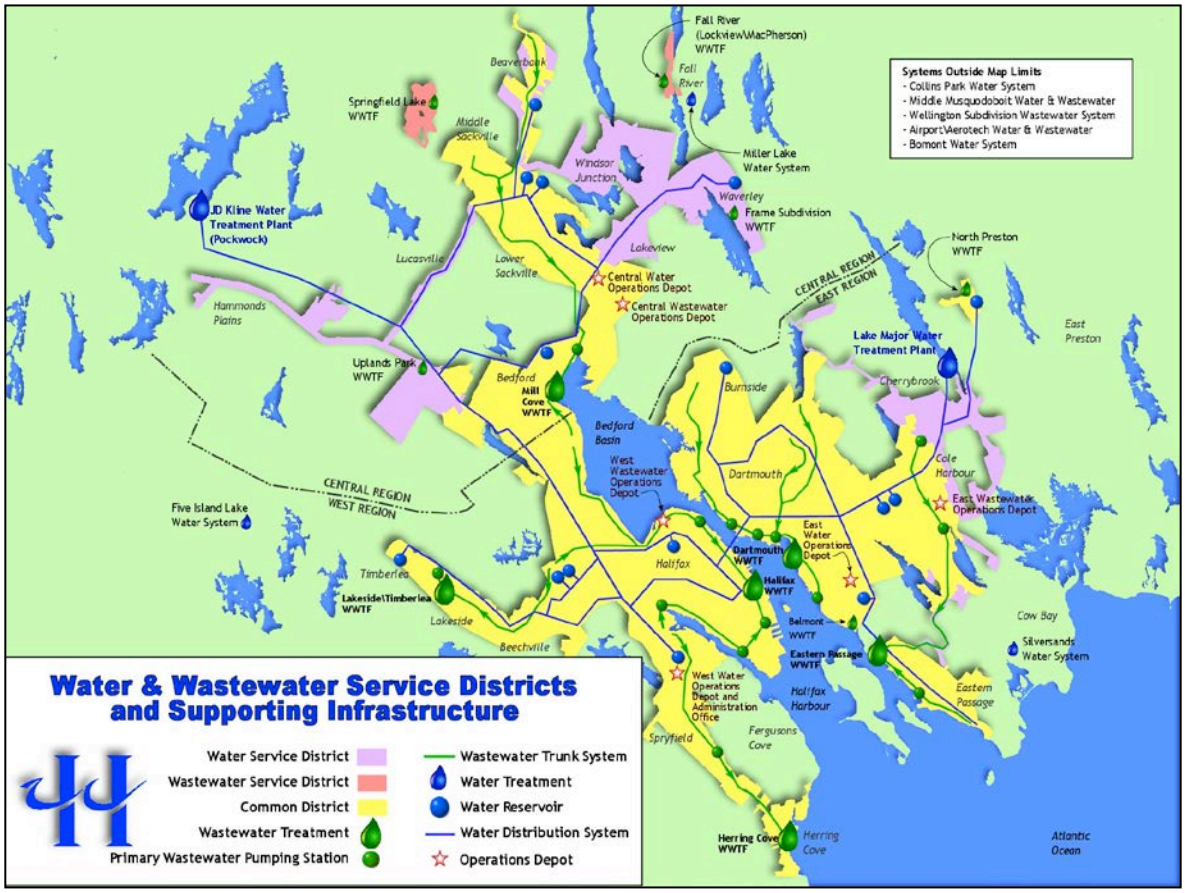


Figure ES-1 Water and Wastewater System Overview

Table ES-1 presents the inventory of the infrastructure as well as their replacement cost.

Table ES-1 Infrastructure Inventory and Replacement Costs

Asset Group	Asset	Number/ Length[1]	Replacement Costs ($ million 2012)[2]
Water	Water Distribution Mains	1187 km	$1,537
	Water Transmission Mains	220 km	$495
	Appurtenances	>93,100	$128
	Water Pumping Stations	20	$47
	Water Reservoirs	16	$140
	Dams	6	$22
	Water Supply Plants	9	$194
	Water System Sub-Total		$2,563
Wastewater	Sewers	1193 km	$1,519
	Trunk	145 km	$483
	Forcemains	90 km	$138
	Pumping Stations	172	$142
	Treatment Facilities	15	$571
	Wastewater System Sub-Total		$2,853
Stormwater	Pipes	790 km	$1,232
	Culverts	8 km	$15
	Structures	29	$1[3]
	Stormwater System Sub-Total		$1,248
All Systems Total			$6,664

Notes:

1. Due to data limitations linear infrastructure lengths are estimated (see Unit Cost Summaries - Volume 3 Appendix C and Data Collection/Gaps - Volume 3 Appendix D).
2. Based on costing procedures presented in Halifax Water Integrated Resource Plan, Volume 3 Appendix C.
3. Replacement cost for stormwater pond inlet/outlet structures.

If all the infrastructure systems required replacement today the cost would exceed $6.6 billion exclusive of land and rights-of-way.

ES 5. INTEGRATED RESOURCE PLAN DEVELOPMENT

ES 5.1 Overview

The selection of the Recommended Integrated Resource Plan was a multi-step iterative process involving the Halifax Water technical team comprised of staff and consultants collaborating with the Tellus team. Results of plan development and analysis were presented to the stakeholders group at key points in the process. Figure ES-2 presents an overview of the IRP alternative resource plan development.

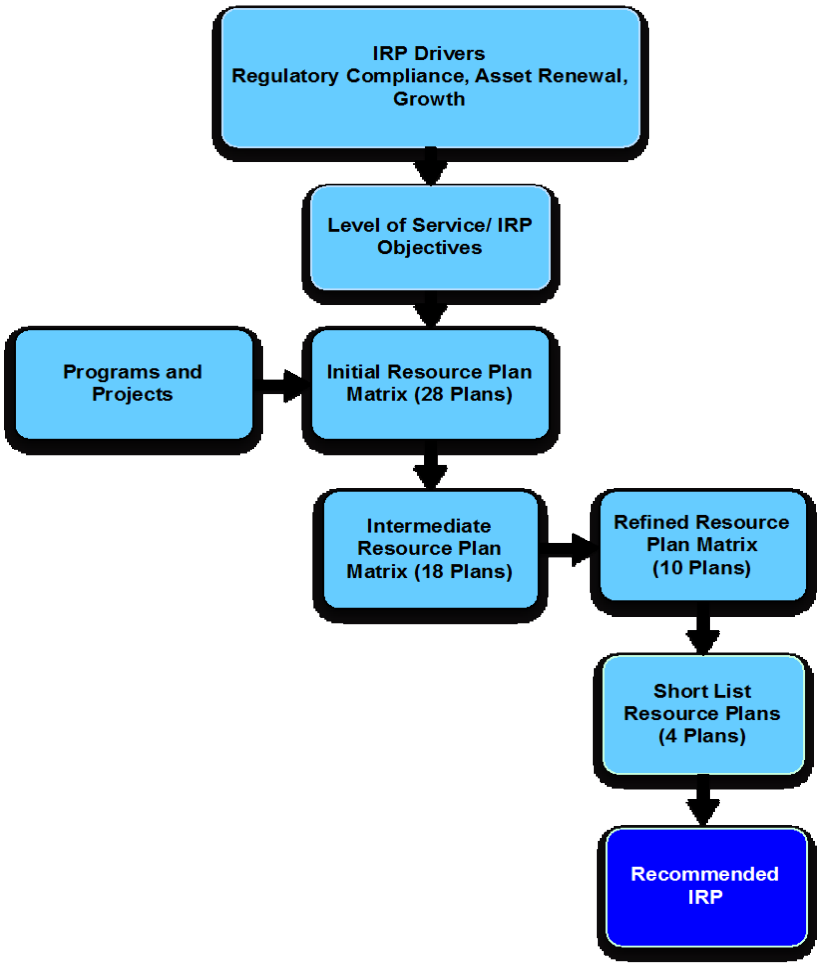


Figure ES-2 IRP Alternative Resource Plan Development

ES 5.2 IRP Drivers

ES 5.2.1 Growth

Growth is one of the key IRP drivers. All three-infrastructure systems will need to meet future growth demands.

HRM planning department provided a range growth projections for use by the IRP project team. Based on the mid-range of those projections the following growth estimates were developed and applied to the IRP and the RWWFP:

- Residential growth to 2046 – 159,240 persons.
- Employment area growth to 2046 – 698.1 ha.

The impact of growth was examined for both the water and wastewater systems. Most of the new growth is planned to occur in the urban core or adjacent areas. Very little of the growth other than infill is expected in the satellite communities. Hence the impacts were primarily on the large water and wastewater facilities and associated distribution or collection systems. New separated stormwater systems would be developed at the same time as the new growth areas and the impact on existing infrastructure would likely be small.

Major facilities that will require expansion due to growth include:

- The Lake Major WSP will be well within plant capacity but reaching the water withdrawal permit at the end of 2046. There will be a need for exploring additional water supplies beyond the 2046 horizon.
- The potential demand at the Bennery Lake WSP is predicted to surpass the safe yield and water withdrawal permit by 2016 and the plant's capacity between 2021-2026. Therefore, during the timeframe of the IRP there is a need to expand the Bennery Lake WSP, increase safe yield of the lake (e.g. using a dam or pumping from Grand Lake), and submit an application to NSE to request an increase in the Water Withdrawal Permit.
- The RWWFP recommended a plan that provides a regional wastewater strategy with upgrades required at a number of WWTFs as well as linking conveyance systems. WWTF expansion will be required as follows:
  - Dartmouth – A 16.06 ML/d capacity expansion (2021 - 2026 horizon).
  - Herring Cove – A 53.55 ML/d capacity expansion (2031 - 2036 horizon).
  - Aerotech – A further 4.65 ML/d capacity expansion (2031 - 2036 horizon), in addition to the 3.00 ML/d capacity expansion project already underway.
- In addition, there are a number of growth-related water and wastewater projects expanding transmission mains, pumping facilities and sewers.

ES 5.2.2 Regulatory Compliance

The second IRP driver involved consideration of current and future regulatory compliance requirements for all three systems.

Water Regulatory Compliance

The water system is presently fully compliant with all regulatory requirements.

Canada's Federal-Provincial-Territorial Committee on Drinking Water[1] has proposed new or changed guidelines for dichloromethane and for N-nitrosodimethylamine (NDMA). Based on the assessment of current source and drinking water quality and current treatment processes, it is expected that neither change in guidelines should pose any compliance issues for Halifax Water.

Over the longer term, the following regulatory developments can reasonably be expected to occur:

- Reducing Disinfection By-Products - Trihalomethanes (THMs), Haloacetic acids (HAAs); and,
- New Parameter and Lower Maximum Acceptable Concentrations (MACs).

The Halifax Water's Water Quality Master Plan[2] (WQMP) provides the planning direction for drinking water compliance. It places a lot of attention on the reduction of THMs and HAAs so compliance should not be an issue when new stricter standards come into place. The water supply plant (WSP) improvement projects already recommended in the Five-Year Capital Plan should enable this future compliance.

Wastewater Regulatory Compliance

At present a number of Halifax Water's WWTFs are not compliant with their NSE Permit to Operate and require upgrades. Many of the required upgrades have already been incorporated into the Five-Year Capital Plan as noted in Table ES-3. Additional upgrades have also been suggested through work done in preparing the IRP.

Additional improvements will also be needed to meet the recently promulgated Canadian Federal Wastewater Systems Effluent Regulations (WSER)[3]. The most significant projects will be the upgrade to full secondary treatment of the three Halifax Harbour Solutions (HHSP) facilities - Halifax, Dartmouth and Herring Cove by 2032.

Halifax Water is required by NSE to monitor and report overflows. NSE has also indicated that the impact of any growth on overflows will need to be mitigated so that there is no increase in overflow frequency or volume. This is the basis for overflow control measures proposed in the RWWFP.

Halifax Water is also taking current actions to mitigate overflows. The Five-Year Capital Plan includes a number of projects addressing wet weather flow issues that includes

[4] *CDW*, Health Canada, 2012
[5] *Water Quality Master Plan Version 2*, Halifax Water, 2011
[6] *Wastewater Systems Effluent Regulations*, Canada Gazette, Vol. 146 No. 15, June 2012

screening of overflow discharges, a number of wet weather flow (I/I) reduction projects, as well as the overflow monitoring program.

Future versions of the WSER or emerging NSE regulations may well require additional controls beyond the offset of growth impacts. Accordingly, Halifax Water recognizes the need to plan for this possible if not probable future and has included an Enhanced Overflow Control Program in the IRP.

Stormwater Regulatory Compliance

The main regulatory compliance concerns related to stormwater runoff are the impacts on receiving water quality and the impacts related to flow volumes and velocity (i.e. flooding and erosion). The Regional Municipal Planning Strategy[4] commits HRM to preparing a Regional Stormwater Functional Plan (RSWFP), which among other aspects should address these issues. Halifax Water will actively participate in HRM's development of the RSWFP. Currently HRM has a by-law[5] that restricts what can be discharged into the wastewater and stormwater sewers.

ES 5.2.3 Asset Renewal

Halifax Water currently delivers an annual asset renewal program that rehabilitates or replaces aging infrastructure. Asset renewal is important to avoid system failures and maintain levels of service. Based on this program the Five-Year Capital Plan identifies prioritized annual asset renewal projects. As well, Halifax Water in 2011 finalized the Asset Management Assessment (AMA) Program[6]. The AMA provides Halifax Water a "roadmap" for the implementation of a future comprehensive asset renewal program. Full implementation of the AMA will require a number of years, during which time the current program will continue.

Based on the review of available asset data undertaken in the IRP, it was clear that there were significant limitations on asset condition data with water system linear assets having the most recorded information and wastewater and stormwater linear assets having little or no recorded condition data. A methodology based on the available asset age data was therefore developed through the IRP to estimate asset renewal needs.

[4] *Regional Municipal Planning Strategy 2006, Amended May 2010,* Halifax Regional Municipality, 2010
[5] *Halifax Regional Municipality By-Law W-101 Respecting Discharge into Public Sewers (Wastewater Discharge By-Law),*Halifax Regional Municipality, June 2001
[6] *Asset Management Assessment (AMA) Project*, Halifax Water, June 2011

ES 5.3 IRP Objectives

Fourteen specific IRP objectives were elaborated for the three IRP drivers: Growth, Regulatory Compliance and Asset Renewal. The objectives were based on the current Halifax Water Levels of Service (LOS) as presented in the Halifax Water Corporate Balanced Scorecard (CBS)[7]. The objectives reflect the current and anticipated compliance requirements (seven objectives) for the three infrastructure systems, optimal asset renewal requirements; as well as a number of related issues addressing water and wastewater system reliability, adequate stormwater capacity, adaptability to climate change and energy efficiency (five objectives); and two growth related objectives addressing the need to extend servicing requirements and the requirement to manage flow capacity allocations. The specific objectives are presented in Table ES-2.

Table ES-2 IRP Objectives

Driver	Infrastructure System	Objective
Compliance	Wastewater	1. Meet Current Nova Scotia Environment WWTF Permit to Operate.
	Water	2. Meet Current Nova Scotia Environment WSP Permit to Operate.
	Wastewater	3. Meet Current Overflow Compliance.
	Wastewater	4. Meet Future WWTF Compliance.
	Water	5. Meet Future Drinking Water Compliance.
	Wastewater	6. Meet Future Overflow Compliance.
	Stormwater	7. Meet Future Stormwater Quality Compliance.
Asset Renewal	Water, Wastewater, Stormwater	8. Implement Optimal Level of Asset Renewal.
	Water, Wastewater	9. Enhance the Reliability of Critical Water and Wastewater Assets.
	Stormwater	10. Ensure Existing Stormwater System Adequately Sized for Minor Storm Conveyance.
	Water, Wastewater, Stormwater	11. Adapt to Future Climate Change.
	Water, Wastewater	12. Reduce Energy Consumption, Operating Costs and Greenhouse Gas Contributions.
Growth	Water, Wastewater, Stormwater	13. Provide Regional Water, Wastewater and Stormwater Infrastructure Needed to Support Planned Growth.
	Water, Wastewater	14. Manage Flow Capacity Allocations.

[7] Halifax Water, *Corporate Balance Scorecard*, 2012

ES 6. PROGRAMS AND PROJECTS

Existing Halifax Water projects and programs as well as new or refined programs and projects proposed through the IRP process were key ingredients in the preparation of the alternative IRP plans.

ES 6.1 Existing Programs and Projects

The existing projects and programs included in the IRP were obtained from three principal sources.

The Halifax Water Five-Year Business Plan[8], which provided a projected Five-Year Capital Plan for the period 2012 to 2017, was the first source. Since the FY 2012 - 2013 was already underway during the preparation of the IRP, only the final four years were included at a value of approximately $200 million. The individual projects were programmed into the IRP with the same timing as in the original Five-Year Capital Plan.

Projects, which in many cases were continuations of programs and projects initiated in the Five-Year Business Plan period, were allocated to 2018 and beyond. This included about $410 million in additional projects that were further refined through the IRP as to both capital requirement and timing.

The recently completed draft Regional Wastewater Functional Plan (RWWFP)[9] with an estimated cost of $645 million was also incorporated into the IRP. The RWWFP provides Halifax Water with a wastewater servicing plan addressing both the needs for future growth and offsetting the impact of growth on wastewater overflows. The RWWFP examined a wide range of alternatives settling on a regionalized wastewater strategy. The projects originating in the RWWFP were incorporated into the IRP with the same timing and capital requirement as the RWWFP.

ES 6.2 New or Refined Programs

In addition to the existing programs and projects, a number of new projects and programs were developed. As well, some of the existing programs were refined through the work performed during the preparation of the IRP and incorporated into the alternative IRP plans. Table ES-3 summarizes these programs.

[2] *Halifax Water Five-Year Business Plan 2012-2013 to 2016-2017,* Halifax Water, December 2011
[3] *Regional Wastewater Functional Plan*, Halifax Water, June 2012

Table ES-3 New or Refined IRP Programs 2013-2043

Program	Description	Capital
Enhanced Overflow Control	• New program to control selected (19 non-growth and 9 growth already considered in RWWFP) overflows to a uniform level of 10 overflows per average year. • Program is in addition to the RWWFP, which will offset the impact of growth on overflows.	$173.0 million
Enhanced WWTF Nutrient Reduction	• New program to control nutrient (N, P) discharges to sensitive or limited receiving waters at 10 WWTFs. • Two options were considered: o Modified RWWFP - upgrade of 9 WWTFs - Wellington, Frame, Mill Cove, North Preston, Aerotech Middle Musquodoboit, Lockview-MacPherson, Uplands Park, and Springfield Lake to Limit of Technology (LOT) in addition to the Beechville-Lakeside-Timberlea (BLT) upgrade under way. o RWWFP - upgrade of 8 WWTFs plus BLT upgrade under way and in longer-term consolidate BLT into Herring Cove WWTF and Springfield Lake WWTF into Mill Cove WWTF as per RWWFP.	Depends on option considered $207.9 million $230.6 million
WWTF Compliance Upgrades	• Additional projects beyond those in Five-Year Capital Plan for upgrading current WWTFs for compliance with Permit to Operate (PTO).	$5.8 million
WSER HHSP Secondary Treatment Upgrade	• New program responding to Canadian Federal Wastewater Systems Effluent Regulations (WSER) program requiring upgrade of the 3 HHSP WWTFs to secondary treatment.	$287.0 million
Enhanced Annual Asset Renewal	• Enhanced asset renewal based on a risk-based composite asset renewal program balancing failure consequences and renewal expenditures. The composite specifies an individual level of renewal for each asset category.	$1,600 million
Water Transmission Main Replacement Program	• An enhanced program updated through the IRP that integrated transmission main replacement with growth related expansion requirements.	$126.0 million
I/I Pilot Program	• An enhanced program initiated under the Five-Year Capital Plan to develop Halifax specific I/I source, reduction feasibility and reduction costs data at a number of pilot sites.	$1.7 million
New Assessment Programs	• A new climate change assessment program intended to examine the impacts of climate change on Halifax Water current infrastructure, operations and future design requirements. • A new stormwater quality assessment program designed to assess likely future stormwater quality management requirements.	$0.7 million $0.3 million
New Planning Programs	• A number of new planning programs providing comprehensive input to future IRPs including: o Water Master Plan addressing the system needs for regulatory compliance, asset renewal and growth. o Wastewater Master Plan addressing the system needs for regulatory compliance, asset renewal and growth. o Wet Weather System Plan presenting demand reduction (I/I) and overflow control strategies as input to the Wastewater Master Plan. o Lead Services Replacement Program o Water Efficiency Program	$3.8 million $3.8 million $14.3 million $2.3 million $2.9 million

ES 7. INTEGRATED RESOURCE PLAN FORMULATION AND EVALUATION

ES 7.1 Alternative Resource Plan Formulation and Evaluation

Considering the key drivers - regulatory compliance, asset renewal and growth - an initial set of 28 alternative resource plans were developed to meet the water, wastewater, and stormwater service needs of Halifax Water's service areas through to the year 2043. The initial plans reflected variations on the timing and nature of wastewater system compliance; levels of asset renewal investment, and the degree of overflow control.

The initial plans were evaluated in terms of their 30-year net present value (NPV) cost, their compliance timing, and their potential environmental and public health impacts. Based on this analysis, 18 intermediate plans worthy of further consideration were identified. Using a single composite asset renewal strategy, redundant intermediate plans were eliminated and 10 refined plans were developed. The 30-year NPV at this stage in the alternative resource plan development and analysis was similar for all resource plans. Based on environmental and public health impacts the 10 refined plans were further reduced to 4 short-list plans. A recommended plan was selected from the 4 short-list plans based on the benefits of nutrient control and the enhanced overflow control program.

ES 7.2 Demand Reduction

One of the key requirements of the IRP Terms of Reference was the examination of demand reduction strategies for both the water and wastewater systems. The purpose was to explore the opportunities to incorporate such strategies as the focus of one or more of the resource plans. Unfortunately, systematic data that would allow a comprehensive examination of I/I reduction in particular were not available. Consequently, a high-level analysis of opportunities was carried out with a view to informing future integrated resource plan evaluation of the potential for incorporating demand reduction strategies. The focus of the analysis was the Dartmouth WWTF, which the RWWFP identified as requiring expansion due to growth. Results of the high-level analysis of the demand reduction potential in the Dartmouth WWTF sewershed indicate that it may be possible to reduce anticipated flows sufficiently to defer the required expansion of the plant beyond the end of the planning period in 2043.

This supports the importance of including a robust treatment of demand reduction strategies in regional wastewater planning, including the proposed Wet Weather System Plan and Wastewater Master Plan. The results of such analysis may significantly impact the recommended plan and should be incorporated when the IRP is updated.

Through a more comprehensive demand reduction analysis, Halifax Water will be able to assess the effectiveness and affordability of a range of demand reduction solutions for the wastewater system that may include additional system storage, sewer

separation, sewer twinning, installation of deep storm sewers, and a range of solutions on the private portion of the network. The formal wet weather planning and I/I reduction pilot programs proposed in the current IRP will build on the preliminary analysis undertaken by Halifax Water for developing a deep storm sewer installation program and the current stormwater inflow reduction (SIR) program in place to address private side contributions to the system. The pilot program will inform the development of an I/I program for inclusion and funding in later years.

ES 8. RECOMMENDED IRP

ES 8.1 Recommended IRP Overview

Based on the extensive analysis carried out through the IRP preparation a Recommended IRP was identified.

The Recommended IRP components and timing are presented in Table ES-4.

Table ES-4 Recommended IRP Components and Timing

IRP Driver	IRP Objective	Recommended IRP Strategy
Compliance	1. Meet Current Nova Scotia Environment WWTF Permits to Operate.	• Five years to implement current WWTF compliance requirements.
	2. Meet Current Nova Scotia Environment WSP Permits to Operate.	• Currently in full compliance. Continue current WQMP program and integrate into Water Master Plan.
	3. Meet Current Overflow Compliance.	• Ten years to implement current overflow compliance requirements.
	4. Meet Future WWTF Compliance.	• Twenty years to implement future WSER compliance requirements for three HHSP WWTFs. • Ten years to implement future nutrient compliance requirements for 10 WTTFs by upgrading 8 WWTFs (Wellington, Frame, Mill Cove, North Preston, Aerotech Middle Musquodoboit, Lockview-MacPherson Uplands Park) plus Beechville-Lakeside-Timberlea (BLT) in the short term and consolidating Springfield Lake into Mill Cove WWTF and BLT WWTF into the Herring Cove WWTF in the long-term as per the RWWFP.
	5. Meet Future Drinking Water Compliance.	• Five years for Five-Year Capital Plan projects.
	6. Meet Future Overflow Compliance.	• New program to control 59 overflows to a uniform level of 10 overflows per average year. Program is in addition to the RWWFP, which will offset the impact of growth on overflows. • Thirty years to implement enhanced overflow control.
	7. Meet Future Stormwater Quality Compliance.	• Three years for stormwater quality assessment program development.

Table ES-4 Recommended IRP Components and Timing

IRP Driver	IRP Objective	Recommended IRP Strategy
Asset Renewal	8. Implement Optimal Level of Asset Renewal.	• Enhanced asset renewal based on risk-based composite asset renewal program balancing failure consequences and renewal expenditures. The composite specifies an individual level of renewal for each asset category.
	9. Enhance the Reliability of Critical Water and Wastewater Assets.	• Implement water system security program based on Five-Year Capital Plan modified through the IRP.
	10. Ensure Existing Stormwater System Adequately Sized for Minor Storm Conveyance.	• Ten years for stormwater capacity evaluation program.
	11. Adapt to Future Climate Change.	• Three years for climate change program development.
	12. Reduce Energy Consumption, Operating Costs and Greenhouse Gas Contributions.	• Implement energy reduction projects based on the Energy Management Plan as per the Five-Year Capital Plan.
Growth	13. Provide Regional Water, Wastewater and Stormwater Infrastructure Needed to Support Planned Growth.	• Timing for wastewater projects/programs as per RWWFP; timing for water projects/programs as per IRP.
	14. Manage Flow Capacity Allocations.	• I/I, water efficiency and other demand reduction projects. • Timing as per RWWFP or as previously programmed in Five-Year Capital Plan.

ES 8.2 Recommended IRP Benefits

Implementation of the Recommended IRP will provide a wide range of benefits addressing the three drivers – regulatory compliance, growth and asset renewal. High-level statements of the benefits derived from the Recommended IRP implementation are presented in Table ES-5.

Table ES-5 Overview Recommended IRP Implementation Benefits

Driver	Benefits
Regulatory Compliance	1. Fully compliant wastewater system. 2. Continued fully compliant water system. 3. Enhanced environmental and public health through reduced overflows and WWTF loadings. 4. Continued high quality drinking water. 5. Fully meets LOS.
Asset Renewal	1. Fully functional water, wastewater and stormwater systems meeting their LOS at an acceptable risk and reasonable cost. 2. Provides risk-based prioritized asset renewal expenditures for all infrastructure systems. 3. Balanced capital and O&M expenditures.
Growth	1. Water, wastewater and stormwater systems meeting the servicing needs of planned growth. 2. Sustainable water, wastewater and stormwater systems. 3. Support for continued community vitality through growth and new opportunity. 4. Balanced system expansion needs with reduction in demand for services.

ES 8.3 Recommended IRP Expenditures

ES 8.3.1 30-Year Expenditures

The total 30-year NPV for the recommended plan inclusive of capital and O&M costs is $2,579 million.

The timing of expenditures (in $2012) is shown in Figure ES-3, which indicates significant expenditures around years 10, 20 and 30. This corresponds to the following projects:

- Year 10 – WWTF Nutrient Upgrades
- Year 20 – WSER HHSP WWTF Upgrades
- Year 30 – Enhanced Overflow Control Program

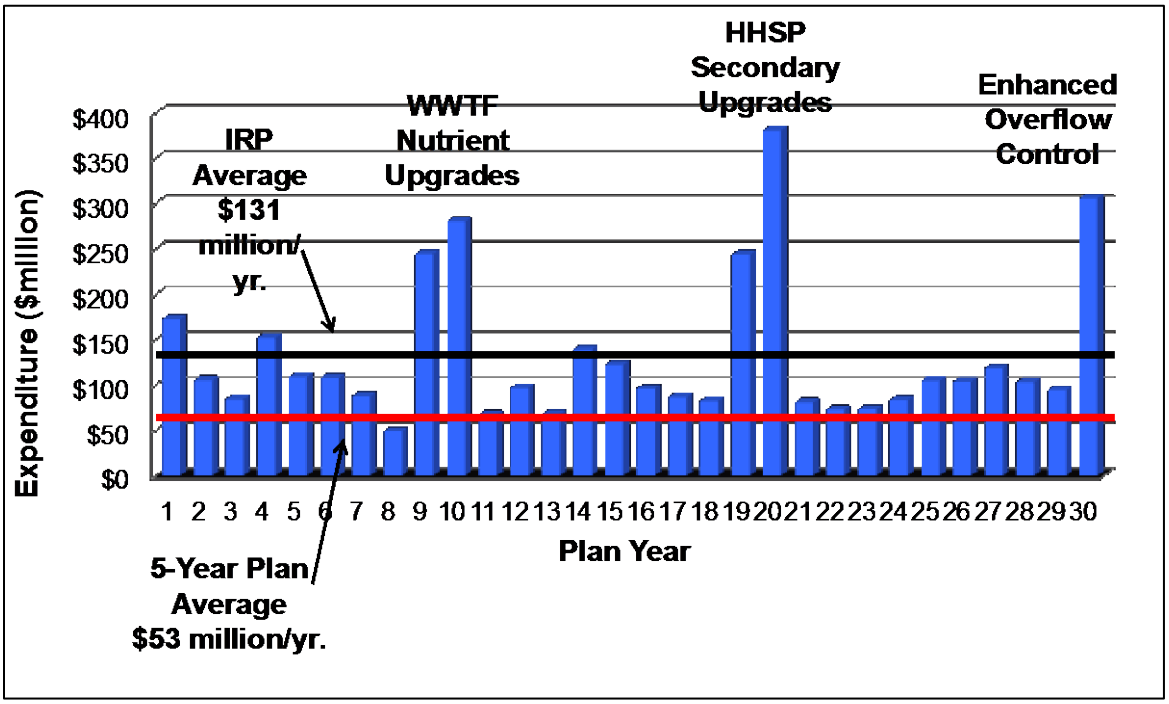


Figure ES-3 Recommended IRP Expenditures by Year

Over the 30-year period the average expenditure under the Recommended IRP is $131 million/yr. This can be compared to the Five-Year Capital Plan with an annual average of $53 million/yr.

The expenditures by driver are shown in Figure ES-4. Approximately 54% of the expenditures are associated with asset renewal and the remainder split between growth (23%) and compliance (23%).

Figure ES-4 Recommended IRP Expenditures by Driver (30-year NPV $ million)

ES 8.3.2 3-Year Expenditures

The three-year actual expenditures ($2012) from 2013 to 2015 associated with the Recommended IRP are presented in Table ES-6.

Table ES-6 Recommended IRP Expenditures 2013 -2015 ($2012 million)

Category	FY 2013	FY 2014	FY 2015	Total
Water	$28.2	$30.9	$32.3	$91.4
Wastewater	$129.2	$65.8	$44.3	$239.3
Stormwater	$2.5	$3.2	$3.0	$8.7
Enterprise Programs [(1)]	$13.5	$5.6	$4.8	$23.9
Total Expenditure	$173.4	$105.5	$84.4	$363.3
Five-Year Plan Capital Plan	$90.7	$49.7	$29.9	$170.3

Notes:

1. Enterprise programs include the SCADA Master Plan, Energy Management Plan, Asset Management Assessment as well as other enterprise-wide programs.

The Five-Year Capital Plan budget values have been included for reference purposes.

Under the Recommended IRP, proposed expenditures would more than double over the three-year timeframe. Nearly, $100 million of the total in both the Recommended IRP budget and the Five-Year Capital Plan is associated with major wastewater treatment upgrades at Aerotech, Eastern Passage and BLT, a major wastewater storage facility in Bedford-Sackville, JD Kline WSP upgrades and a number of water transmission main projects. An additional approximately $135 million of the Recommended IRP budget is

associated with the proposed enhanced asset renewal program. The remainder consists of additional projects and programs with an approximate value of $128 million.

Asset renewal estimates, originating from the asset renewal model, project an expected level of investment for asset renewal based on a range of assumptions. These values, however, do not imply a level of understanding of where specifically the expenditures are required. A significant amount of additional effort will be required to identify the specific asset renewal priorities including implementing the Asset Management Assessment program ("roadmap") and a number of activities related to asset inventory and condition assessment.

This increase in expenditure levels for the three-year period will be challenging. Major capital projects are already underway to varying degrees, as are a number of the other infrastructure projects. Any flexibility in timing and required expenditure would likely be associated with overall asset renewal and some of the other programs. The updated AMA program outlined in the "roadmap" is still emerging and currently relies on Halifax Water's existing available resources. Even with accelerated implementation, it will require at least 2 to 3 years to have adequate data and systems in place to obtain strong returns from scaled-up asset renewal expenditures.

The three-year outlook will be in large measure determined by funding availability. It expected that the Halifax Water capital planning process would determine the project/program priorities once funding levels have been established.

ES 8.4 Recommended IRP Implementation Schedule

The master IRP schedule is presented in Figure ES-5. The figure is organized around the drivers and objectives for each of the three systems. Specific projects are indicated in the timeline as well as on-going programs. The overall plan spans the period 2013 to 2043.

Halifax Water Integrated Resource Plan Schedule 2013 -2043

System	Driver	Objective	Activity	2013 – 2018 – 2023 – 2028 – 2033 – 2038 – 2043
Wastewater	Compliance	1	Current WWTF Compliance	Specific WWTF Compliance Projects to 2018
		3	Current Overflow Compliance	Specific Overflow Compliance Projects 2018-2023
		4	WWTF Future Compliance	Specific WWTF Upgrades to 2018 · WWTF Nutrient Upgrades 2023 · HHSP WWTF Upgrade to Secondary 2033
		6	Future Overflow Compliance	Overflow Control and Storm Sewer Projects to 2018 · Ongoing Wet Weather System Planning · Enhanced Overflow Control Program - 2043
	Asset Renewal	8	Asset Renewal Program	Specific Renewal Projects to 2018 · Ongoing Asset Renewal Program
		9	System Reliability	Specific Reliability Improvement Projects to 2018 · Ongoing System Reliability Program
		10	Minor Storm System Adequacy	Specific Storm/Collection System Upgrades 2015 –2018 · Ongoing Storm Sewer Program
		12	Reduce Energy Consumption	Specific Energy Reduction Projects to 2018 · Ongoing Energy Mangement Program
	Growth	13	Support Planned Growth	Specific Capacity Projects to 2042 · Ongoing Wastewater Master Plan and IRP Updates
		14	Manage Flow Capacity	Specific Flow Management Projects and I/I Pilot Program to 2018
Water	Compliance	2	Water System Current Compliance	Specific Compliance Projects to 2018
		5	Water System Future Compliance	Specific Compliance Projects 2014 -2019 · Ongoing Water Quality Programs
	Asset Renewal	8	Asset Renewal Program	Specific Renewal Projects to 2042 · Ongoing Asset Renewal Program
		9	System Reliability	Specific System Reliability Projects to 2018 · Specific System Reliability Projects 2023 · Specific System Reliability Project 2028 · Ongoing System Reliability Program
		12	Reduce Energy Consumption	Specific Energy Reduction Projects to 2018 · Ongoing Energy Mangement Program
	Growth	13	Support Planned Growth	Specific Capacity Projects to 2018 · Specific Capacity Projects 2023 - 2025 · Ongoing Water Master Plan and IRP Updates
		14	Manage Flow Capacity	Water Efficiency Program
Stormwater	Compliance	3	Current Overflow Compliance	Specific Stormwater Projects 2018 - 2023
		6	Fututre Overflow Compliance	Stormwater Projects to 2018 · Ongoing Wet Weather System Planning
		7	Future Stormwater Quality Compliance	Stormwater Quality Compliance Assessment 2013 - 2015
	Asset Renewal	8	Asset Renewal Program	Specific Renewal Projects to 2018 · Ongoing Asset Renewal Program
		10	Minor Storm System Adequacy	Specific Storm Improvement Projects to 2018 · Ongoing Storm Sewer Program
		11	Climate Change	Climate Change Impact Assessment Project 2013 -2015
	Growth	14	Manage Flow Capacity	Specific Stormwater Projects to 2018 · Ongoing Storm System Planning and IRP Updates
Business Improvement	All Drivers	1 -14	Supporting Technology and Business Process Programs	Specific EnablingTechnology or Business Process Projects to 2022 · Ongoing Technology and Business Process Program

LEGEND:
Specific Wastewater Projects · Specific Water Projects · Specific Stormwater Projects · Specific Business Improvement Projects

Figure ES-5 Master Recommended IRP Implementation Schedule

ES 8.5 IRP Integration and Program Planning

One of the central tasks of the IRP was to build a working framework for future integrated resource planning. This in turn required that the IRP process itself to be linked to other Halifax Water and HRM planning and financial processes.

Figure ES-6 presents the generalized steps for IRP development and places the IRP in context with other contemporary planning activities. As shown in the Figure, the HRM Regional Plan provides policy direction on growth and development while provincial regulations and policies drive compliance requirements for the protection of public health and the environment. These drivers in turn inform the specific master plans for the water, wastewater and stormwater systems. Master plans are designed to translate the growth, regulatory compliance and asset renewal drivers into infrastructure projects and programs. Part of the future master plan development should be consideration of sustainable practices such as demand reduction programs. In addition, future IRP updates will require strong integration among master plans.

Figure ES-6 Halifax Water Planning Overview

As a result of the IRP, Halifax Water is considering consolidating its system planning into comprehensive master plans, which along with other planning activities feed into the IRP. The concept is illustrated in Figure ES-7.

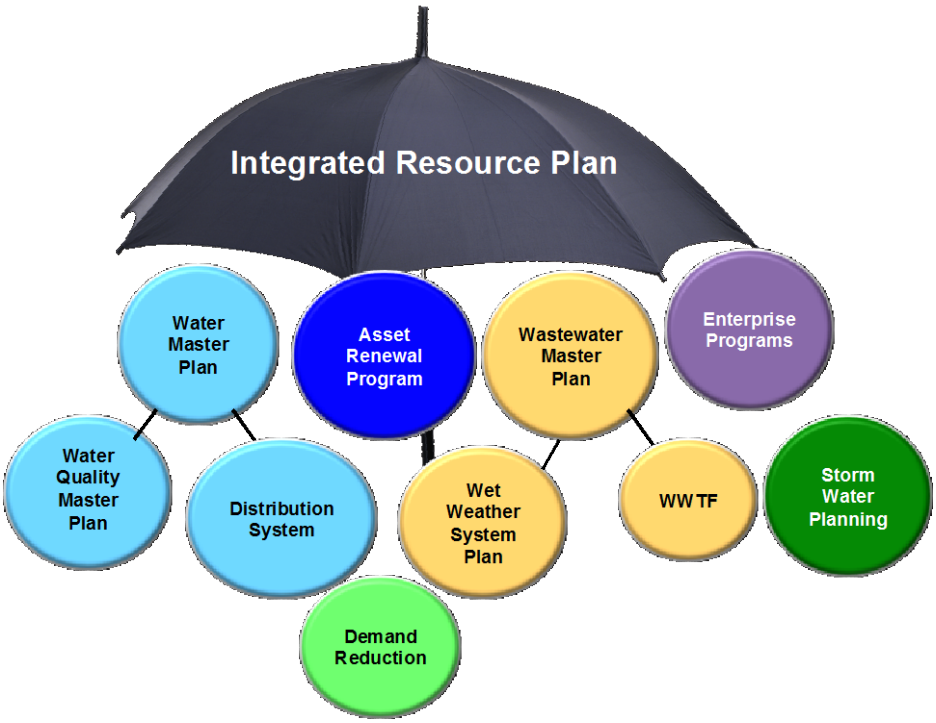


Figure ES-7 Halifax Water IRP Integration

The costs of the new planning related program activities in the Recommended IRP are presented in Table ES-7. The Recommended IRP includes other existing program costs that are associated with program implementation such as GIS upgrade and the lead services replacement program. These costs are not shown in the Table but are incorporated in the Recommended IRP.

Table ES-7 New Planning Program Expenditures

Program	2013-2015	2016-2022	2023-2032	2033 - 2043	Program Details
IRP Update	$0.4	$1.2	$1.7	$1.7	• Periodic IRP updates assuming initial IRP update at 3 years and every 5 years thereafter
Wet Weather System Planning	$0.8	$3.5	$5.0	$5.0	• On-going wet weather system planning including monitoring and model updates/refinements
Wastewater System Master Plan	-	$0.8	$1.5	$1.5	• Wastewater Master Plan update every 5 years
Stormwater Quality Assessment	$0.2	$0.1	-(1)	-	• Project to define likely stormwater quality requirements (additional expenditures may result from the assessment outcomes)

Table ES-7 New Planning Program Expenditures

Program	2013-2015	2016-2022	2023-2032	2033 - 2043	Program Details
Climate Change Impact Assessment	$0.7	-(1)	-	-	• Project to define impacts of future climate change and resulting vulnerabilities on water, wastewater and stormwater systems (additional expenditures may result from the assessment outcomes)
Asset Management Program	$2.7	$3.6	$5.0	$5.0	• Implementation of the asset management roadmap and on-going program updates and refinements
I/I Reduction Pilot Program	$1.2	$0.5	-(1)	-	• I/I pilot program aimed at developing I/I source contribution and remediation cost data specific to the Halifax area
Water Master Plan	-	$0.8	$1.5	$1.5	• Water Master Plan update every 5 years
Total	**$6.0**	**$10.5**	**$14.7**	**$14.7**	

Notes:

1. Expenditures are for program development only. Additional expenditures will be required for program implementation.

ES 8.6 Levels of Service

One of the IRP outcomes was the presentation of the 14 IRP planning objectives. Some of these objectives are linked to current Halifax Water LOS. Table ES-8 presents a series of recommendations for updating/expanding the current LOS to allow a full evaluation of program implementation.

Table ES-8 Recommended LOS Updates or Additions

Driver	Objective	Proposed LOS Update or Addition
Compliance	1. Meet Current Nova Scotia Environment WWTF Permits to Operate	• Update to include additional compliance parameters associated with new programs, e.g. nutrient control. • Review percentage compliance criteria.
	2. Meet Current Nova Scotia Environment WSP Permits to Operate	• Update to include any additional compliance parameters.
	3. Meet Current Overflow Compliance	• Develop frequency and volume targets for overflows.
	4. Meet Future WWTF Compliance	• See Objective 1 for LOS.
	5. Meet Future Drinking Water Compliance	• See Objective 2 for LOS.
	6. Meet Future Overflow Compliance	• Develop frequency and volume targets for long term overflow program. • May require updated LOS for site specific overflow frequency and volume targets, e.g. NW Arm.

Table ES-8 Recommended LOS Updates or Additions

Driver	Objective	Proposed LOS Update or Addition
	7. Meet Future Stormwater Quality Compliance	• Consider preliminary stormwater quality monitoring LOS, e.g. number samples/sites.
Asset Renewal	8. Implement Optimal Level of Asset Renewal	• Develop specific asset renewal targets and LOS. This will require a new monitoring system to provide reporting on progress.
	9. Enhance the Reliability of Critical Water and Wastewater Assets	• No changes suggested.
	10. Ensure Existing Stormwater System Adequately Sized for Minor Storm Conveyance	• Develop specific pipe and culvert capacity LOS. • At a minimum apply customer satisfaction LOS.
	11. Adapt to Future Climate Change	• Incorporate future climate change impacts into existing LOS where appropriate.
	12. Reduce Energy Consumption, Operating Costs and Greenhouse Gas Contributions	• Consider specific energy reduction targets and incorporate into more detailed LOS.
Growth	13. Provide Regional Water, Wastewater and Stormwater Infrastructure Needed to Support Planned Growth	• No changes suggested.
	14. Manage Flow Capacity Allocations	• Develop specific targets for I/I reduction at WWTFs and in major pumping stations and other locations, e.g. overflows. • Consider water demand targets.

The updated/expanded LOS once developed will require support for LOS monitoring, data analysis and reporting. Halifax Water will need to consider the impact on staff for this additional data collection, analysis, and reporting.

In a number of cases, no change or addition to the LOS have been recommended.

ES 9. IRP RECOMMENDATIONS

Based on the analysis carried out through the course of the IRP preparation the following 17 recommendations are presented:

IRP Next Steps

1. Implement the IRP as per Table ES-4 components and timing.
2. Finalize the overall integrated planning approach and future schedule (i.e. HRM Regional Plan updates, master plans and Asset Management Assessment, and financial planning) within the IRP framework.
3. Evaluate the adequacy of Halifax Water's existing institutional capacity and staffing to implement the programs and projects identified in the IRP.
4. Continue public outreach with stakeholders and the public at large for incorporation into the next IRP review.
5. Update the IRP periodically, as needed.

Wastewater System

6. Implement I/I Pilot Program and integrate results into Wet Weather System Plan and Wastewater Master Plan.
7. Develop Wet Weather System Plan through integrating RWWFP, Enhanced Overflow, I/I Pilot program and other wet weather related wastewater projects/programs.
8. Undertake ERAs for 8 WWTFs requiring nutrient control and confirm effluent and technology requirements.
9. Develop Wastewater Master Plan.

Water System

10. Develop Water Master Plan.
11. Apply water use trends to water and wastewater design criteria and integrate into Water and Wastewater Master Plans.

Stormwater System

12. Assess stormwater quality compliance requirements.
13. Clarify role and mandate of Halifax Water in stormwater planning and management.

All Systems

14. Assess impacts of climate change on all systems, update design standards, update operational practices, and integrate findings into Water and Wastewater Master Plans and Wet Weather System Plan.

Corporate Balanced Scorecard and Level of Service

15. Implement recommendations for LOS update/expansion and update CBS.
16. Develop monitoring, analysis and reporting framework to support the updated/expanded LOS.
17. Identify needed resources to support updated/expanded LOS program.

Glossary of Acronyms

ADF.....Average daily flow
BAF.....Biological aerated filtration
BLT.....Beechville Lakeside Timberlea
CBOD.....Carbonaceous biochemical oxygen demand
CBS.....Corporate balanced scorecard
CCI.....Construction Cost Index
CCME.....Canadian Council of Ministers of the Environment
COSS.....Cost of service study
CSF.....Critical success factor
CSO.....Combined sewer overflow
DFO.....Department of Fisheries and Oceans (federal)
EAC.....Ecology Action Centre
ENRCCI.....Engineering News Record Construction Cost Index
ERA.....Environmental risk assessment
GHG.....Greenhouse gases
HHSP.....Halifax Harbour Solutions Plants
HRM.....Halifax Regional Municipality
HRWC.....Halifax Regional Water Commission
HW.....Halifax Water
ICI.....Industrial-commercial-institutional
I/I.....Inflow and infiltration
IRP.....Integrated Resource Plan
LIC.....Local improvement charge
LOS.....Levels of service
LOT.....Limit of technology
MOH.....Medical Officer of Health (province)
NPV.....Net present value
NSE.....Nova Scotia Environment
NSUARB.....Nova Scotia Utility and Review Board
O&M.....Operations and maintenance
OI.....Organizational indicator
PI.....Performance indicator
PTO.....Permit to Operate
Redbook.....Halifax Regional Municipality, Municipal Design Guidelines (2009)
ROW.....Right-of-way
RSWFP.....Regional Stormwater Functional Plan
RWWFP.....Regional Wastewater Functional Plan

SS.....Suspended solids
SSO.....Sanitary sewer overflow
SW.....Stormwater
TSS.....Total suspended solids
White Book.....Halifax Water Design and Construction Specifications
WQMP.....Water quality master plan
WSER.....Wastewater systems effluent regulations
WSP.....Water supply plant
WW.....Wastewater
WWTF.....Wastewater treatment facility

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1. INTEGRATED RESOURCE PLANNING

The Halifax Regional Water Commission (HWRC) known as Halifax Water is a publicly owned utility charged with providing water, wastewater and stormwater services to the residents of Halifax Regional Municipality (HRM). Halifax Water embarked on the preparation of an Integrated Resource Plan (IRP) in order to define its overall program and resource needs for the next thirty years (2013 - 2043). The IRP responds to the combined requirements of regional growth, present and expected regulatory compliance and asset renewal. The IRP is being prepared at the direction of the Nova Scotia Utility and Review Board (NSUARB).

Quoting directly from the NSUARB regarding the purpose of the IRP: [10]

- *'First, the plan will provide the framework for HRWC (Halifax Regional Water Commission) to comprehensively evaluate alternative planning scenarios for its water, wastewater and stormwater services in an integrated fashion and identify the most efficient means of achieving its service goals while meeting all environmental requirements.*
- *Second, it will provide long-term direction for HRWC and be a platform for comprehensively assessing alternative generic facility and programmatic investment options.*
- *Third, it will serve as an umbrella under which more detailed, facility- or program specific capital investment analyses can take place.*
- *Fourth, the plan will explicitly identify and plan for the management of risks facing HRWC.*
- *Fifth, the plan will provide the Board with the information and context it needs to make fully informed decisions about proposed future capital investments, revenue requirements and rates. '*

The detailed Terms of Reference for the IRP is presented in Volume 1 Appendix A of the IRP report.

Figure 1.1 presents an overview of the IRP development process linked to the contents of the Volume 1 report.

[10] *In The Matter Of An Application By Halifax Regional Water Commission for Approval of a Schedule of Rates and Charges and Schedules of Rules and Regulations for the Provision of Water, Public and Private Fire Protection, Wastewater and Stormwater Services*, (252) Nova Scotia Utilities and Review Board, 2010

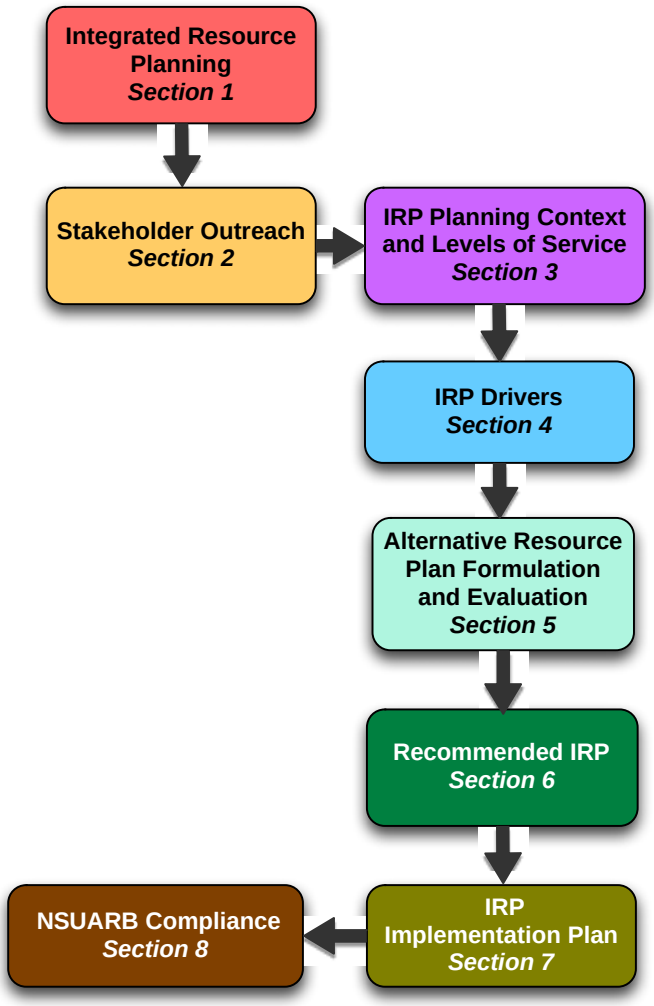


Figure 1.1 Overview of IRP Development Process

The IRP was developed collaboratively with the NSUARB consultants led by the Tellus Institute. The Tellus Team Statement with regard to the IRP is presented in Appendix I. The IRP development process considerably benefitted from the engagement with a wide range of stakeholders on five occasions in Technical Conferences and through numerous one-on-one interactions.

The IRP is a high level plan prepared under considerable time constraint. Plan development strove for completeness. Where data or other information was not available, the best professional judgment of the study team was employed. This resulted in a number of assumptions, which are documented throughout the report. The lack of data in some cases does represent a risk that new information may require adjustments to proposed programs and costs. This is an invariable aspect of all major planning undertakings, particularly those that look 30 years into the future.

Halifax Water has a talented and highly professional staff with demonstrated capacity to adapt to changing circumstances. An adaptive management approach will certainly be needed as changing regulations, growth estimates and new information about asset condition and performance is considered. The recommended IRP should therefore be considered the first step in an on-going and evolving process of continuous improvement.

The IRP represents an important component of Halifax Water's financial planning. It feeds into subsequent studies that examine debt requirements to meet capital programs and into utility ratemaking. It was not designed to undertake the analysis of debt or rates within the IRP project activities. Rather the focus of the IRP preparation was as follows:

- Capital and additional O&M costs to meet the program and project requirements of the Recommended IRP for the 30-year planning period from 2013 to 2043
- Development of an overall planning framework integrating the IRP into Halifax Water's business processes
- Identification of institutional constraints required to implement the Recommended IRP
- Recommendations for additions and refinements of Halifax water's Levels of Service (LOS) to facilitate the measurement of program success.

The IRP is presented in three volumes as follows:

- Volume 1 – Halifax Water Integrated Resource Plan, 2013-2043
- Volume 2 – Stakeholder Consultation Record
- Volume 3 – Technical Appendices

Volume 1 is as follows:

- Executive Summary
- Section 1 – Overview of the IRP process and the contents of the IRP Report
- Section 2 – Technical conferences and consultation summary
- Section 3 – IRP planning context including institutional context, existing infrastructure and definition of existing levels of service
- Section 4 – IRP Drivers including growth, asset renewal and regulatory compliance
- Section 5 – IRP alternative resource plan formulation and evaluation including, development of IRP objectives, an overview of current and proposed programs and projects and selection of the Recommended IRP
- Section 6 – Recommended IRP presenting details of the plan and examining the sensitivity of the plan to demand reduction and growth assumptions

- Section 7 – Recommended IRP Implementation Plan presenting the schedule and details of plan implementation
- Section 8 – Recommended IRP compliance with the NSUARB order
- Volume 1 Appendices including:
  - Appendix A – IRP Terms of Reference
  - Appendix B – Halifax Water Five-Year Business Plan
  - Appendix C – Halifax Water Corporate Balanced Scorecard
  - Appendix D – Maps
  - Appendix E – Regional Wastewater Functional Plan – Cost Tables
  - Appendix F – Current and New Programs
  - Appendix G – NSUARB Terms of Reference Compliance Tables
  - Appendix H – Recommended IRP Financial Model
  - Appendix I - Tellus Statement

Volume 2 provides the IRP consultation record including key issues identified through the one-on-one interactions and Technical Conference resource materials and commentary.

Volume 3 presents a series of Technical Appendices providing details of the water and wastewater systems, presenting details of the cost estimation procedures, a review of available data and the details of the asset renewal methodology.

2. STAKEHOLDER OUTREACH

2.1 PURPOSE

The purpose of this Section is to present an overview of the stakeholder consultation for the IRP. A detailed consultation record including a complete list of stakeholders is available in Volume 2, Stakeholder Consultation Record.

2.2 CONSULTATION OVERVIEW

The IRP Terms of Reference detail the purpose and mandate of the stakeholder consultation. Stakeholder consultations were carried out using two approaches. A short list of stakeholders was consulted in one-on-one interviews. These interviews involved groups or individuals who have acted as interveners during Halifax Water's rate hearing before NSUARB. The second element of the consultation involved the five Technical Conferences. (See discussion of Technical Conferences below).

The stakeholders included groups and individuals with representation from the public, non-governmental organizations, municipal and provincial government, consumer advocates, and other parties. They expressed diverse views reflecting a wide range of interests, concerns and experience. The range of opinions in turn fostered a thorough and well-considered IRP.

2.3 ONE-ON-ONE STAKEHOLDER MEETINGS

Starting in July 2011, the project team met with various stakeholder groups in parallel with the technical review. The purpose of these one-on-one meetings was to understand the views of the different stakeholders, to reduce and to resolve any potentially conflicting issues and concerns early in the IRP process. The comments provided by the stakeholders were all valuable; however, some matters were outside Halifax Water's mandate. In general, stakeholder comments from the one-on-one sessions fall into the six topics presented in Table 2.1.

Table 2.1 Stakeholder General Comments on IRP during One-on-One Meetings

Stakeholder Concerns	Comment	Addressed in IRP Section
Stormwater	1. Confusion over who owns assets, Halifax Water or HRM.	3.2.2
	2. Stormwater Functional Plan is needed.	3.2.2
Watershed Level Planning	3. Watershed level planning is needed, concerns over septic systems.	4.3.4
	4. A board is needed to bring together different jurisdictions on watershed planning (similar to approach by the Ontario Conservation Authorities).	IRP recommendations address clarification of stormwater responsibilities and need for comprehensive stormwater planning. This is further discussed in Section 3 of this report.
Water Conservation	5. Effective conservation measures are needed.	6.3.1
	6. A pricing structure that encourages water conservation is needed.	While the IRP does not cover rates, it will inform future rate applications
	7. Encouragement of water conservation is needed including use of grey water and dual flush systems.	6.3.1
Climate Change	8. Consideration of climate change is needed.	5.4.2
Green Methods	9. Alternative green energy methods are need.	5.4.1
Transparency	10. Better communication with public is needed.	2.0
	11. Stakeholders want to be involved in the ratemaking methodologies (true cost of accounting).	Rates are set through public hearing process available to all interested parties; while the IRP does not cover rates, it will inform future rate applications
	12. Provision of a cost outline to the public is needed.	7.0

2.4 TECHNICAL CONFERENCES

During TC1, stakeholders reviewed the IRP Terms of Reference and key uncertainties. This technical conference occurred prior to Halifax Water retaining consultants and initiating the IRP preparation. The remaining four technical conferences presented the following: TC 2 – model assumptions and plan considerations; TC 3 – review of resource plans; TC4 – analysis of the alternative resource plans; and TC 5 – selection of the preferred resource plan, the implementation plan, and the IRP recommendations. Table 2.2 presents an overview of the five technical conferences.

Table 2.2 Purpose of Stakeholder Technical Conferences

Technical Conference (TC)	Date	Purpose
TC1	March 24, 2011	Overview of the purpose and background of the overall IRP process and the review of the IRP Terms of Reference.
TC2	October 4, 2011	Outline of the IRP drivers and constraints, review the demand and supply options, and review the assumptions being used for development of the IRP resource plans. Details of Halifax Water's mandate with respect to water, wastewater, and stormwater services.
TC3	December 14, 2011	Overview of the methodology used for formulating the alternative resource plans, outline of the resource plan components, and presentation of the preliminary alternative resource plans.
TC4	March 21, 2012	Review of the alternative resource plans and the preliminary financial modeling results, outline of the proposed programs, and discussion of the qualitative benefits of the plans.
TC5	June 28, 2012	Overview of the plan evaluation results and selection of the Recommended IRP, the IRP Implementation Plan, and the IRP recommendations.

Briefing packages were prepared for each of the technical conferences and made available to stakeholders. The packages contained necessary information on the particular technical conference including maps, graphs, tables, and resource plans. During the technical conferences the IRP team presented the information noted in Table 2.2 and documented the discussion from the stakeholders. Documentation included questions and comments given by stakeholders and Halifax Water. Meeting summaries of the technical conferences, presentation materials, and conference agendas were posted on the Halifax Water IRP website, available publically at: http://www.halifax.ca/hrwc/IntegratedResourcePlan.html.

Other specific stakeholder consultations included:

- Access to the IRP study SharePoint site for viewing IRP related documents.
- Replies to questions issued by stakeholders throughout the process.
- Stakeholder's input on the IRP's Recommended IRP.
- Direct engagement by stakeholders with NSUARB's representatives (Tellus).

Written submissions received from stakeholders also form part of the consultation record and were considered in the IRP.

2.5 STAKEHOLDER COMMENTS

Volume 2 of the IRP provides a summary record of comments received from stakeholders (meeting summaries) during the one-on-one sessions and the five Technical Conferences. Halifax Water and its consultants addressed the stakeholder comments, where appropriate, throughout the preparation of the IRP. Stakeholder comments also raised future issues that will be addressed upon specific IRP reviews and subsequent applications being filed with the NSUARB.

The IRP can serve as a helpful guide and reference plan for all stakeholders, Halifax Water, and the NSUARB as future applications are considered.

3. IRP PLANNING CONTEXT AND LEVELS OF SERVICE

3.1 PURPOSE

The purpose of this section is to present the municipal and provincial planning context associated with IRP and to present an overview of the Halifax Water wastewater, water and stormwater infrastructure systems. The details of the Halifax Water Corporate Balanced Scorecard (CBS) and Levels of Service are also presented. The section presents the current Halifax Water Five-Year Business Plan.

3.2 PLANNING CONTEXT

3.2.1 Halifax Regional Municipality (HRM)

In 1996, Halifax Regional Municipality (HRM) was established through the amalgamation of the former City of Halifax, City of Dartmouth, Town of Bedford and Halifax County, into one municipal unit.

Halifax Regional Municipality is comprised of 5,490 square kilometres[11] and accounts for approximately about ten percent (10%) of total area of Nova Scotia. The boundary of HRM extends along the Atlantic coastline to Hubbards, from the southwest, to Ecum Secum, from the southeast and extends northward for an average of 50-60 kilometres.

Despite HRM's large landmass, the majority of the municipality's population is located around Halifax Harbour and Bedford Basin, and extends up through the Sackville River Valley and northeast along the Highway 102 corridor. Outside the urban core, the majority of residents are concentrated in a number of rural communities along the Southern Shore, Eastern Shore and Musquodoboit Valley.

In 2006 HRM adopted a Regional Plan, which covers the entire Municipality and provides policy direction over the future of the Municipality.

In terms of new growth, the HRM Regional Municipal Planning Strategy[12] indicates, *"This Plan seeks to focus development in areas where water distribution and wastewater systems can be provided in a cost-effective manner with consideration given to both capital and operating costs. HRM also seeks to support a competitive housing market by maintaining a 15 year supply of serviced lands."*

The relationship between HRM and Halifax Water is complex and continuously evolving with changes in programs, staff, technology advancements, and environmental regulations. HRM however maintains overall planning authority and provides the specific direction for the nature and location of future growth.

---

[11] *Census Profile*, Statistics Canada, 2006

[12] *Regional Municipal Planning Strategy 2006, Amended May 2010,* Halifax Regional Municipality, 2010

3.2.2 Halifax Water

Responsibilities and Mandate

Halifax Water has a long and justifiably proud history. It was formally created on January 1, 1945 as the Public Service Commission to operate and manage the City of Halifax water utility. It was renamed in 1987 as the Halifax Water Commission. As a result of amalgamation in 1996, the Dartmouth and Halifax County water utilities were merged with Halifax Water Commission creating the Halifax Regional Water Commission. On August 1, 2007, the Commission expanded its mandate with the transfer of the Halifax Regional Municipality's wastewater and stormwater assets. This transfer created the first regulated water, wastewater and stormwater utility in Canada.

The principle underlying this decision was to create an integrated approach to the management of water. The boundaries and municipal entities in HRM are presented in Volume 1 Appendix D, which contains the maps for this report.

Halifax Water presently operates and manages all elements of the water and wastewater system but only specific portions of the stormwater system.

Halifax Water is responsible for operating and maintaining existing stormwater infrastructure located within the street right-of-way (ROW) or easements owned by Halifax Water. New stormwater infrastructure designed according to Halifax Water standards and developed as a result of growth, becomes part of the stormwater asset base of Halifax Water. However, overall stormwater planning and management remain the joint responsibility of the province (through NSE), HRM, and Halifax Water. In detail, Halifax Water is responsible for the pipes and ditches in the street right-of-way (ROW), and public easements. HRM is responsible for the overland flows (during major storms), lot grading, and private property drainage. Watercourses, wetlands, and lakes are the jurisdiction of Nova Scotia Environment. Halifax Water comments on any of the proposed infrastructure that will become Halifax Water's responsibility. Halifax Water, as a stakeholder, provides input into stormwater decisions and infrastructure owned by others that may impact the stormwater infrastructure owned by Halifax Water. Halifax Water also participates in revising stormwater specifications. Figure 3.1 graphically illustrates the areas of stormwater responsibility.

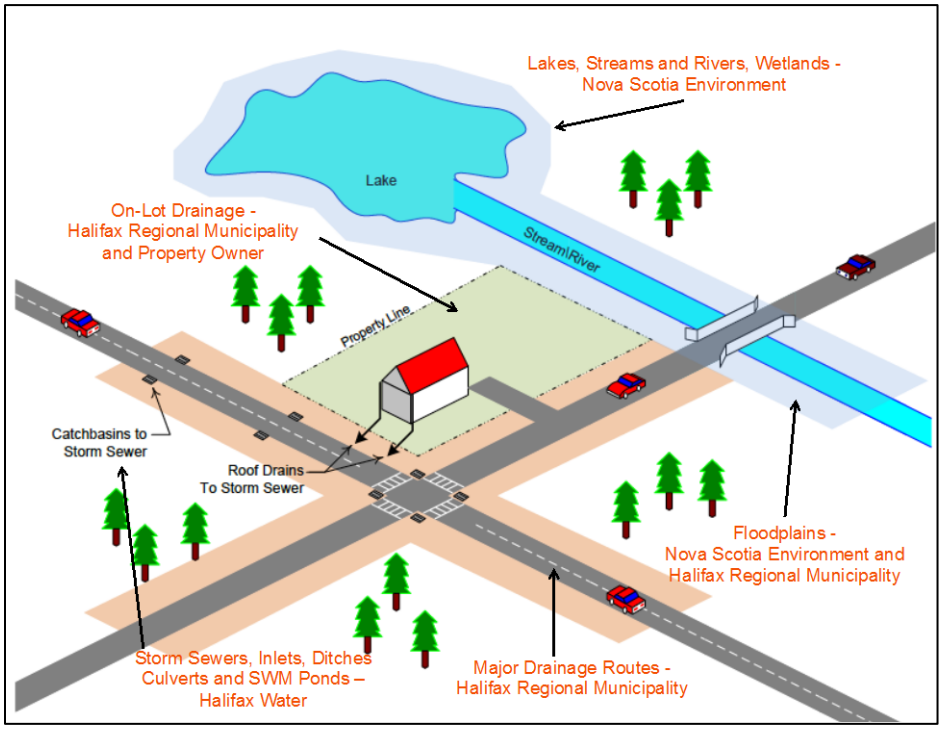


Figure 3.1 Stormwater Responsibilities

The present system is complex and creates uncertainty with respect to jurisdiction and responsibility. It does not foster a forward-looking and comprehensive stormwater management system that will be needed to meet the challenges of future stormwater regulation and more importantly the future risks associated with drainage operation impacted by climate change.

The HRM Regional Plan presently requires the preparation of a Regional Stormwater Functional Plan (RSWFP) by HRM. The preparation of the RSWFP should be used to provide the "road map" that will resolve the jurisdictional and other issues surrounding stormwater management.

Governance

Halifax Water is an autonomous, self-financed utility owned by HRM. A Board of Commissioners governs Halifax Water. This Board includes the Mayor of Halifax Regional Municipality, three members of the HRM Regional Council appointed by Council, three residents of HRM who are appointed by Council and the Chief Administrative Officer of HRM or an HRM employee appointed by the CAO.

The roles and functions of Halifax Water are governed under the *Halifax Regional Water Commission Act Chapter 55 of the Acts of 2007*. Section 7 of the Act outlines the powers of the Commission. These include the ability to acquire, own or operate water, wastewater and stormwater systems, facilities and utilities to customers located within the Regional Municipality.

The internal organizational structure of Halifax Water is comprised of a senior executive, two lead operational departments: Water Services and Wastewater/Stormwater Services and other major supporting departments including: Engineering and Information Services, Environmental Services, Finance and Customer Service and Human Resources.

The main source of funding for Halifax Water operation is from rates. From time-to-time the provincial and federal levels of government assist with capital projects. This may include funding assistance for renewing old infrastructure or creating new infrastructure. Developers also provide funding for new infrastructure within individual developments. In some cases developers also pay a Capital Cost Contribution (CCC) towards Regional infrastructure that is used to support the particular development.

Two provincial bodies have responsibility for oversight of Halifax Water – Nova Scotia Utility and Review Board (NSUARB) and Nova Scotia Environment (NSE). Federal departments including Department of Fisheries and Oceans (DFO), Environment Canada (EC) and Health Canada (HC) may also play a role for specific issues, projects and activities.

Nova Scotia Utility and Review Board

The NSUARB role in relation to a utility is governed by the Public Utilities Act which provides it with the powers to set rates, tolls and charges, rules and regulations, fire protection regulations, charges and rates and for the provision of service and approval of capital expenditures in excess of $250,000. It also provides an independent forum in which customer complaints can be heard.

From the perspective of Halifax Water the NSUARB is the critical body that approves business plans, significant projects and sets rates for water, wastewater, and stormwater services. Any new projects or programs would be subject to Board approval, for example a specific project related to a regulatory requirement. As was noted in Section 1, the NSUARB required the preparation of the IRP as the vehicle to be used for Halifax Water's long term business planning.

Nova Scotia Environment

Nova Scotia Environment (NSE) is governed by the *Environment Act*[13], which provides it with authority to issue municipal water approvals from the *Activities Designation Regulations* section of the Act. Effectively the role of NSE is as the environmental regulator ensuring public health and environmental quality. NSE specifically regulates drinking water quality as well as municipal and industrial discharges from wastewater treatment plants and other sources such as overflows. NSE key roles in relation to this can be summarized as:

[13] Environment Act, Nova Scotia Environment, 1994-95 (last amended 2006)

- Setting drinking water and ambient water quality standards;
- Issuing approvals for water, wastewater and stormwater systems;
- Inspection and monitoring of permits and approvals; and,
- Enforcement activities and response to public issues and complaints.

NSE, while mindful of the fiscal impacts of regulatory programs, is nonetheless mandated to enforce provincial and federal legal requirements and hence the direction to Halifax Water from the two provincial bodies can at times be a challenge to reconcile. Without careful coordination by the two agencies Halifax Water is in the position of not having the resources to meet its requirements.

Further information regarding the roles and functions of these governing bodies in relation to the Water Utility is outlined in a document entitled *Municipal Water Utilities Oversight* prepared by both the NSUARB and NSE.[14]

3.3 HALIFAX WATER VISION, MISSION, CORPORATE BALANCED SCORECARD (CBS) AND LEVELS OF SERVICE (LOS)

Halifax Water has adopted Mission and Vision statements as well as a supporting set of corporate balanced scorecard (CBS) measures to help with continuously improving its service to its customers. The CBS measures in turn define the Organizational Indicators (OI) and Levels of Service (LOS) that are used to measure organizational and infrastructure performance.

The Halifax Water Mission and Vision statements are as follows:

Mission:

"To Provide World Class Services for our Customers and our Environment"

Vision:

- *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 CBS is comprised of eight critical success factors, which in turn informs 29 organizational indicators. Table 3.1 presents the 17 of 29 Halifax Water OI/LOS statements related to asset renewal and regulatory compliance. The full CBS is presented in Volume 1 Appendix C.

[14] *Municipal Water Utilities Oversight,* Government of Nova Scotia, 2010

The critical success factors are broad statements and cross all functional areas of Halifax Water. The OIs provide a detailed clarification of the critical success factor and allow a target or goal for performance to be established and tracked. The OIs indicate the LOS appropriate to each system (e.g. water supply) and Halifax Water as a whole. From the perspective of the IRP, the OIs or LOS[15] are of paramount importance. They provide the objective measures by which the benefits of the proposed program expenditures can be assessed. They also provide a means to measure the negative impacts or risks when the LOS is not met. In this manner the level of risk can be properly balanced against the capital and operational expenditures required to mitigate the risk to an acceptable level.

Table 3.1 Halifax Water Critical Success Factors and Levels of Service

Driver	Critical Success Factor	Organizational Indicator/Level of Service	Target
Compliance	High Quality Drinking Water	Adherence to five drinking water quality parameters presented in Halifax Water Quality Master Plan (WQMP)[16]	Adherence of 90% of samples to the five parameter water quality targets
		Bacteriological tests	Absence of total coliforms in 99.3 % of samples
		Customer satisfaction with drinking water quality	90% of customers satisfied or very satisfied
	Regulatory Compliance	Number of public health and environmental infractions resulting in a written warning	No more than 2 warnings per year
		Number of public health and environmental infractions resulting in a conviction	Zero convictions per year
		Percentage of wastewater treatment facilities meeting their discharge permit requirements (does not include any WWTF owned for less than one year by Halifax Water)	Eighty percent (80%)
		Percentage of water supply plants meeting permit water quality requirements	One hundred percent (100%)
	Effective Asset Management	Number of CSO and SSO events per year	Awaiting regulations

[15] LOS is used as a short form for OI/LOS in the remainder of the report for the sake of brevity.
[16] *Water Quality Master Plan Version 2,* Halifax Water, 2011

Table 3.1 Halifax Water Critical Success Factors and Levels of Service

Driver	Critical Success Factor	Organizational Indicator/Level of Service	Target
Asset Renewal	Effective Asset Management	Water system leakage allowance	200 L/service connection/d
		Number of I/I related private property inspections	200 inspections/year
		Asset renewal activity for selected asset classes	80-90% of planned asset renewal projects completed
	Service Excellence	Customer satisfaction	90% satisfied or very satisfied
		Water service outages	200 connection hours per 1000 customers
		Wastewater service outages	200 connection hours per 1000 customers
		Average call wait time	70 seconds
	Environmental Stewardship	Energy demand reduction	1.5 % reduction per year in water and wastewater systems
		Biosolids processing	Minimum solids content of 25% for HHSP facilities and 18% for Aerotech WWTF

The LOS statements and targets have some limitations reflecting in part uncertainty about future regulation and the emerging nature of certain LOS e.g. asset renewal. The IRP development described in Section 5, created 14 performance objectives tied back to the existing LOS where possible. New LOS will however be required in other cases.

Halifax Water should review the existing LOS and targets and address the need to update and expand the LOS. Specific recommendations are presented in Section 7 in support of the IRP Implementation Plan.

3.4 HALIFAX WATER INFRASTRUCTURE

HRM's topography, geography, current land use and history of development strongly influence the nature of current water, wastewater and stormwater infrastructure. The topography requires considerable water pressure management and wastewater pumping due to the hills and plateaus, which define the geographic features within HRM. The Halifax Peninsula together with the area in Dartmouth on the harbour side of the Circumferential Highway forms the central part of the urban core within HRM. The surrounding urban area of HRM is built around the outer harbour, Bedford Basin and extending up the Sackville River Valley.

The large geographic reach of HRM and the diverse community size ranging from large urban areas such as Halifax and Dartmouth to small communities such as Middle Musquodoboit has resulted in a serviced urban core as well as independent services for local areas. This has yielded a large number of small water and wastewater facilities

(pumping and treatment) burdened with complex operations and large per capita costs. One feature of the small wastewater facilities is the discharge of effluents to a number of freshwater lakes and streams with limited assimilative capacity particularly with respect to the aquatic nutrients nitrogen and phosphorus. This potential issue is addressed in Section 4, which describes the current and future wastewater treatment requirements stemming from the IRP regulatory compliance driver.

Figure 3.2 presents an overview of the water and wastewater systems for the urban Halifax area.

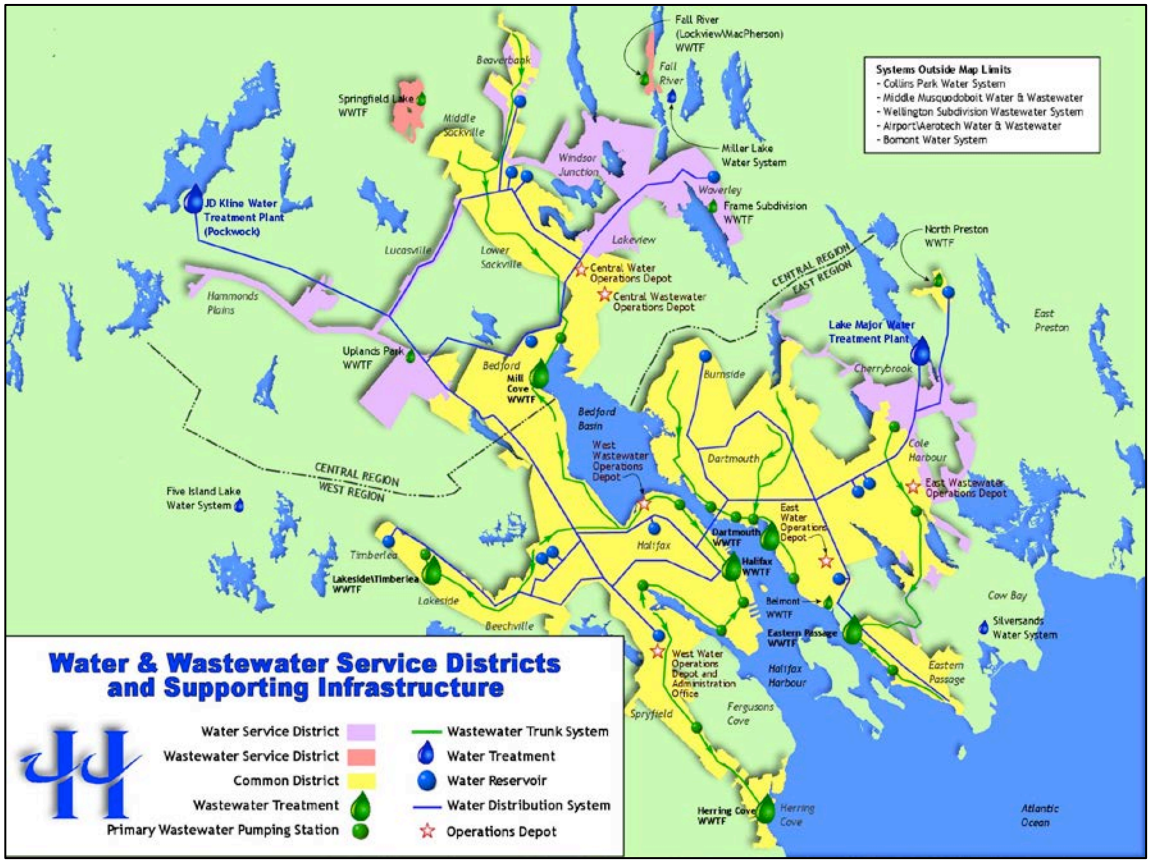


Figure 3.2 Water and Wastewater System Overview

3.4.1 Water System

Water Supply Plants

When Halifax was founded in the mid-eighteen century, water was supplied to the settlement by wells. In 1844, the Halifax Water Company (now Halifax Water) chose Chain and Long Lakes as the source of water. In the early 1970's, water consumption was approaching the existing capacity of the Chain Lake system; Pockwock Lake was selected as the new source water. The J.D. Kline WSP (Pockwock Lake) was commissioned in 1977.

The City of Dartmouth (now part of HRM) water supply system dates back to the nineteenth century.

Lamont and Topsail Lakes were originally used as the raw water supply for Dartmouth. Due to increasing demands in the early 1990's, Lake Major became the largest source of water for Dartmouth. The Lake Major Water Supply Plant (WSP) was commissioned in 1999.

The current Bennery Lake WSP was commissioned in 1987 by the County of Halifax (now part of HRM). The WSP was built due to the business park development (Aerotech) in the vicinity of the Halifax Stanfield International Airport (HSIA). The operation of the WSP was transferred from HRM to Halifax Water in 2006.

Halifax Water owns and operates a total of nine water supply plants. Three are the large facilities named above. Six small water supply plants service the rural/suburban area of HRM. The systems are summarized in Table 3.2.

Table 3.2 Summary of Water Supply Plants

Name	Source Water	Plant Capacity	Average Production	Process	Communities Served
Large WSP					
J.D. Kline WSP	Pockwock Lake	227,000 m^3/d	85,700 m^3/d	Direct dual media filtration	Halifax, Bedford, Sackville, Fall River, Waverley, Timberlea, Herring Cove, Spryfield
Lake Major WSP	Lake Major	94,000 m^3/d	40,100 m^3/d	Upflow clarification with tri-media filtration	Dartmouth, Eastern Passage, Cole Harbour, Westphal
Bennery Lake WSP	Bennery Lake	3,980 m^3/d	1,000 m^3/d	Direct filtration	Halifax Airport and Aerotech Business Park
Small WSP					
Five Island Lake	Ground water (one (1) well)	27 m^3/d	6 m^3/d	Disinfection with UV and chlorine	Twelve residents on St. Margaret's Bay Road near Hubley
Collins Park	Lake Fletcher	160 m^3/d	73 m^3/d	Membrane filtration, disinfection with UV and chlorine	Collins Park and Kendlemark Subdivision, Wellington
Middle Musquodoboit	Musquodoboit River	260 m^3/d	60 m^3/d	Membrane filtration, disinfection with UV and chlorine	Middle Musquodoboit

Table 3.2 Summary of Water Supply Plants

Name	Source Water	Plant Capacity	Average Production	Process	Communities Served
Silver Sands	Ground water (two (2) wells)	144 m^3/d	21 m^3/d	Iron and manganese oxidation, green sand filtration, disinfection with chlorine	Silver Sands Mini-home park, Cow Bay Road
Miller Lake	Ground water (three (3) wells)	55 m^3/d	26 m^3/d	Arsenic removal with G2 Media and disinfection with chlorine	Miller Lake Road and Oakes Road near Fall River
Bomont	Shubenacadie River	20 m^3/d	15m^3/d (expected)	Membrane filtration with ion exchange, disinfection with UV and chlorine	Bo-Mont Subdivision in Elmsdale

A review of the WSPs is presented in the Water System Review located in Volume 3 Appendix A.

Storage and Transmission System

The primary network in HRM supplying the urban core is divided into three operating regions: West (Metro Halifax, Spryfield, Herring Cove), Central (Bedford and Sackville), and East (Dartmouth, Cole Harbour, and Eastern Passage). The J.D. Kline WSP supplies the West and Central regions, while the Lake Major WSP supplies the East region. The service areas for the J.D. Kline and Lake Major WSPs are presented in Volume 1 Appendix D, which contains the maps for Volume 1.

The three operating regions are further subdivided into a total of 67 pressure zones (21 in the West, 30 Central, 16 East). The pressure zones reflect the elevation differences through the HRM. There are approximately 1,400 km of water mains ranging in diameter from 50mm to 1500mm, some of which date back to the mid-nineteenth century.

Halifax Water is currently developing a long-term plan to expand and upgrade the trunk water transmission main system across the urban core to meet the demands of a growing population, to enhance overall system security, and to strengthen the capacity of the system to provide water under emergency conditions between the Pockwock System and the Lake Major System. The details of the transmission main program are presented in Volume 1 Appendix F of the IRP report.

A summary of the distribution systems is also presented in the Water System Review located in Volume 3 Appendix A.

Water System Summary

The water system infrastructure is summarized in Table 3.3.

Table 3.3 Summary of Water System Infrastructure

Asset Category	Number of Assets
Pressure Reducing Valves (PRV)	81
Large WSP	3 and 2 backups
Small WSP	6
Distribution Mains	1187 km
Transmission Mains	220 km
Water Pumping Stations	20
Dams	6
Concrete Storage Reservoirs	7
Steel Storage Reservoirs	9
Appurtenances (Valves, and Meters)	Valves – 13,027 Meters – 80,000

The water system currently meets all the Levels of Service presented in Table 3.1 including full compliance with present drinking water quality standards.

3.4.2 Wastewater System

Installation of central wastewater collection systems commenced in the Halifax and Dartmouth areas towards the end of the 1800s. At that time, most wastewater systems installed were combined, carrying both sanitary sewage and stormwater. Trunk sewers were installed to provide localized drainage and discharged directly to Halifax Harbour at the closest convenient point.

As development progressed beyond the boundaries of the core cities, Halifax County adopted a policy of installing separate sanitary sewers in these areas. Stormwater runoff was generally directed to local watercourses while sanitary sewage was discharged directly into Halifax Harbour or into the upper reaches of the core combined collection systems. Commensurate with the construction of these systems, numerous roof and foundation drains were connected to the sanitary sewers. These illegal connections, as well as inflow and infiltration from other sources, continue to cause overloading in the sanitary system during even frequent rainfall events.

From 1970 onward, increasingly stringent standards were adopted with dual storm and sanitary piped systems.

Historically, the cities of Dartmouth and Halifax and Halifax County were responsible for wastewater collection and treatment within their own service areas. After the 1996 amalgamation, HRM took over the operation of the wastewater system and in 2007 transferred the system to Halifax Water. In the intervening 5 years Halifax Water has been challenged to bring the system into regulatory compliance and to fully assess the condition of wastewater system assets.

Wastewater Treatment Facilities (WWTF)

Presently Halifax Water owns and operates 15 wastewater treatment facilities (WWTFs). These WWTFs provide varying levels of treatment, from primary to tertiary, and have a broad range of average day flow (ADF) capacities that range from 45 m^3/d to 133,920 m^3/d. Nova Scotia Environment regulates the quality and quantity of effluent discharged from each WWTF through 'Permits to Operate' (PTO) which are specific to each facility.

A summary of 14 of the 15 wastewater treatment facilities operated by Halifax Water is presented in Table 3.4. The fifteenth WWTF - Belmont WWTF will soon be decommissioned once the expansion/upgrade of the Eastern Passage WWTF is completed and has not been included in the summary table.

Five of the WWTFs (six including Belmont) presently discharge to salt water receiving environments while the remainder discharge to small freshwater lakes or streams. As noted previously, the freshwater bodies have significant restrictions on assimilative capacity and hence limit the ability for continued population growth and WWTF expansion. In future, as treated effluent nutrient requirements for nitrogen and phosphorus become more stringent, additional limitations on WWTF discharges will likely result. This is further discussed in Section 4 under the wastewater regulatory compliance driver and in Section 5, which proposes a new enhanced nutrient reduction program that was ultimately incorporated into the IRP.

Based on results from fiscal year (FY) 2010-2011, 10 of the 14 WWTFs were non-compliant with their NSE PTO effluent requirements.[17] Many of the non-compliant effluents exceeded their suspended solids (TSS) or biological oxygen demand (BOD) targets. This is likely at least partly the result of excessive wet weather flows stressing the treatment processes. The widely spread and significant nature of this issue argues for a comprehensive inflow infiltration (I/I) program across most of the WWTF service areas. This is further discussed in Section 5 and Volume 1 Appendix F under a new I/I pilot program as well as in Section 6 in examining the benefits of an I/I program for wastewater demand reduction.

[17] *Draft Wastewater Treatment Facilities (WWTF) Compliance Plan,* Halifax Water, August 2011

Table 3.4 Summary of Wastewater Treatment Facilities

Facility Name	Level of Treatment	Rated Capacity (m^3/d)	Receiving Water Body (type)
Halifax WWTF	Enhanced Primary	133,920	Halifax Harbour (salt water)
Dartmouth WWTF	Enhanced Primary	83,808	Halifax Harbour (salt water)
Herring Cove WWTF	Enhanced Primary	28,512	Halifax Harbour (salt water)
Lockview / Macpherson (Fall River) WWTF	Tertiary	454	Lake Fletcher (fresh water)
Middle Musquodoboit WWTF	Secondary	114	Musquodoboit River (fresh water)
North Preston WWTF	Tertiary	680	Whynder Lake (fresh water via wetland)
Uplands Park WWTF	Tertiary	91	Sandy Lake via a wetland (fresh water)
Wellington (Steeves Subdivision) WWTF	Secondary	45 (1)	Fletcher's Run (fresh water)
Frame Subdivision (Waverley) WWTF	Secondary	80	Lake William via a ditch (fresh water) New outfall to Lake William
Springfield Lake WWTF	Secondary	545	Lisle Lake via a brook (fresh water)
Mill Cove WWTF	Secondary	28,400	Bedford Basin (salt water)
Eastern Passage WWTF	Secondary (2)	25,000 (2)	Halifax Harbour (salt water)
Beechville/Lakeside /Timberlea WWTF	Secondary	4,540	Nine Mile River (fresh water)
Aerotech WWTF	Tertiary	1,400	Johnson River (fresh water)

Notes:

1. The rated capacity for the Wellington (Steeves Subdivision) WWTF shown is for the proposed Wellington WWTF to replace the existing package extended aeration facility (under construction).
2. Upgrades are currently underway to upgrade the Eastern Passage WWTF to a secondary treatment facility, and increase the rated capacity to 25,000 m^3/d.

Full details of each of the WWTFs are presented in the Wastewater System Review in Volume 3 Appendix B.

Biosolids Management

In addition to the liquid process treatment plants, Halifax Water also operates a number of biosolids processing facilities. The Halifax Harbour Solutions (HHS) facilities (Halifax, Dartmouth, and Herring Cove) have on-site dewatering facilities for the undigested primary sludge generated by the liquid treatment train. The Aerotech WWTF provides centralized dewatering for undigested sludge and anaerobically digested biosolids from the other Halifax Water WWTFs: liquid, anaerobically digested sludge is hauled to Aerotech WWTF from the Mill Cove, Eastern Passage, and

Beechville/Lakeside/Timberlea (BLT) WWTFs; liquid, undigested sludge is hauled to Aerotech WWTF from the remaining facilities.

All sludge cake produced, either at the HHS facilities or Aerotech WWTF, is trucked to the biosolids processing facility (BPF), located in the Aerotech Business Park, for alkaline stabilization. In the past, the return of a recycle stream from the BPF had a negative influence on the effluent quality discharged from the Aerotech WWTF. A pre-treatment facility at the BPF has addressed this issue. The Aerotech WWTF still receives hauled waste, which can upset plant processes and result in adverse effluent quality. Halifax Water is presently reviewing its hauled waste management with a view to resolving this issue.

Regional Wastewater Functional Plan

Halifax Water recently completed the Regional Wastewater Functional Plan (RWWFP)[18]. The RWWFP presents a regionalized wastewater strategy that consolidates a number of the smaller WWTFs now discharging into limited freshwater receivers and diverts them to WWTFs discharging to more robust saltwater environments. The RWWFP addresses the residential and employment growth that is presented in Section 4 under the growth driver as well as the requirement to offset the increase in wet weather overflows that results from future growth. This is also addressed in Section 4 under future wastewater regulatory compliance.

The growth planning period for the RWWFP extends to 2046. This is somewhat beyond the 2043 end of planning period used in the IRP. As it emerged, all the RWWFP project expenditures are complete by the 2043 date. The RWWFP recommended plan includes expansion of the Dartmouth, Herring Cove and Aerotech WWTFs as well as a number storage and pumping facilities and trunk sewer upgrades and expansions. Reference should be made to the RWWFP for plan details.

The preferred servicing solutions recommended by the RWWFP are briefly summarized as follows:

Central Region

- Includes: Mill Cove, Springfield Lake, Fall River, Frame subdivision, Middle Musquodoboit, Uplands Park, Wellington and Aerotech.
- In total, planned growth is 17, 800 persons of residential growth plus related employment growth. Employment only, no residential growth for Aerotech.
- Only Mill Cove, Aerotech and Springfield Lake have planned serviced growth over the RWWFP time horizon and are therefore the focus of the servicing strategy for the central region.

[18] *Regional Wastewater Functional Plan,* Halifax Water, June 2012

- Springfield Lake is proposed to be diverted to the Mill Cove WWTF via a new pumping station, force main and gravity sewer to the existing Bedford Sackville trunk sewer (BSTS). A large storage tank is proposed in the upper section of the BSTS, with a further storage tank in the lower section of the trunk sewer.
- The west section of the current Mill Cove sewershed is proposed to be diverted south, ultimately discharging to the Herring Cove WWTF.
- Total flow arriving at Mill Cove WWTF is expected to stay approximately at current levels. Aerotech requires upgraded conveyance and treatment.
- Additionally, the WWTF effluent discharge outfall is proposed to be relocated to a less sensitive waterbody.

West Region

- Includes: Halifax, Beechville-Lakeside-Timberlea (BLT) and Herring Cove
- In total, planned serviced growth is 85,400 persons of residential growth plus related employment growth.
- The strategy for the West Region is focused on diverting a portion of flows from west of Mill Cove to the Halifax WWTF and a large flow diversion to the Herring Cove WWTF, which has a large proposed expansion driven by the recommendations of the RWWFP.
- The entire BLT sewershed flows are proposed to be diverted towards the Halifax peninsula and potentially connected to the Herring Cove diversion.
- Management of the BLT flows require an interim expansion/upgrade of the WWTF to address on-going compliance issues that are already identified in Halifax Water's Five-Year Capital Plan.
- Flows from the north and BLT are proposed to be directed to an upgraded Armdale pumping station, which together with the existing pumped flows (lower Spryfield/Armdale area) are routed through a new force main to the Herring Cove system where a new proposed gravity sewer will take flows to the Herring Cove pumping station which, following upgrade will deliver flows to the expanded Herring Cove WWTF.

East Region

- Includes: Belmont, Dartmouth, Eastern Passage and North Preston
- In total, planned growth is 56,100 persons of residential growth and related employment growth.
- In Dartmouth, new storm sewers from little Albro Lake to the vicinity of Jameson PS and from Fenwick St to the vicinity of Old Ferry Rd PS will help separate and convey

stormwater flows to the Halifax Harbour. This will help to alleviate some capacity constraints within the existing collection system.

- Existing sewers will be twinned along Albro Lake / Slayter Street to Old Ferry Road PS to help divert flows away from the already constrained harbour-side sewers and CSO facilities. New storage facilities will be provided at Shannon Park and Anderson Lake to service those growth areas.
- The Old Ferry Rd PS and forcemain will need to be upgraded to accommodate additional flows from projected growth, conveyed to the pumping station by the new Albro Lake / Slayter Street sewer.
- The Dartmouth WWTF will need to be upgraded to accommodate future growth flows within the Dartmouth service area.
- In Eastern Passage, localized sewerage upsizing will mitigate local system constraints. A combination of increased storage at Bissett Lake Pumping Station and a new pressure sewer line will accommodate growth flows, conveying them to Eastern Passage WWTF, which is currently being upgraded and expanded.

The total capital cost of the RWWFP is estimated as $645 million ($2012). The RWWFP expenditures were directly incorporated into the IRP using the timing as indicated in the RWWFP. A summary of RWWFP expenditures is presented in Volume 1 Appendix E.

The RWWFP has presented a plan addressing growth driven wastewater servicing and the mitigation of growth related overflows. The RWWFP represents an important step forward in preparing a holistic strategy for wastewater management in Greater Halifax. Nonetheless, there are additional wastewater planning dimensions that will need to be merged with the RWWFP in future. They include:

- The incorporation of wet weather flow reduction measures (principally a realistic made-in-Halifax I/I reduction program). This planning element should examine the economic trade-offs between expanded capital facilities and flow reduction measures.
- The incorporation of water demand reduction in the planning of water and wastewater facilities. This planning element should be merged with the I/I reduction program and should examine the economic trade-offs between expanded capital facilities and combined flow reduction measures.
- The expansion of the RWWFP overflow control program to include outfalls not directly impacted by planned growth and to develop an overflow control strategy prioritized by receiving water body.
- The implementation of additional storm drainage facilities in presently underserviced areas. This program ties into the wet weather flow reduction program as well as it provides an engineered outlet for on-lot footing drain and roof

leader flows. This program relies on reaching a cost sharing solution with HRM and the benefitting ratepayers.

- The update and expansion of the wastewater system model as well as additional sewer system data collection with incorporation into GIS that will provide improved decision support tools to update the evaluation of alternatives in the RWWFP.
- The revised planning projections that are being developed in the Regional Plan.
- Updated wastewater system design standards and allowances including a realistic incorporation of future climate change impacts.

It is for these reasons that the IRP recommendations address a revamped approach to system master planning. This would involve key component activities such as an I/I pilot program upon which the business case for wet weather flow reduction program could be developed. The wet weather flow reduction program would then form one of the key components of a Wet Weather System Plan integrating all the aspects of wet weather flow and overflow management along with climate change. These in turn would be brought together with other collection system needs such as asset renewal and the WWTF expansion/compliance requirements into a Wastewater System Master Plan. The water system would adopt a similar approach with key components such as the WQMP and transmission main program integrated into a Water System Master Plan. The proposed planning approach is presented in Section 7 under the IRP Implementation Plan.

Collection System

As noted in the introduction to the wastewater system, the present collection systems include areas of combined and separated sewers as well as separated areas that are strongly influenced by wet weather due to historical household connection practices. The topography and geography of the HRM has necessitated extensive use of pumping resulting in 172 wastewater pumping stations. Many of these stations as well as the WWTFs are subject to substantial wet weather influence with wide swings in flow rates resulting from rainfall or snowmelt. This has resulted in numerous designed and some unintentional locations that allow excess wastewater to overflow during wet weather.

Based on data collected by Halifax Water there are presently a total of 216 known potential overflow locations within the wastewater system approximately 105 of which are known to have been active at any time. Twenty-nine (29) of the 105 active overflows locations are associated with the combined sewer system.

The RWWFP modelled a total of 96 of the potential overflow locations and determined based on the modeled results, 59 overflows are active during a year with average rainfall. The RWWFP modeling further determined that 28 of the 59 overflows active during an average rainfall year would be impacted by future growth. The RWWFP includes measures to control only those 28 overflow locations that are expected to

experience growth in their tributary sewersheds and only to a level sufficient to offset the effects of growth.

Halifax Water has produced an evaluation of the environmental and public health risks associated with known overflow locations. It has categorized each location according to the categories presented in Table 3.5.

Table 3.5 Receiving Water Risk Categories

Risk Category	Risk Description
A	Drinking water
B	Supervised HRM beach or on-ground with high potential for human contact
C	Known unsupervised swimming areas and designated recreational areas (boat clubs, parks etc.)
D	Other freshwater bodies and/or ground with low potential for human contact
E	Other marine bodies

The average year overflow volumes associated with current conditions, future growth with no controls, and future growth under the RWWFP preferred scenario are summarized for the 28 overflows impacted by growth in Table 3.6. The Table also includes the 31 non-growth impacted overflow volumes for the same scenarios.

Table 3.6 Average Year Overflow Volumes

Category	Receiving Water Risk Level	Number of Outfalls	Baseline1 (1000 m^3/yr.)	Growth No Controls1 (1000 m^3/yr.)	Preferred RWWFP1 (1000 m^3/yr.)
Non-Growth Outfalls (31)	E	12	789	802	947
	D	0	0	0	0
	C	6	74	74	74
	B	13	697	696	667
	A	0	0	0	0
	Total	**31**	**1,560**	**1,572**	**1,688**
RWWFP Growth Impacted Outfalls (28)	E	15	6,772	10,935	5,449
	D	4	46	355	43
	C	5	935	4,895	646
	B	4	29	51	28
	A	0	0	0	0
	Total	**28**	**7,782**	**16,236**	**6,166**
Total System Outfalls		59	9,342	17,808	7,854

Notes:

1. The differences in the non-growth overflow volumes are due to the impact of the system diversions proposed by the RWWFP along with other minor modeling variations.

The results presented in Table 3.6 show that under current baseline conditions approximately 7.8 million m^3/yr is discharged through the 28 outfalls addressed in the RWWFP with an additional 1.6 million m^3/yr. discharged through the remaining 31 active overflows. It is noteworthy that 49% of the non-growth baseline volume is made to B or C risk level receiving waters while about 12% of the growth impacted volume is discharged to B and C risk level receiving waters. The impact of growth with no additional controls is evident with an over 100% increase in overflow volumes between the baseline and growth with no controls cases. The preferred RWWFP strategy however reduces the average annual overflow volume for the 28 outfalls by 16% for the total system outfalls thus already achieving a substantial improvement.

It is for these reasons that an Enhanced Overflow Control Program was developed and is proposed for implementation through the IRP. The Enhanced Program would control the 28 B and C risk level growth (9) and non-growth (19) overflows to a uniform 10 overflows per average year. It would be in addition to the overflow control provided by the RWWFP. Ideally, these two programs would be integrated under the Wet Weather System Plan, discussed above, to achieve optimal receiving water benefit for the overall investment. The Enhanced Overflow Control Program is discussed under new programs in Volume 1 Appendix F.

Presently, regulatory compliance requirements for overflows include monitoring and reporting. Halifax Water complies with these requirements and through its Five-Year Capital Budget, discussed later in this Section, has a variety of programs and projects aimed at overflow mitigation (e.g. overflow screening) and reduction (e.g. Stormwater Inflow Reduction (SIR) Program).

The location of the combined and separate sewer areas as well as the overflow locations and major trunk sewers are presented in Volume 1 Appendix D, which contains the maps for Volume 1.

Wastewater System Summary

The wastewater system assets are summarized in Table 3.7.

Table 3.7 Summary of Wastewater Infrastructure

Asset Category	Number of Assets
Forcemains	90 km
WWTF	15 facilities(1)
Trunk	145 km
Sewers	1193 km
Wastewater Pumping Stations	172 stations

Notes:
1. This includes the Belmont WWTF, which will be soon decommissioned.

3.4.3 Stormwater System

Prior to 2007, stormwater was entirely the responsibility of HRM. On August 1, 2007 Halifax Water's mandate was expanded with the transfer from HRM of certain stormwater assets. As was noted previously, management of stormwater in the greater Halifax area is a multi-jurisdictional undertaking. Ownership, operations, and maintenance of the stormwater management infrastructure within the public right-of-way including Halifax Water stormwater easements is the responsibility of Halifax Water. Stormwater runoff is managed by a combination of piped systems (some deep, some shallow), overland flow and ditches discharging to area watercourses.

Halifax Water also owns 29 stormwater retention ponds and other stormwater control structures. These structures range from earthfill, concrete, timber and masonry dams, to culverts, weirs and other non-traditional structures. The main purpose of the retention ponds is to control stormwater runoff from the surrounding area during heavy rainfall and/or snowmelt events, maintain lake levels, and/or allow settling and containment of pollutants in runoff from adjacent industrial sites. Halifax Water is responsible for the operation, repair, maintenance, and cleaning of all stormwater retention ponds located on Halifax Water-owned lands and easements.

There are over 790 km of stormwater pipe and an estimated 8 km of culverts in Halifax Water's stormwater system. In addition, there are approximately 37,000 manholes, and 17,000 catch basins throughout the HRM. Halifax Water is responsible for the operation, repair, maintenance, and cleaning of all stormwater pipes (culverts and open ditches), manholes and catch basins.

The locations of the stormwater system features are presented in Volume 1 Appendix D, which contains the maps for Volume 1.

Stormwater System Summary

Halifax Water manages the stormwater assets presented in Table 3.8.

Table 3.8 Summary of Stormwater Infrastructure

Asset Category	Number of Assets
Pipes	790 km
Culverts	8 km (estimated)
Stormwater Structures	29 structures

3.5 FIVE-YEAR BUSINESS PLAN AND CAPITAL BUDGET

Halifax Water prepared a Five-Year Business Plan[19] in December of 2011. This plan was developed to support the December 2011 rate application for the urban core/satellite systems, a January 2012 rate application for the Airport/Aerotech system, and to provide a comprehensive financial plan for Halifax Water. From the perspective of the IRP, the Five-Year Business Plan contains the Five-Year Capital Plan, which defines the specific projects and programs prepared by Halifax Water and accepted (first year) by the NSUARB. These projects and programs were incorporated in the alternative IRP resource plans. The projects and programs included in the Five-Year Capital Plan address the full range of IRP drivers and were accordingly allocated to the appropriate IRP objectives described in Section 5.

Since the FY 2012 -2013 was already underway during the preparation of the IRP, only the final four years were included at a value of approximately $200 million. The individual projects were programmed into the IRP with the same timing as in the original Five-Year Capital Budget.

Projects, which in many cases were continuations of programs and projects initiated in the Five-Year Capital Plan, were allocated as appropriate to 2018 and beyond. This included about $410 million in additional projects which were further refined through the IRP as to both capital requirement and timing. These projects should be reviewed as part of translating the IRP into the next Five-Year Capital Plan.

Table 3.9 summarizes the capital budget for years 2013-2017. The details of the projects and programs for the Five-Year Capital Plan are presented in Volume 1 Appendix B. The long-term capital projects outside the Five-Year Capital Plan were also incorporated into the IRP following review and refinement.

Table 3.9 Halifax Water 2013 – 2017 Capital Plan

	Y2	Y3	Y4	Y5	Y2 –Y5 Sub-Total 2013-2017
	2013 -2014	2014-2015	2015 -2016	2016 -2017	
Stormwater Sub-Total	$2.2	$2.8	$2.4	$3.8	$11.2
Wastewater Sub-Total	$75.6	$32.9	$14.5	$15.1	$138.1
Water Sub-Total	$12.9	$14.0	$13.1	$11.3	$51.3
Totals	**$90.7**	**$49.7**	$30.0	**$30.2**	**$200.**6

[19] *Halifax Water Five-Year Business Plan 2012-2013 to 2016-2017,* Halifax Water, December 2011

Many of the issues and concerns noted in the review of the water, wastewater and stormwater systems are addressed in the Five-Year Capital Plan. Some of the highlights include:

- Wastewater compliance projects intended to facilitate WWTF effluent compliance.
- WQMP process improvements intended to ensure continued compliance with drinking water standards.
- Water transmission upgrade/replacement projects for system capacity and security.
- Collection system improvements for system capacity and I/I reduction.
- Overflow monitoring and screening for compliance and overflow mitigation.
- New storm sewers for improved drainage.
- Asset renewal projects for all three infrastructure systems.

4. INTEGRATED RESOURCE PLAN DRIVERS AND OBJECTIVES

4.1 PURPOSE

The purpose of this section is to present the three IRP drivers – Growth, Regulatory Compliance and Asset Renewal. The section also reviews the challenges, opportunities and risks associated with the drivers.

4.2 GROWTH

Growth is one of the key IRP drivers. All three-infrastructure systems will need to meet future growth demands.

HRM provided a range of growth projections for use by the IRP project team. Based on the mid-range of those projections, the following growth estimates were developed and applied to the IRP and the RWWFP:

- Residential growth to 2046 – 159,240 persons
- Employment area growth to 2046 – 698.1 ha

The locations of planned growth are provided in Volume 1 Appendix D in the IRP maps.

4.2.1 Water and Wastewater

The impact of growth was examined for both the water and wastewater systems. Most of the new growth is planned to occur in the urban core or adjacent areas. Very little growth other than infill is expected in the satellite communities. Hence the impacts were primarily on the large water and wastewater facilities and associated distribution or collection systems.

Major facilities that will require expansion due to growth include:

- The Lake Major WSP will be well within the WSP capacity but reaching the maximum water withdrawal permit limit at the end of 2046. There will be a need for exploring additional water supplies beyond the 2046 horizon.
- The potential demand at the Bennery Lake WSP is predicted to surpass the water source safe yield and the maximum water withdrawal permit limit by 2016. The forecast demand is projected to exceed the WSP's capacity between 2021-2026. Therefore, during the timeframe of the IRP there is a need to expand the Bennery Lake WSP, increase safe yield of the lake (e.g. using a dam or pumping from Grand Lake), and submit an application to NSE to request an increase in the Water Withdrawal Permit.

- As noted in Section 3, the RWWFP recommended a plan that provides a regional wastewater strategy with upgrades required at a number of WWTFs as well as linking conveyance systems. WWTF expansion will be required as follows:
  - Dartmouth – A 16.06 ML/d capacity expansion (2021 - 2026 horizon).
  - Herring Cove – A 53.55 ML/d capacity expansion (2031 - 2036 horizon).
  - Aerotech – A further 4.65 ML/d capacity expansion (2031 - 2036 horizon), in addition to the 3.00 ML/d capacity expansion project already underway.
- In addition, there are a number of growth-related water and wastewater projects expanding transmission mains and major sewers as well as water and wastewater pumping facilities.

The details of growth impacts on both water and wastewater systems are provided in Volume 3 Appendices A and B respectively.

Growth Impact on Wastewater Overflows

Future requirements for overflow management are uncertain at present and represent a significant risk for Halifax Water. Special attention was therefore given to the impact of growth on overflows. Based on preliminary discussions with regulators, the minimum future requirement appears to be “no net increase in overflows with growth”. The RWWFP has addressed this requirement through a strategy of wastewater regionalization combined with application of new storage, conveyance and pumping facilities. The RWWFP presents a future path to meet this baseline overflow control goal. It is expected that 28 of 59 overflow locations identified in the RWWFP will have growth impacts by 2046. The impact of growth on overflows was presented in Table 3.6.

As noted in Section 3, additional controls may be necessary to meet yet undefined future overflow control requirements. As part of the IRP, a risk-based Enhanced Overflow Control Program was developed based on receiving water characteristics. This program would be additional to the measures in the RWWFP.

4.2.2 Stormwater System

New separated stormwater systems would be developed at the same time as the new growth areas. The impact on existing stormwater infrastructure would likely be small. However, with growth, the length of the stormwater network (both piped and ditches) will be expanded and therefore impact the on-going asset management and operational programs over time. Sewer separation is an option for asset renewal projects, leading to increased stormwater infrastructure over time.

4.3 REGULATORY COMPLIANCE

4.3.1 Water System

Nova Scotia Environment is the provincial government department with oversight responsibility for drinking water. Current NSE regulations for drinking water focus on water works approvals, facility classification and operator certification, drinking water quality, and monitoring and reporting.

The *Guidelines for Canadian Drinking Water Quality* [20] provide guidance about acceptable levels of microbiological, chemical and radiological contaminants in drinking water as well as acceptable physical characteristics of drinking water, including taste and odour. The guidelines are based on current, published scientific research related to health effect, aesthetics, and facility operations and infrastructure.

Halifax Water meets all current water distribution and treatment compliance requirements.

All water distribution and treatment facilities owned and operated by Halifax Water have received the required approvals, and certified operators of appropriate classification operate all facilities.

Canada's Federal-Provincial-Territorial Committee on Drinking Water has undertaken a number of consultations since 2010 aimed at identifying new or revised drinking water quality guidelines. Of interest to Halifax Water are proposed guidelines for dichloromethane[21] and for N-nitrosodimethylamine (NDMA) [22], and these are shown in Table 4.1.

Table 4.1 Recent Health Canada Consultations on Drinking Water Quality Guidelines

Parameter Description	Type	Current Guideline	Proposed Guideline
Dichloromethane	Existing	0.05 mg/L	0.015 mg/L
N-nitrosodimethylamine (NDMA)	New	–	0.04 µg/L

Based on the assessment of current source and drinking water quality and current treatment processes, it is expected that neither change in guidelines should pose any compliance issues for Halifax Water.

[20] *Guidelines For Canadian Drinking Water Quality,* Health Canada, August 2012
[21] Dichloromethane in Drinking Water, Federal-Provincial-Territorial Committee on Drinking Water, July 2010
[22] *N*-nitrosodimethylamine (NDMA) in Drinking Water, Federal-Provincial-Territorial Committee on Drinking Water, March 2010

Over the longer term, the following regulatory developments can reasonably be expected to occur:

- **Reducing Disinfection By-Products – Trihalomethanes (THMs), Haloacetic acids (HAAs).**

  Continued use of chlorine-based (and bromine-based) disinfectants is expected to result in continued scrutiny of the health and environmental effects of halogenated compounds that form during drinking water treatment. In the United States, for example, the United States Environmental Protection Agency (U.S. EPA) has identified chlorinated disinfection by-products as a group of contaminants that will be the focus of efforts in the short term. Actions under consideration include increasing disinfection by-product precursor removal targets. The U.S. EPA example is provided here because, historically, Canada has often followed developments in the United States with similar regulatory initiatives here.

  The Halifax Water WQMP places attention on the reduction of THMs and HAAs to mitigate risk exposure with respect to compliance when new, stricter standards come into place. The WSP improvement projects needed to meet expected disinfection by-product precursor removal targets are already incorporated in the Five-Year Capital Plan. Implementation of the water treatment process improvements delivered by these projects will ensure future compliance.

- **New Parameters and Lower Maximum Acceptable Concentrations (MACs)**

  Over the longer term, it is reasonable to expect that the Federal-Provincial-Territorial Committee on Drinking Water will continue to review the MACs for individual parameters and propose changes when warranted by new information. As detection limits are lowered, it is reasonable to assume that existing MACs may be reduced to reflect new scientific information in cases where adverse health effects may, or are expected to, occur. It is also reasonable to expect that guidelines will be introduced for new parameters.

  The requirements for new drinking water quality parameters or lower MACs should be readily addressed with continued updates of the WQMP, the incorporation of the WQMP into a system-wide proposed Water Master Plan and the on-going Halifax Water collaborative research with Dalhousie University.

4.3.2 Wastewater System

Halifax Water has a strong commitment to ensuring high quality wastewater services and has operationalized this commitment through a variety of actions, policies, and programs. All wastewater facilities owned and operated by Halifax Water have received the required approvals, and certified operators of appropriate classification operate all facilities.

As indicated in Section 3, 10 of 14 WWTFs are not currently compliant with their NSE Permit to Operate and require upgrades. Details of compliance status can be found in Volume 3 Appendix B –Wastewater Treatment System Review. A number of projects are included in the Five-Year Capital Plan that address the required upgrades. Additional projects were identified through the preparation of the IRP and have been included for consideration in the alternative plans.

Additional wastewater treatment improvements will also be needed to meet the recently promulgated Canadian Wastewater Systems Effluent Regulations (WSER)[23]. The proposed regulations are intended to phase out the release of untreated and undertreated wastewater. The regulations will apply to wastewater systems that treat, or are designed to treat, an average daily volume of at least 100 cubic metres per day (m^3/d). The national performances standards that wastewater systems will be expected to meet are shown in Table 4.2.

Table 4.2 Proposed National Performance Standards

Parameter	Concentration
Carbonaceous Biochemical Oxygen Demand (CBOD)	Average ≤ 25 mg/L
Suspended Solids (TSS)	Average ≤ 25 mg/L
Total Residual Chlorine (TRC)	Average ≤ 0.02 mg/L
Un-ionized ammonia as N at 15˚C ± 1˚C	Maximum < 1.25 mg/L

The average concentrations shown in Table 4.2 are typically achievable with a secondary level of treatment. The WSER also requires that wastewater treatment facility effluents must not be acutely lethal.

Some Halifax Water WWTFs will need to be upgraded to meet the WSER. Halifax Water has recently completed a risk assessment of its Halifax Harbour Solutions WWTFs indicating that under the WSER all three facilities will be required to upgrade to full secondary treatment within 20 years (by 2032).

The Province of Nova Scotia has indicated that it will implement WSER requirements under its jurisdiction through conditions attached to approvals issued by Nova Scotia Environment.

In addition to the current compliance and future WSER requirements, a review of the Halifax Water WWTFs indicates that 10 WWTFs (see Table 4.3) discharge to receiving waters with limited assimilative capacity. Discussions with NSE have indicated that advanced nitrogen and/or phosphorus removal potentially to the limit of technology (LOT) will be required for these facilities at some point in the future. Halifax Water has already implemented more conventional nutrient removal at four facilities including

[23] *Wastewater Systems Effluent Regulations,* Canada Gazette, Vol. 146 No. 15, June 2012

BLT, Aerotech, North Preston and Lockview – MacPherson (Fall River) and is in the process of further upgrading the BLT facility on the basis of effluent limits developed through an environmental risk assessment (ERA). LOT applied at Aerotech, North Preston and Lockview WWTFs would further enhance their capabilities for both nitrogen and phosphorus removal.

For purposes of the IRP, development of a conservative assumption was made that each facility except BLT, which is already being upgraded, would need to meet limit of technology (LOT) effluent limits. The term "limit of technology" has been used to describe the lowest, consistently achievable effluent concentration for total phosphorus (TP) and total nitrogen (TN) utilizing existing technology. In Chesapeake Bay, a program has been in place since 1992, which implemented the concept of LOT utilizing biological nutrient removal (BNR) technologies.[24]

The following future effluent requirements are projected based on the concept of LOT, for TN and TP:

- Monthly TN limit of 5 mg/L as N, based on accepted LOT.
- Monthly TP limit of 0.1 mg/L as P based on the range of proposed LOT and full-scale plant performance at other WWTFs.

Before embarking on the implementation of LOT it is recommended that ERAs be carried out for each receiving water to allow a more precise definition of WWTF effluent requirements. As noted, an ERA has been completed for the BLT WWTF and one is underway for the Aerotech WWTF.

The current and future compliance requirements needed at each of the Halifax Water wastewater facilities for current NSE PTOs, future WSER requirements and potential future nutrient requirements are presented in Table 4.3. The current compliance projects are a combination of projects identified in the Five-Year Capital Plan and through the analysis of the IRP. The Five-Year Capital Plan projects are presented in Volume 1 Appendix B while the IRP derived projects are presented in Volume 3 Appendix B in the Wastewater Treatment Facility Review.

[24] Chesapeake Bay Foundation, 2004

Table 4.3 Current and Future Compliance Requirements for WWTFs

WWTF	Current Compliance with NSE Requirements	Compliance with WSER Requirements	Future Nutrient Requirements for Limited Receiving Waters
Halifax	• Non-compliant • IRP included projects: o Process optimization	• WSER requires secondary treatment by 2032 • IRP included projects: o Add secondary treatment system	• None
Dartmouth	• Non- compliant • IRP included projects: o Process optimization	• WSER requires secondary treatment by 2032 • IRP included projects: o Assess and upgrade/expand UV disinfection system o Add secondary treatment system	• None
Herring Cove	• Compliant	• WSER requires secondary treatment by 2032 • IRP included projects: o Add secondary treatment system	• None
Eastern Passage	• Non-compliant • IRP included projects: o Upgrade to secondary treatment and expand WWTF	• No additional upgrades required	• None
Lockview/ MacPherson (Fall River)	• Non-compliant • IRP included projects: o Modifications to equalization tank o Modifications to secondary clarifiers o Additional filtration capacity o UV system upgrade	• No additional upgrades required	• Possible LOT facility • Site specific Environmental Risk Assessment (ERA) should determine effluent limits
Middle Musquodoboit	• Compliant	• No additional upgrades required	• Possible LOT facility • Site specific Environmental Risk Assessment (ERA) should determine effluent limits
North Preston	• Non-compliant • IRP included projects: o Supplemental alkalinity addition required o Complete a biological treatment capacity assessment o Establish benefit of wetland to effluent quality through monitoring	• No additional upgrades required	• Possible LOT facility • Site specific Environmental Risk Assessment (ERA) should determine effluent limits

Table 4.3 Current and Future Compliance Requirements for WWTFs

WWTF	Current Compliance with NSE Requirements	Compliance with WSER Requirements	Future Nutrient Requirements for Limited Receiving Waters
Uplands Park	• Compliant	• No additional upgrades required	• Possible LOT facility • Site specific Environmental Risk Assessment (ERA) should determine effluent limits
Wellington	• Non-compliant • IRP included projects: o Construct a new WWTF	• No additional upgrades required	• Possible LOT facility • Site specific Environmental Risk Assessment (ERA) should determine effluent limits
Frame	• Non-compliant • IRP included projects: o Optimize WWTF following collection system improvements o Possible new WWTF in long term	• No additional upgrades required	• Possible LOT facility • Site specific Environmental Risk Assessment (ERA) should determine effluent limits
Springfield Lake	• Non-compliant • IRP included projects: o Upgrade collection system o Diversion to Mill Cove under RWWFP	• No additional upgrades required	• Diversion to Mill Cove WWTF under RWWFP
Mill Cove	• Compliant • No upgrades required	• No additional upgrades required	• Possible LOT facility due to sensitive nature of Bedford Basin receiving environment • Site specific Environmental Risk Assessment (ERA) should determine effluent limits
Beechville Lakeside Timberlea	• Non-compliant • IRP included projects: o WWTF upgrade and expansion for interim o Diversion to Halifax WWTF under RWWFP	• No additional upgrades required	• Current WWTF upgrade for interim • Long-term diversion to Halifax WWTF (and potentially Herring Cove WWTF) under RWWFP
Aerotech	• Non-compliant • IRP included projects: o WWTF upgrade and expansion	• No additional upgrades required	• Possible LOT facility due to sensitive nature of receiving environment • Site specific Environmental Risk Assessment (ERA) should determine effluent limits
Belmont	• Decommissioned in 2015 • IRP included projects: o WWTF decommissioning	• NA	• NA

4.3.3 Wastewater Overflows

At present, Halifax Water is required by NSE to monitor and report on CSOs and SSOs. NSE has also indicated that the impact of any growth on overflows will need to be mitigated so that there is no increase in overflow frequency or volume. This is the basis for the overflow control measures proposed in the RWWFP.

Halifax Water is also taking current actions to mitigate overflows. The Five-Year Capital Plan includes a number of projects addressing wet weather flow issues that includes screening of CSO discharges, a number of wet weather flow (I/I) reduction projects, as well as the overflow monitoring program.

Sections 17, 18, and 20 of the recently implemented WSER reinforce the monitoring and reporting requirements but require no more action for the present. Discussions with NSE should be used to verify whether any specific requirements have changed and to confirm what additional measures NSE will require over and above what is stipulated in the WSER.

As discussed in Section 3 and above, an Enhanced Overflow Control Program has been included within the IRP to address these future overflow control needs. The Enhanced Overflow Control Program is presented in Volume 1 Appendix F.

4.3.4 Stormwater System

Under current requirements there are no regulatory compliance issues with respect to the stormwater system.

The main future concerns are the impacts of stormwater on receiving water quality and the impacts related to flow volumes and velocity (i.e. flooding and erosion). A report[25] commissioned by HRM noted that stormwater runoff could negatively affect both the quality and quantity of area water resources. With respect to water quality, the report stated that stormwater runoff can lead to increased loadings of toxic substances, such as heavy metals and hydrocarbons, increased nutrient loadings from fertilizers and organic debris, increased levels of bacteria from animal waste, increased sedimentation, increased salinity from road salt, lower levels of dissolved oxygen, increased stream temperature, and reduced biodiversity. Water quantity impacts resulting from stormwater runoff cited in the report included increased volume and velocity of watercourses in developed areas and decreased base flows in receiving waters.

The Regional Municipal Planning Strategy[26] commits HRM to preparing a Regional Stormwater Functional Plan (RSWFP), which is expected to consider:

- Methods to reduce increased stormwater flows caused by development with consideration given to problems associated with downstream flooding, stream bank

[25] *Water Resource Management Study*, Dillon Consulting Ltd., 2002
[26] *Regional Plan,* Halifax Regional Municipality, 2006

erosion, groundwater contamination and inflow and infiltrations into wastewater systems;
- Incorporating natural watercourses as a component of a stormwater management strategy;
- Reducing site disturbance and impervious surfaces in new developments;
- Employing naturally occurring soils and native plant species in stormwater management plans;
- Methods of reducing sediments and contaminants being discharged into watercourses;
- Applying emerging technologies to improve the performance of stormwater management systems; and,
- Establishing best management practices and criteria for the quantity and quality of stormwater discharge.

Halifax Water will actively participate in HRM's development of the RSWFP. It is anticipated that recommendations from the RSWFP would be adopted under the Municipal Service Systems Specification document or incorporated into HRM's operational and administrative programs and land use policies and regulations. Changes to HRM's specifications, policies and/or regulations can be expected to affect how Halifax Water delivers stormwater services, including how Halifax Water operates and maintains its stormwater infrastructure.

The proposed review of existing policies and regulations that affect the planning, design and approval of stormwater management system elements is an opportune time to examine the existing jurisdiction and roles of Halifax Water, HRM, Nova Scotia Environment, and other regulators as they relate to stormwater management and systems overall. Such a review would serve to clarify roles and responsibilities, and identify where better integration of activities may be warranted, including opportunities for enhancing effectiveness and efficiencies.

4.4 ASSET RENEWAL

The third IRP driver is asset renewal. Halifax Water currently delivers an annual asset renewal program that rehabilitates or replaces aging infrastructure. Asset renewal is important to avoid system failures and maintain levels of service. The Five-Year Capital Plan and the annual Halifax Water capital budget identify prioritized annual asset renewal projects. As well, Halifax Water in 2011 finalized the Asset Management Assessment (AMA) [27]. The AMA document recommended 22 initiatives to be implemented over five years (2012 - 2016) to further improve Halifax Water's asset management systems and capacities. Additional details regarding the AMA are provided in Volume 1 Appendix F.

[27] *Asset Management Assessment (AMA) Project*, Halifax Water, 2011

4.4.1 Asset Inventory and Replacement Value

For purposes of evaluating the current asset renewal program the replacement value of the Halifax Water assets were estimated. The cost estimation procedures are presented in Volume 3 Appendix C. Table 4.4 shows the estimated value of water, wastewater and stormwater assets. The total value of assets currently under management by Halifax Water is approximately $6.6 billion (i.e. $2012 replacement cost). This does not include buildings, land, IT, vehicles and other equipment. Approximately, $5.4 billion or 81% of the total is associated with linear assets (e.g. sewers and watermains) while $1.1 billion or 17% is associated with point facilities such as storage, treatment and pumping facilities. The remainder is associated with various appurtenances such as valves.

Table 4.4 Infrastructure Inventory and Replacement Costs

Asset Group	Asset	Number/ Length[1]	Replacement Costs ($ million 2012)[2]
Water	Water Distribution Mains	1187 km	$1,537
	Water Transmission Mains	220 km	$495
	Appurtenances	>93,100	$128
	Water Pumping Stations	20	$47
	Water Reservoirs	16	$140
	Dams	6	$22
	Water Supply Plants	9	$194
	Water System Sub-Total		*$2,563*
Wastewater	Sewers	1193 km	$1,519
	Trunk	145 km	$483
	Forcemains	90 km	$138
	Pumping Stations	172	$142
	Treatment Facilities	15	$571
	Wastewater System Sub-Total		*$2,853*
Stormwater	Pipes	790 km	$1,232
	Culverts	8 km	$15
	Structures	29	$1[3]
	Stormwater System Sub-Total		*$1,248*
All Systems Total			**$6,664**

Notes:

1. Due to data limitations linear infrastructure lengths are estimated (see Unit Cost Summaries - Volume 3 Appendix C and Data Collection/Gaps - Volume 3 Appendix D)
2. Based on costing procedures presented in Unit Cost Summaries, Halifax Water Integrated Resource Plan, Volume 3 Appendix C.
3. Replacement cost of stormwater pond inlet/outlet structures.

4.4.2 Asset Data Gaps

The foundation of an efficient asset renewal program is a solid understanding of the asset inventory coupled with an understanding of current asset condition. This information along with cost data provides the ingredients to develop a well-founded program. A review of available asset information was carried out as part of IRP preparation. The data gaps identified are presented in Volume 3 Appendix D and summarized in Table 4.5.

Table 4.5 Water, Wastewater, and Stormwater System Asset Data Gaps

System	Data Gap
All	
	• Historical capital expenditure.
Water	
Distribution and Transmission Mains	• Only about half of the water mains are digitized in GIS. • 39% of water main material is unknown. • 50% of all water mains have dates. • Main renewal data not available for 2009/10 and 2010/11.
Hydrants, Valves, and Water Meters	• 74% of hydrants, 20% of valves and 90% of water meters have installation dates. • There is no condition or performance data on hydrants, valves and water meters.
Pumping Stations	• No breakdown of assets to equipment/component level. • No data on pumping station failures and their impact on network service levels.
Reservoirs	• No condition data.
Water Supply Plants	• No breakdown of assets to equipment/component level. • No process/equipment installation dates. • No facility/equipment condition data.
Wastewater	
Collection and Trunk Sewer	• 248km of sewer (18%) is not on GIS. • Pipe Diameter – 25% of sewer length is unknown. • Material – 37% of sewers have unknown material. • Age data: 75% of sewers do not have an installation date. • No condition data. • No sewer flooding data. • Limited blockage and collapse data. • No data on the replacement/renewal rates of the collection system.
Forcemains	• 23km of forcemains (25%) are not on GIS. • Pipe Diameter – 26% of length is unknown. • Material – 37% have unknown material. • Age data: 58% of the forcemains do not have an installation date. • No break data linked to assets. • No condition data. • No renewal/replacement data.
Pumping Stations	• No breakdown of assets to equipment/component level. • No data on pumping station failures and their impact on network service levels.
Wastewater Treatment Facilities	• No breakdown of assets to equipment/component level. • No process/equipment installation dates. • No facility/equipment condition data.

Table 4.5 Water, Wastewater, and Stormwater System Asset Data Gaps

System	Data Gap
Stormwater	
Pipes, Culverts, and Ditches	• 190km (24%) of stormwater pipes are not in GIS. • Limited data in GIS for stormwater culverts (only 8km recorded). • No asset data on stormwater ditches. • 31% of stormwater pipes and 21% of stormwater culverts lack data on diameter/sizing. • There is no condition data on the stormwater collection network. • There are no service levels or performance indicators for the stormwater collection network. • No historical renewal/rehabilitation activity recorded for the stormwater collection network.

Based on the review, it was clear that there were significant limitations on asset condition data with water system linear assets having the most recorded information and wastewater and stormwater linear assets having little or no recorded condition data. The status of condition data for point assets such as treatment plants and pump stations were somewhat more difficult to assess. From the standpoint of a central asset management system, data pertaining to these assets was sparse. Nonetheless, it is believed that the operations staff has good knowledge of their facilities and is able to provide on-going identification of renewal, repair and replacement projects.

The review also indicated limitations in knowledge about the current asset inventory particularly for the wastewater and stormwater systems. Certainly, only a fraction of asset inventory currently resides in an easily accessible form in the Halifax Water GIS system.

These data limitations shaped the asset renewal methodology that was ultimately employed in the IRP and represents a planning risk in the estimation of the renewal costs. The details of the asset renewal estimation methodology are presented in Volume 3 Appendix E.

4.4.3 Current Asset Renewal Expenditure

The current level of asset renewal expenditure based on the Five-Year Capital Plan is about $22.4 million/yr. Table 4.6 presents the details of the current renewal rates for the major linear systems. The Halifax Water replacement rates range from about 0.23% to 0.5% for water mains and 0.13% to 0.21% for sewers. These rates actually compare favourably with UK benchmark rates shown in the last column of Table 4.6; this however does not indicate an adequate level of renewal activity in Halifax.

Table 4.6 Linear Infrastructure Renewal Rates

Asset System	Asset	Design Life (yrs.)	Replacement Costs $million	Current Average Annual Expenditure $ million/yr.	Current Renewal Rate %/yr.	Benchmark Renewal Rate Range28 %/yr.
Water	Distribution Mains	75	$1,537	$3.5	0.23	0.1 -2.2
	Transmission Mains	75	$495	$2.5	0.50	0.1 -2.2
Wastewater	Collector Sewers	100	$1,518	$2.0	0.13	0.01 -0.14
	Trunk Sewers	100	$483	$1.0	0.21	0.01 -0.14

4.5 INTEGRATED RESOURCE PLAN CHALLENGES, OPPORTUNITIES AND RISKS

Based on the review of IRP drivers, the following summarizes IRP challenges and opportunities.

4.5.1 Compliance Challenges, Opportunities and Risks

Water

The water system is currently fully in compliance with drinking water standards and related Halifax Water LOS. The on-going implementation of the WQMP will ensure continued compliance with anticipated future drinking water standards. From the perspective of the IRP, this program is well established with the WQMP already in its second version. The uncertainty surrounding future water regulation is therefore relatively small. Hence the risk to Halifax Water from unforeseen future requirements is also small.

Wastewater

A number of the wastewater treatment facilities are currently not in compliance with permitted effluent requirements or with related Halifax Water LOS. The WSER will require upgrade of the three HHSP facilities to secondary treatment. This will occur within a 20-year timeframe. Halifax Water also owns and operates nine WWTFs (plus BLT which is already being upgraded) that discharge into limited capacity or sensitive receiving waters. It is expected that within the 30-year lifetime of the IRP that advanced nutrient control (N and P) will be required for these facilities. These future requirements are reasonably certain with only the extent and timing of the nutrient upgrades not fully specified.

Regulation of sanitary and combined sewer system overflows is at present limited to monitoring and reporting requirements as well as requirements for controlling gross debris through screening at selected outfalls. Future requirements for overflow management are

[28] *International Comparison of Water and Sewerage Service 2007 Report*, OFWAT, April 2007

quite uncertain at present and represent a significant risk for Halifax Water. Nonetheless, it is expected that within the 30-year lifetime of the IRP, future regulation will require system-wide overflow control likely with consideration of the nature of the receiving water body. The incorporation of Enhanced Overflow Control Program into the IRP along with the recommended development of the Wet Weather System Plan, the I/I pilot program among other planned activities mitigates this future risk.

Stormwater

Halifax Water owns and operates only a portion of the storm drainage system. Joint responsibility for managing storm drainage also lies with the Province, HRM and individual property owners. At present, there is no clear regulatory driver nor has Halifax Water needed a LOS. Future stormwater regulation is however expected to consider stormwater quality. The timing and nature of future requirements are quite uncertain and may represent a risk to Halifax Water. At the same time, climate change will increasingly impact storm drainage systems and will require adaptation strategies. This also represents a significant risk to Halifax Water in the design and operation of its drainage facilities. It is for this reason that the IRP has recommended two scoping studies addressing the likely direction of future stormwater regulation and a climate change assessment examining the impact of future climate modifications of storm drainage as well as the wastewater and water systems.

4.5.2 Asset Renewal Challenges, Opportunities and Risks

Halifax Water currently has over $ 6.6 billion in assets under management in three asset systems – water, wastewater and stormwater. The review of asset renewal expenditures based on the Five-Year Capital Plan indicated that the current program is underfunded. (See Volume 3 Appendix E) The recently completed review of asset management indicated a number of programmatic challenges including a lack of basic asset data and information systems (See AMA Report).

Two major uncertainties were associated with the asset renewal assessment. The lack of asset condition data meant that a surrogate approach using industry standard asset service life had to be employed to determine the intensity of renewal efforts. The approach was the best available but did not consider the actual condition of existing assets or provide the means based on Halifax data to forecast the actual service life of various assets. In turn this introduced uncertainty and risk into the asset renewal analysis.

The lack of meaningful industry benchmarks also presented challenges. Benchmark data are available largely for linear assets. There is scarcity of any data regarding accepted renewal rates for point assets such as pumping stations and treatment facilities. More critically, asset renewal in North America and parts of Europe has been underfunded resulting in misleading benchmark data based on potentially unsustainable levels.

Accordingly, the IRP undertook the development of an Enhanced Asset Renewal Program beyond that presented in the Five-Year Capital Plan. The program was based

on the concept of replacing of assets once they reach their service life and was applied uniformly to virtually all assets other than unique facilities such as dams. Dams and some other unique facilities such as water storage were evaluated on a case-by-case basis and appropriate replacement decisions made. This approach is further discussed in Section 5 and in Volume 3 Appendix E.

The Enhanced Asset Renewal Program presented in the IRP, satisfied the immediate need for a systematic approach used to estimate future asset renewal capital requirements. It is not a substitute for the AMA program. It will however provide short-term direction until the AMA implementation is sufficiently advanced.

4.5.3 Growth Challenges, Opportunities and Risks

In the period to 2046, the residential population of Greater Halifax is expected to grow by over 150,000 persons with a proportionate increase in employment.

The baseline or medium growth scenario prepared by HRM Planning was used to assess future servicing requirements for the water and wastewater systems. Based on current practice, it was assumed that extensions to the stormwater system would be managed as part of the local development process. The major growth related risk therefore was the uncertainty associated with the level of growth. This in turn influences capital expansion requirements and timing for both the water and wastewater systems. In general, there was a belief on the part of HRM Planning staff that the baseline (medium) projection was reasonable with uncertainty increasing somewhat in the later period of the 30-year forecast. In order to address the uncertainty, the sensitivity of the short-listed alternative resource plans to higher and lower growth rates was evaluated.

4.5.4 Other Challenges, Opportunities and Risks

In addition to the above driver specific challenges, opportunities and risks there are a number of particularly risks that should be considered in IRP implementation. They include:

- The IRP recommendations may change moving forward as a result of more extensive studies and knowledge and as noted in Section 1, an adaptive management approach is the prudent path forward.
- The scope and cost of the recommended plan may grow once more studies are done. For example, the review of climate change impacts and the potential need to identify and implement adaptation strategies could have significant cost implications for the water and wastewater systems. Likewise, the stormwater quality study may identify additional improvements not currently included.
- Subsequent financial studies may reveal that the plan as laid out in the IRP may exceed affordability thresholds and if supplemental funding sources can't be found, more extended implementation schedules and/or reduced LOS might have to be considered.

5. INTEGRATED RESOURCE PLAN DEVELOPMENT AND EVALUATION

5.1 PURPOSE

The purpose of this report Section is to present the formulation of alternative resource plans and their evaluation leading to the selection of a Recommended IRP. All costs presented in this Section are 30-year NPV other than Tables 5.2 and 5.3, which are in $2012.

5.2 RESOURCE PLAN DEVELOPMENT PROCESS

The formulation and evaluation of the alternative resource plans was a multi-step iterative process involving the Halifax Water technical team, comprised of staff and consultants, in collaboration with the Tellus team. Results from this process were presented to the Stakeholders Group at key points as presented in Section 2 of this report. Figure 5.1 presents an overview of the IRP alternative resource plan development.

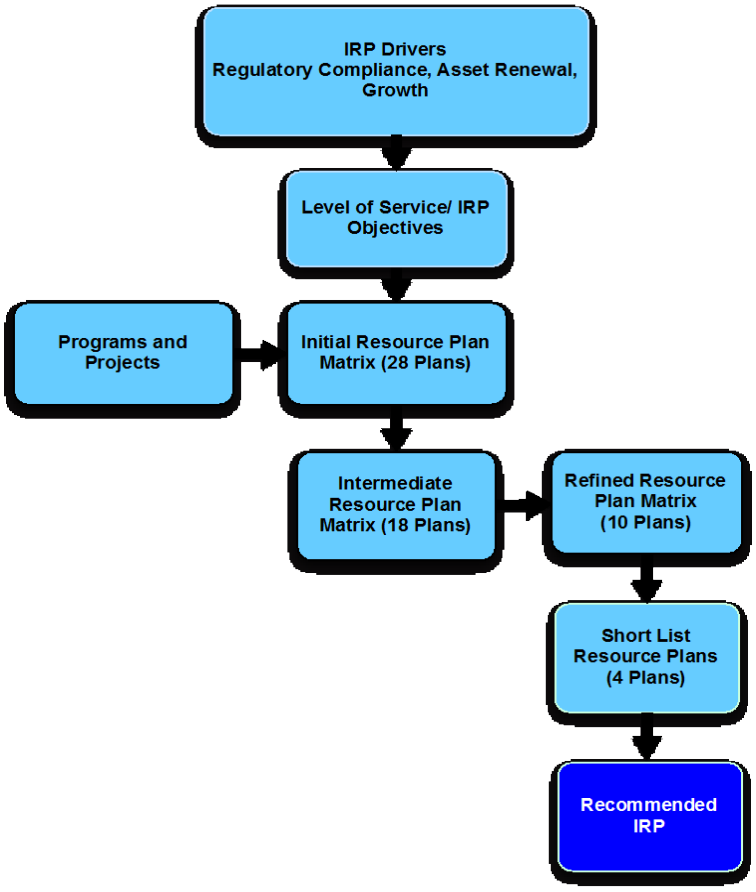


Figure 5.1 IRP Objectives

The IRP drivers were already discussed in Section 4. The remainder of Section 5 presents each of the steps shown in Figure 5.1 starting with the development of IRP objectives.

5.3 IRP OBJECTIVES

Following the analysis of the IRP drivers presented in Section 4, fourteen specific IRP objectives were developed. The objectives were based on the current Halifax Water LOS as described in Section 3 and in Volume 1 Appendix C. The objectives reflect the current and anticipated compliance requirements (seven objectives) for the three infrastructure systems; optimal asset renewal requirements as well as a number of related issues addressing water and wastewater system reliability, adequate stormwater capacity, adaptability to climate change and energy efficiency (five objectives); and two growth related objectives addressing the need to extend servicing requirements and the requirement to manage flow capacity allocations. The specific objectives and related LOS are presented in Table 5.1.

Table 5.1 IRP Objectives

Driver	Objective	Infrastructure System	Existing Level of Service
Compliance	1. Meet Current Nova Scotia Environment WWTF Permit to Operate	Wastewater	• Number of public health and environmental infractions resulting in a written warning • Number of public health and environmental infractions resulting in a conviction • Percentage of wastewater treatment facilities meeting their discharge permit requirements (HW must own facility for one year to include as a measure)
	2. Meet Current Nova Scotia Environment WSP Permit to Operate	Water	• Adherence to five drinking water quality parameters presented in Halifax Water WQMP • Bacteriological tests (99.3% absence of Total Coliforms) • Customer satisfaction with drinking water quality • Number of public health and environmental infractions resulting in a written warning • Number of public health and environmental infractions resulting in a conviction • Percentage of water supply plants meeting permit water quality requirements
	3. Meet Current Overflow Compliance	Wastewater	• Number of CSO and SSO events per year
	4. Meet Future WWTF Compliance	Wastewater	• Refer to Objective 1 LOS (Table 5.1)
	5. Meet Future Drinking Water Compliance	Water	• Refer to Objective 2 LOS (Table 5.1)
	6. Meet Future Overflow Compliance	Wastewater	• Refer to Objective 3 LOS (Table 5.1)
	7. Meet Future Stormwater Quality Compliance	Stormwater	• No LOS specified at present

Table 5.1 IRP Objectives

Driver	Objective	Infrastructure System	Existing Level of Service
Asset Renewal	8. Implement Optimal Level of Asset Renewal	Water	• Customer satisfaction • Water service outages • Average call wait time • Water system leakage allowance • Asset renewal activity for selected asset classes
		Wastewater	• Customer satisfaction • Wastewater service outages • Average call wait time • Asset renewal activity for selected asset classes
		Stormwater	• Customer satisfaction • Asset renewal activity for selected asset classes
	9. Enhance the Reliability of Critical Water and Wastewater Assets	Water	• Customer satisfaction • Water service outages • Average call wait time
		Wastewater	• Customer satisfaction • Wastewater service outages • Average call wait time
	10. Ensure Existing Stormwater System Adequately Sized for Minor Storm Conveyance	Stormwater	• No current LOS
	11. Adapt to Future Climate Change	Water, Wastewater, Stormwater	• No current LOS
	12. Reduce Energy Consumption, Operating Costs and Greenhouse Gas Contributions	Water, Wastewater	• Energy demand reduction
Growth	13. Provide Regional Water, Wastewater and Stormwater Infrastructure Needed to Support Planned Growth	Water	• No current LOS
		Wastewater	• No current LOS
		Stormwater	• No current LOS
	14. Manage Flow Capacity Allocations	Water, Wastewater	• Water system leakage allowance • Number of I/I related private property inspections

The multiple IRP objectives, and where available, the associated LOS defined the purpose for the many programs and projects that were consolidated into the IRP. In some cases existing programs and projects were already developed and funded while in others program or funding enhancements were necessary or altogether new programs needed. The expenditures for a number of programs were already discussed under the Five-Year Capital Plan in Section 3. The next section presents a summary of the current programs and projects as well as programs and projects designed to fill the future needs identified through the analysis of drivers.

5.4 PROGRAMS AND PROJECTS

5.4.1 Current Programs and Projects

Existing Halifax Water projects and programs as well as new or refined programs and projects proposed through the IRP process were key ingredients in the preparation of the alternative IRP plans.

The existing projects and programs included in the IRP were obtained from three principal sources:

1. The Halifax Water Five-Year Capital Plan, which provided a projected capital budget of about $200 million for the period 2012 to 2017, was the first source. The individual projects were programmed into the IRP with the same timing as in the original Five-Year Capital Plan.
2. Projects, which in many cases were continuations of programs and projects initiated in the Five-Year Capital Plan period, were allocated to 2018 and beyond. This included about $410 million in additional projects that were further refined through the IRP as to both capital requirement and timing.
3. The RWWFP with an estimated cost of $645 million was also incorporated into the IRP. The projects originating in the RWWFP were incorporated into the IRP with the same timing and capital requirement as the RWWFP.

Table 5.2 summarizes the current programs. Current program and project details are presented in Volume 1 Appendix F.

5.4.2 Proposed Programs and Projects

In addition to the current programs and projects, a number of proposed projects and programs were developed. They are summarized in Table 5.3. Proposed program and project descriptions are presented in Volume 1 Appendix F.

The most significant new element introduced in the IRP was the Enhanced Asset Renewal Program, which developed a 30-year program for all asset systems and classes. This program incorporated the asset renewal expenditures in the final four years of the Five-Year Capital Plan (2013-2017).

The asset renewal program evaluation in the IRP was conducted in two steps. Initially, three levels of asset renewal were considered for all point and linear assets. The levels of asset renewal for point assets were:

- A – 0.8 x asset service life
- B – 1.0 x asset service life
- C – 1.2 x asset service life

The levels of asset renewal for linear assets were:

- A – Decreasing average asset life at end-of-period
- B – No change in average asset life at end-of-period
- C – Increasing average asset life at end-of-period

These levels (A to B to C) notionally corresponded to an increasing risk of not meeting LOS and IRP objectives. The first stage of the IRP analysis explored the above monolithic risk level for all asset systems (i.e. water, wastewater and stormwater) and all asset classes within each system (e.g. water – distribution mains).

Asset renewal requirements were generated using a proprietary asset renewal model. The asset renewal model evaluated the age of every asset at every model time step and then compared this age with service life of the asset. If the age in the time step exceeded the service life of the asset, the asset was replaced. Ideally, replacement decisions should be based on asset condition information not just on service life alone. In actuality, an asset management program would employ a range of interventions from repair through rehabilitation to extend asset service life rather than always replacing assets at their service life limits. However, given the limitations of available asset data (see Section 4), service life was used as a reasonable surrogate.

This analysis was carried out for each year of the 30-year planning period from 2013 to 2043. This provided a year-by-year asset renewal program cost, which was incorporated into the overall financial model.

The details of the asset renewal modeling procedures used to estimate the asset renewal costs are presented in Volume 3 Appendix E.

As is explained later in this Section, the initial and intermediate alternative resource plans used the A, B, C analysis described above. Later in the formulation and evaluation of alternative resource plans it was decided to use asset specific risk based renewal rules for each asset type. The resulting overall asset renewal strategy was designated as “composite” since it was formed from the individual asset strategies.

Table 5.2 Current Halifax Water Programs and Projects 2013 -2043

Program	Description	Capital ($2012)
Five-Year Capital Plan	• Years 2-5 (2013 -2017) of the Five-Year Capital Plan were included in the IRP	• $200.1 million
Capital Program Continuation	• Additional capital expenditures beyond 2017 for projects initiated in the Five-Year Capital Plan	• $410.4 million
Asset Management Assessment (AMA) Program	• Halifax Water in 2011 finalized the Asset Management Assessment (AMA). The AMA Project document recommended 22 initiatives to be implemented over five years (2012 – 2016) • 2013 -2017 included in Five Year-Capital Plan	• $ 3.0 million (2012-2016) • $ 13.6 million (2017-2043)
Wastewater Compliance	• Five-Year Capital Budget plus program continuation into Years 6-10 aimed at WWTF and overflow compliance	• $58.3 million current WWTF compliance • $37.3 million current overflow compliance
RWWFP	• RWWFP addresses future wastewater capacity to accommodate planned growth as well as offsetting the impacts of growth on overflows	• $645.3 million
I/I Program	• The Five-Year Capital Plan and the RWWFP contain a significant number of projects aimed at I/I reduction.	• $122 million
Energy Management Plan	• Through its newly launched Energy Management Program, Halifax Water has committed to creating and ensuring an on-going focus on sustainability and energy efficiency throughout all operating areas. This new program serves to define the goals, objectives, accountabilities, and structure for activities related to sustainability and responsible energy use. • 2013 -2017 included in Five-Year Capital Plan	• $ 2.4 million
Water Quality Master Plan	• The Halifax Water WQMP has been a key tool in establishing drinking water quality goals and setting a baseline for monitoring progress toward these goals. • 2013 -2017 included in Five-Year Capital Plan	• $ 0.6 million
Dalhousie Water Research Collaboration	• Halifax Water collaborates with Dalhousie University on water treatment research • 2013 -2017 included in Five-Year Capital Plan	• $ 4.2 million

The details of the Enhanced Asset Renewal Program as well as some other new programs shown in Table 5.3 are presented in Volume 1 Appendix F. In addition to these new and existing capital programs there are recommended changes to infrastructure master planning integrating the IRP into the business processes of Halifax Water. These recommended changes are discussed in more detail in Section 7 under the IRP Implementation Plan.

Table 5.3 New or Refined IRP Programs 2013-2043

Program	Description	Capital ($2012)
Enhanced Overflow Control	• New program to control selected (19 non-growth and 9 growth already considered in RWWFP) overflows to a uniform level of 10 overflows per average year. • Program is in addition to the RWWFP, which will offset the impact of growth on overflows.	$173.0 million
Enhanced WWTF Nutrient Reduction	• New program to control nutrient (N, P) discharges to sensitive or limited receiving waters at 10 WWTFs • Two options were considered: o Modified RWWFP - upgrade 9 WWTFs - Wellington, Frame, Mill Cove, North Preston, Aerotech, Middle Musquodoboit, Lockview-MacPherson, Uplands Park and Springfield Lake to LOT in addition to the BLT upgrade already under way o RWWFP - upgrade of 8 WWTFs plus BLT upgrade under way and in longer-term consolidate BLT into Herring Cove WWTF and Springfield Lake WWTF into Mill Cove WWTF as per RWWFP	Depends on option considered $207.9 million $230.6 million
WWTF Compliance Upgrades	• Additional projects beyond those in Five-Year Capital Plan for upgrading current WWTFs for compliance with Permit to Operate	$5.8 million
WSER HHSP Secondary Treatment Upgrade	• New program responding to Canadian Federal WSER program requiring upgrade of the 3 HHSP facilities to secondary treatment.	$287.0 million
Enhanced Annual Asset Renewal	• Enhanced -asset renewal based on - risk-based composite asset renewal program balancing failure consequences and renewal expenditures. The composite specifies an individual level of renewal for each asset category.	$1600 million
Water Transmission Main Replacement Program	• An enhanced program updated through the IRP that integrated transmission main replacement with growth related expansion requirements.	$126.0 million
I/I Pilot Program	• An enhanced program initiated under the Five-Year Capital Plan to develop Halifax-specific I/I sources, reduction feasibility and reduction costs data at a number of pilot sites.	$1.7 million
New Assessment Programs	• A new climate change assessment program intended to examine the impacts of climate change on Halifax Water current infrastructure, operations and future design requirements • A new stormwater quality assessment program designed to assess likely future stormwater quality management requirements	$0.7 million $0.3 million
New Planning Programs	• A number of new planning programs providing comprehensive input to future IRPs including: o Water Master Plan addressing the system needs for regulatory compliance, asset renewal and growth o Wastewater Master Plan addressing the system needs for regulatory compliance, asset renewal and growth o Wet Weather System Plan presenting demand reduction (I/I) and overflow control strategies as input to the Wastewater Master Plan o Lead Services Replacement Program o Water Efficiency Program	$3.8 million $3.8 million $14.3 million $2.3 million $2.9 million

5.5 IRP VARIATIONS

The exploration of a broad range of variations in the IRP had to be balanced with data limitations and with the practicalities of a compressed timeframe for IRP preparation.

The variations that were considered within the IRP were organized around the 14 objectives and the underlying LOS that were presented in Table 5.1.

Programs/projects presented in Tables 5.2 and 5.3 were incorporated into the 28 initial alternative resource plans. The programs and projects by IRP objective with timing fixed by the Five-Year Capital Plan were as follows:

- Objective 2 – Current Water System Compliance
- Objective 5 – Future Water System Compliance
- Objective 9 – Enhance System Security
- Objective 12 – Energy Reduction

The RWWFP projects and programs were designed to meet the demands of the HRM baseline (medium) growth scenario, which in turn dictated the timing of required system expansions. The programs and projects by IRP objective with timing fixed by the RWWFP were as follows:

- Objective 6 – Future Wastewater Overflow Compliance (Baseline Case)
- Objective 13 – Meeting Demands of Growth
- Objective 14 – Managing Flow Capacity Allocations

A number programs/projects proposed through the IRP were developmental and designed to establish the program scope and to prepare an appropriate business case indicating the nature and timing of future expenditures. The program scoping represented small expenditures with limited impact on the overall IRP fiscal requirements. The programs and projects by IRP objective with program development timing fixed were as follows:

- Objective 7 – Future Stormwater Compliance
- Objective 10 – Storm System Capacity
- Objective 11 – Adapt to Future Climate Change

A number of programs /projects did consider variations in timing implementation. These programs/projects were in all cases associated with wastewater compliance issues. The variations reflected the uncertainties in desired regulatory implementation timing. The exception is a number of current WWTF compliance related upgrades that were incorporated with timing fixed by the Five-Year Capital Plan. Some adjustments were made in the original Five-Year Capital Plan timing through discussions with Halifax Water staff. This was due to the advanced state of these projects. The programs/projects by IRP objective with implementation timing varied were as follows:

- Objective 1 – Current Wastewater Compliance (other than for projects within the Five-Year Capital Plan).
- Objective 3 – Current Wastewater Overflow Compliance.
- Objective 4 – Future Wastewater System Compliance.

As shown in Table 5.3, two variations were considered for nutrient reduction upgrading at the 10 WWTFs discharging to receiving waters with limited assimilative capacity. The WWTFs considered were: Aerotech, BLT, Fall River, Frame, Middle Musquodoboit, Mill Cove, North Preston, Springfield Lake, Uplands and Wellington. Under the option termed "Modified RWWFP" 9 of 10 WWTFs were upgraded to the limit-of-technology for nutrient (N and P) reduction. The BLT facility was already undergoing substantial upgrade, which was incorporated into this option. The timing of the upgrades other than BLT was as per the variations considered under IRP Objective 4 as shown in Table 5.4. Under the second option designated "RWWFP", 8 of 10 WWTFs were upgraded, the current upgrade of BLT satisfied short-term requirements while the consolidation of the remaining two – BLT and Springfield Lake as per the concept of the RWWFP satisfied long term requirements. The timing of the upgrades other than BLT was as per the variations considered under IRP Objective 4. The timing of the consolidations was fixed as per the RWWFP.

The RWWFP provided a baseline level of overflow control that offset the impacts of growth for only the 28 modeled overflows with tributary growth. This was termed "Baseline" overflow control. As noted previously, the timing of the Baseline was fixed by the RWWFP. A second level of overflow control addressing 31 overflows including 9 with baseline controls provided by the RWWFP was also developed as the Enhanced Program.

At present there is no regulatory requirement or associated timing that corresponds to the Enhanced Overflow Control Program. Hence, given these uncertainties, the Enhanced Program was incorporated with a fixed 30-year timing at the end of the IRP planning period.

A, B, C levels of asset renewal (Objective 8) were considered for both point and linear assets in the initial and intermediate resource plans. As was explained above and in Volume 1 Appendix F, these were converted into a composite plan for the refined and shortlisted plans.

5.6 PLAN ANALYSIS ASSUMPTIONS

The capital costs and change in operating and maintenance (O&M) costs associated with all alternative resource plans were entered into a financial modeling tool developed for the IRP. The IRP financial model facilitates data entry, enables calculation of the 30-year net present value (NPV), evaluation of the impact of the variations on the 30-year NPV, and can present capital and O&M costs by driver, objective, and asset system as well as

by period. An individual financial model was prepared for each plan. The principal inputs to the financial models were:

- Five-Year Capital Plan (Yrs. 2-5).
- Extended capital program (Years 6 and beyond) refined through the IRP.
- Asset renewal costs as per Five-Year Capital Plan (Yrs. 2-5) and IRP asset renewal modeling.
- Additional asset renewal costs determined by asset renewal modeling due to capital additions during planning period.
- RWWFP capital costs.
- Capital programs/projects proposed through the IRP (e.g. enhanced overflow control).
- Additional water and wastewater O&M costs associated with growth or systems upgrades.

The key financial model assumptions were as follows:

- A discount rate of 3% was applied to all capital expenditures and a discount rate of 1% was applied for all additional O&M costs. The discount rates were calculated as the difference between the current municipal borrowing rate of 5% and an inflation rate of 2% for capital projects estimated from an analysis of ENRCC[29] index changes for municipal construction projects and 4% inflation rate for O&M.[30]
- As previously noted, only years 2-5 of the Halifax Water Five-Year Capital Plan were incorporated in the financial models. The initial year 2012-2013 was considered already in process and was not included. Year 1 of the IRP financial analysis is 2013-2014.
- The expenditures associated with projects identified in the years beyond the Five-Year Capital Plan were distributed through the financial model through discussions with Halifax Water staff on priorities and programming.
- All capital projects where variations were considered in timing were allocated to the single year indicated in the variation.
- All capital expenditures developed during the IRP are stated as project costs and include a 1.6 multiplier to account for engineering, construction management, other incidental costs and a 25% estimating contingency. The details of the unit rates (e.g. cost per meter of pipe) and other aspects of the project costing

[29] *Construction Cost Index History,* Engineering News Record, July 2012
[30] *Creating a Sustainable Solution for Pennsylvania,* Governor's Sustainable Infrastructure Task Force, November 2008

procedures are presented in Volume 3 Appendix C. All capital costs presented for the RWWFP have been harmonized with regard to costing procedure used by the IRP. All capital costs are presented in $2012 using an ENRCC Index value of 9200.

- Additional (change in) O&M costs were developed using the procedures described in Volume 3 Appendices B and C. The costs account for labour, energy, and chemicals as well as such consumables as UV bulbs and membrane filter cartridges. Additional O&M costs for upgrade/expansion projects were started the year after the project was implemented.
- All programs/projects and O&M costs were allocated to one or more IRP objectives. The cost split among objectives was based on best professional judgment. The splits are recorded in the financial models presented in Volume 3 Appendix F.
- The Enhanced Overflow Control Program was allocated in total to Objective 6. The asset renewal costs arising from the asset renewal modeling were allocated to Objective 8. These program costs incorporated the Halifax Water Five-Year Capital Plan specific asset renewal projects. The RWWFP costs were allocated primarily to Objective 13 reflecting the need to offset the impacts of growth on the existing wastewater system. Some RWWFP costs were however allocated to Objectives 6 and 14.

5.7 PLAN FORMULATION AND EVALAUTION OVERVIEW

Considering the key drivers - regulatory compliance, asset renewal and growth - an initial set of 28 alternative resource plans were developed to meet the water, wastewater, and stormwater service needs of Halifax Water's service areas through to the year 2043. The initial plans reflected variations on the timing and nature of wastewater system compliance; levels of asset renewal investment, and the degree of overflow control.

The initial plans were evaluated in terms of their 30-year net present value (NPV) cost, their compliance timing, and their potential environmental and public health impacts. Based on this analysis, 18 intermediate plans worthy of further consideration were identified. Using a single composite asset renewal strategy, redundant intermediate plans were eliminated and 10 refined plans were developed. The 30-year NPV at this stage in the alternative resource plan development and analysis was similar for all resource plans. Based on environmental and public health impacts the 10 refined plans were further reduced to 4 short-list plans. A recommended plan was selected from the 4 short-list plans based on the benefits of nutrient control and the enhanced overflow control program.

An overview of alternative plan formulation and the changes in the plans as they went from the 28 initial plans to the Recommended IRP are shown in Figure 5.2.

5.8 INITIAL RESOURCE PLAN FORMULATION AND EVALUATION

5.8.1 Initial Resource Plan Formulation

The programs and program elements discussed in Section 5.4 were organized into 28 initial alternative resource plans. The 28 plans provided the full span of variations in the implementation of programs and program elements. Table 5.4 presents the variations incorporated in the development of the initial alternate resource plans.

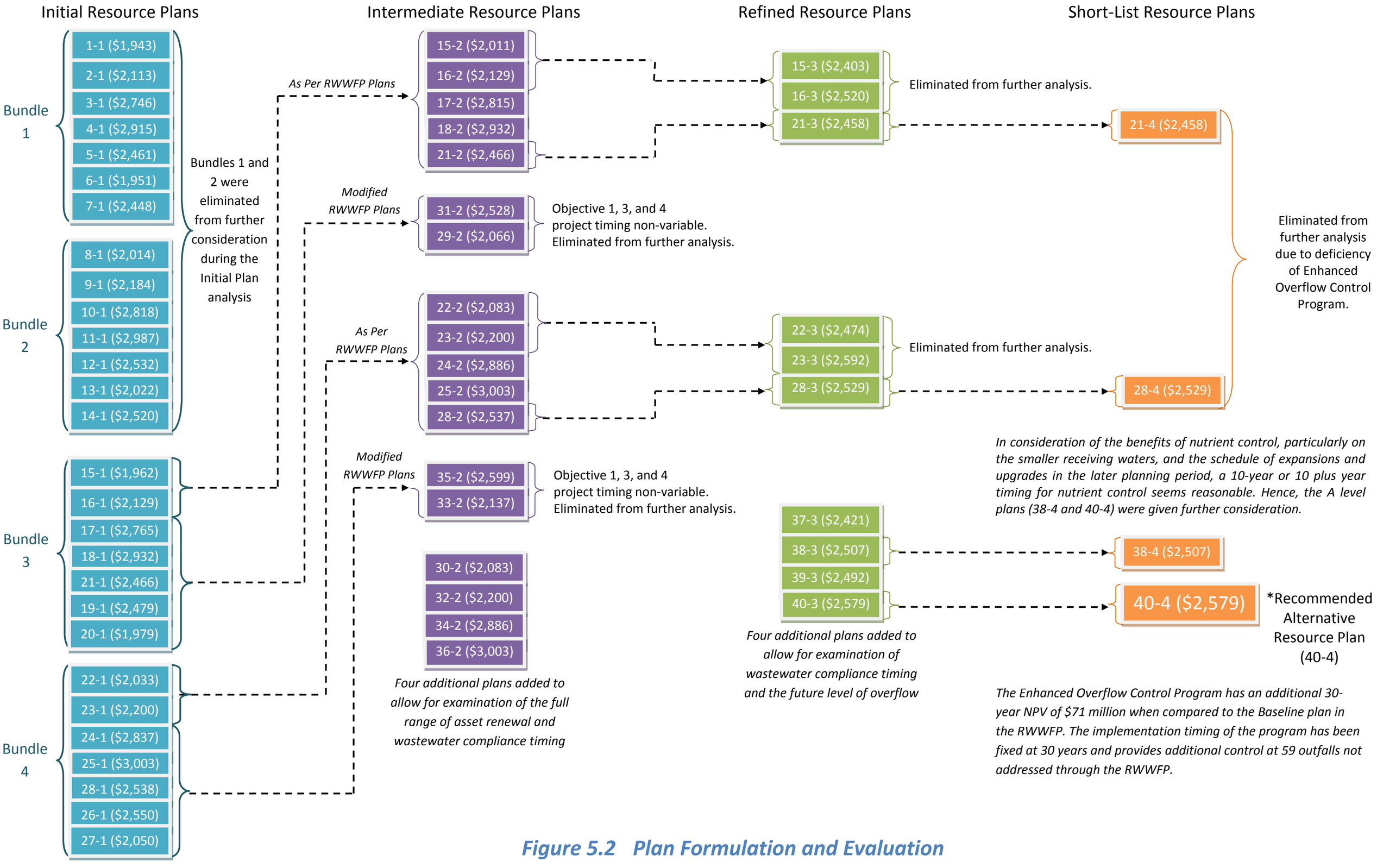


Figure 5.2 Plan Formulation and Evaluation

Table 5.4 Initial Alternative Resource Plan Variations

Driver	Objective	Infrastructure System	Variation
Compliance	1. Meet Current Nova Scotia Environment WWTF Permit to Operate	Wastewater	Time frame to implement current compliance requirements A – 3 years, B – 5 years, C – 7 years
	2. Meet Current Nova Scotia Environment WSP Permit to Operate	Water	Currently in full compliance No variation considered
	3. Meet Current Overflow Compliance	Wastewater	Time frame to implement current compliance requirements A – 5 years, B – 10 years, C – 15 years
	4. Meet Future WWTF Compliance	Wastewater	Time frame to implement future WSER compliance requirements for HHSP facilities A – 20 years, B – 20 years, C – 30 years Time frame to implement future nutrient compliance requirements for WWTFs discharging to limited or sensitive receiving waters A – 10 years, B – 20 years, C – 30 years Nutrient reduction strategy Option 1 – Upgrade 9 WWTFs plus BLT upgrade already under way – designated "Modified RWWFP" Option 2 – Upgrade 8 WWTFs plus BLT upgrade already under way (interim) and divert Springfield Lake and BLT WWTFs (long-term) as per the RWWFP – designated " RWWFP"
	5. Meet Future Drinking Water Compliance	Water	Implementation within 5 years as per the HW Five-Year Capital Plan
	6. Meet Future Overflow Compliance	Wastewater	Option 1 – "Baseline" program was based on the RWWFP and utilized RWWFP timing set by growth demands Option 2 – "Enhanced" program included additional overflow control that incorporated RWWFP measures plus additional controls. The Enhanced program employed RWWFP timing for the RWWFP recommended measures and a 30-year implementation for the enhanced measures developed through the IRP.
	7. Meet Future Stormwater Quality Compliance	Stormwater	Implementation timing of 3 years is for stormwater quality program development

Table 5.4 Initial Alternative Resource Plan Variations

Driver	Objective	Infrastructure System	Variation
Asset Renewal	8. Implement Optimal Level of Asset Renewal	Water, Wastewater, Stormwater	Three levels asset renewal were considered for point assets A – 0.8 x asset life B – 1.0 x asset life C – 1.2 x asset life Three levels of asset renewal were considered for linear assets A – Decreasing average asset life over period B – No change in average asset life over period C – Increasing average asset life over period
	9. Enhance the Reliability of Critical Water and Wastewater Assets	Water, Wastewater	Time frame to implement water system security program is based on Five-Year Capital Plan modified through the IRP
	10. Ensure Existing Stormwater System Adequately Sized for Minor Storm Conveyance	Stormwater	Implementation timing of 10 years is for stormwater capacity evaluation program development
	11. Adapt to Future Climate Change	Water, Wastewater, Stormwater	Implementation timing of 3 years is for HW climate change program development
	12. Reduce Energy Consumption, Operating Costs and Greenhouse Gas Contributions	Water, Wastewater	Time frame to implement energy reduction projects is based on the Energy Management Plan as presented in the Five-Year Capital Plan
Growth	13. Provide Regional Water, Wastewater and Stormwater Infrastructure Needed to Support Planned Growth	Water, Wastewater, Stormwater	Timing for wastewater projects/programs as per RWWFP designed to meet demands of baseline growth; timing for water projects/programs as laid out in IRP Financial Model; no regional level stormwater projects/programs are anticipated for growth
	14. Manage Flow Capacity Allocations	Water, Wastewater	Timing as per RWWFP designed to manage demands of baseline growth

The initial alternative resource plan matrix is presented in Table 5.5 for the 28 initial plans. In order to aid presentation and discussion, the plans were organized into four bundles based on variations in the level of overflow control and on the variations to the RWWFP. The bundles are defined as follows:

- Bundle 1 – Modified RWWFP + Baseline Future Overflow Control
- Bundle 2 – Modified RWWFP + Enhanced Future Overflow Control
- Bundle 3 – Original RWWFP + Baseline Future Overflow Control
- Bundle 4 – Original RWWFP + Enhanced Future Overflow Control

Table 5.5 Initial Alternative Resource Plan Matrix

Bundle	Plan No.	Current WWTF	Current Overflow	Future WWTF CCME	Future WWTF Nutrient	RWWFP	Future Overflow	Asset Renewal
		Objective 1	Objective 3	Objective 4	Objective 4	Objective 4, 6 & 13	Objective 6 & 13	Objective 8
1	1-1 to 7-1	Variable				Modified	Baseline	Variable
2	8-1 to 14-1	Variable				Modified	Enhanced	Variable
3	15-1 to 21-1	Variable				RWWFP	Baseline	Variable
4	22-1 to 28-1	Variable				RWWFP	Enhanced	Variable

Note:
See Table 5.8 for detailed variation between the initial alternative resource plans.

5.8.2 Initial Plan Financial Evaluation

The results of the financial model analysis for the 28 initial alternative resource plans are summarized in Table 5.6 presenting the 30-year NPV value present of overall costs.

Table 5.6 Initial Alternative Resource Plan Financial Analysis

Bundle	Plan No.	Asset Renewal Level (Objective 8)	30 Year NPV $ million
1	1-1	C	$1,943
	2-1	C	$2,113
	3-1	A	$2,746
	4-1	A	$2,915
	5-1	B	$2,461
	6-1	C	$1,951
	7-1	B	$2,448
2	8-1	C	$2,014
	9-1	C	$2,184
	10-1	A	$2,818
	11-1	A	$2,987
	12-1	B	$2,532
	13-1	C	$2,022
	14-1	B	$2,520
3	15-1	C	$1,962
	16-1	C	$2,129
	17-1	A	$2,765
	18-1	A	$2,932
	19-1	B	$2,479
	20-1	C	$1,979
	21-1	B	$2,466
4	22-1	C	$2,033
	23-1	C	$2,200
	24-1	A	$2,837
	25-1	A	$3,003
	26-1	B	$2,550
	27-1	C	$2,050
	28-1	B	$2,538

Table 5.6 shows an overall variation in 30 year NPVs of about $1 billion (capital and O&M). As indicated in Table 5.6, Plan 25-1 with A Level compliance timing for Objectives 1, 2 and 4 and A level asset renewal, the unmodified RWWFP and Enhanced Overflow Control is the most expensive. Plan 1-1 with C Level compliance timing for Objectives 1, 2 and 4 and C level asset renewal, the Modified RWWFP and Baseline overflow control is the least expensive.

The impact of the drivers and program elements were subjected to the analysis of variations, which are explored further below.

IRP Driver

The IRP expenditures by driver for fully A, B and C plans with enhanced overflow control and the RWWFP (Plans 25-1, 28-1, 22-1 respectively) are presented in Figure 5.3. Asset renewal expenditures dominate. Total asset renewal program costs range from $1,801 million to $992 million for the thirty-year period. This corresponds to 60% of the expenditures associated with Level A, 55% for Level B and 49% for Level C.

The growth and compliance related expenditures show less variation in moving from the A to B to C levels.

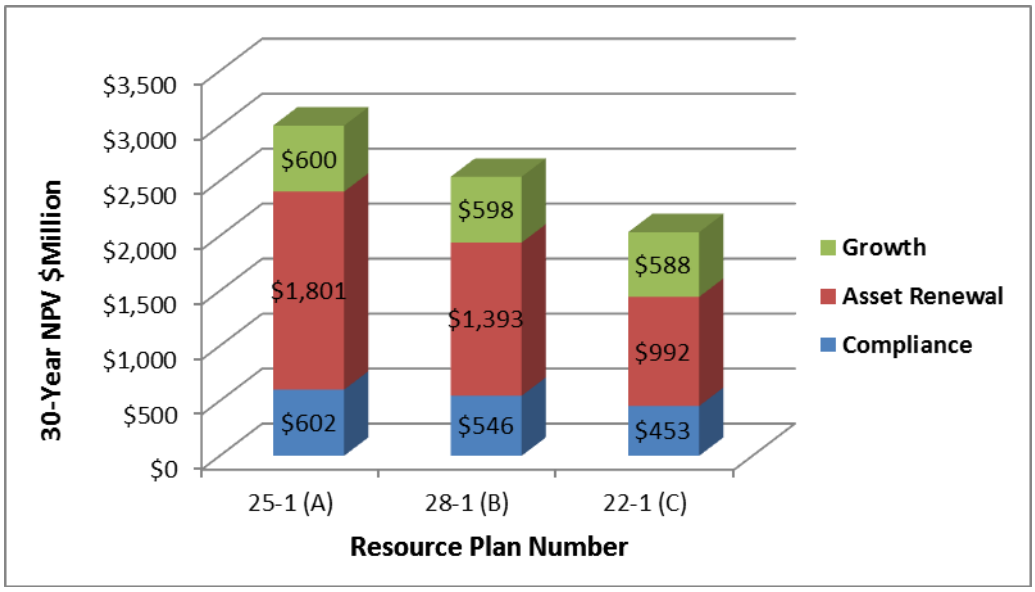


Figure 5.3 IRP Expenditure by Driver

RWWFP and Modified RWWFP for WWTF Nutrient Control

Comparison of the plans in Bundles 1 and 3 shows an approximately $19 million difference in 30-year NPV ($23 million in $2012 as per Table 5.3) associated with the two nutrient reduction strategies for WWTFs discharging to limited receiving waters (Modified RWWFP versus RWWFP). The Modified RWWFP (upgrading all 9 WWTFs plus BLT upgrade already under way) is the less expensive of the two alternatives. It has however the disadvantage that the discharges, although upgraded, are still maintained into the Nine Mile River from BLT WWTF and Lisle Lake from Springfield Lake WWTF. This is a less sustainable alternative. The IRP analysis of the costs of the nutrient reduction alternatives was carried out at a high level and the cost difference will likely shrink with a more detailed evaluation. Consequently, for purposes of further plan evaluation the Modified RWWFP option was abandoned eliminating Plans 1-1 to 14-1 (Bundles 1 and 2) from further consideration and concentrating the analysis on Plans 15-1 to 28-1 (Bundles 3 and 4).

Baseline and Enhanced Overflow Control

Comparison of the plans in Bundles 3 and 4 show a difference of $71 million in the 30-year NPV of costs or about 3.6 % of Plan 15-1 (2.4 % of Plan 25-1). This is associated with the Enhanced Overflow Control Program. As was previously noted, due to the significant uncertainty around both the required level of control and the timing of required implementation this program was allocated to the end of the planning period. Thus, the NPV of the program capital costs are heavily discounted and no O&M costs have been added since they would accrue beyond the end of the planning period.

For purposes of further analysis, both the Baseline and the Enhanced Overflow Control Program were carried forward to the intermediate plan analysis.

Asset Renewal

The Objective 8 asset renewal costs associated with each infrastructure system are presented in Figure 5.4.

For each level of asset renewal, the wastewater system costs are dominant. For example, the A level wastewater represents approximately 50% of the total asset renewal effort. The storm sewer systems are relatively new but still require some on-going investment. The water systems require an intermediate level of expenditure (38% of the total for Level A).

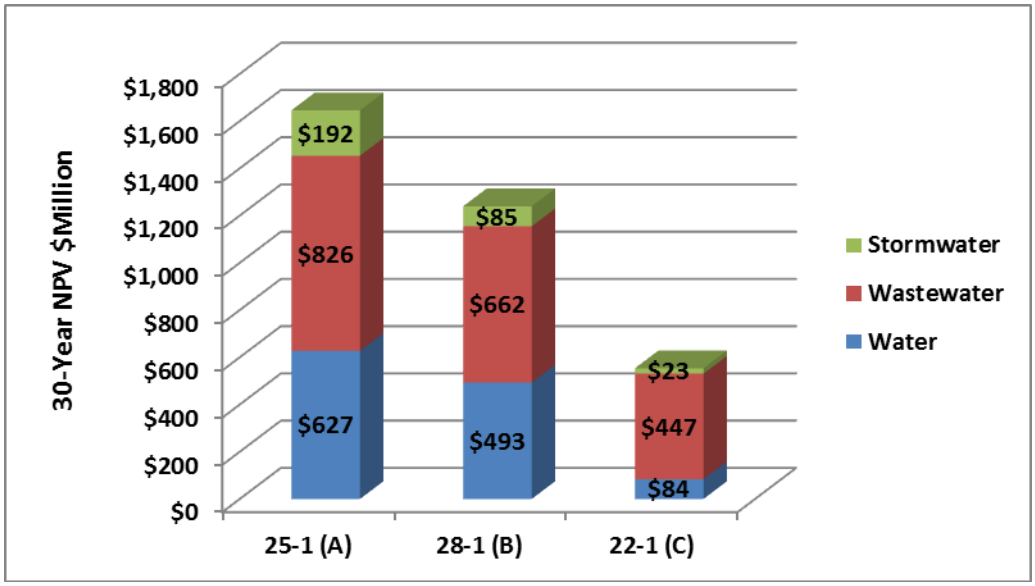


Figure 5.4 Objective 8 Asset Renewal Costs by Asset System ($million)

For purposes of further detailed analysis of asset renewal requirements the asset renewal variation was brought forward into the intermediate set of IRP plans.

Additional O&M Costs

The additional O&M costs associated with growth (water and wastewater systems) and enhanced compliance (wastewater system only) were estimated as part of the financial modeling. The 30-year NPV costs are presented in Figure 5.5 showing the O&M growth and compliance components. The compliance related costs change by about 41 % from level A to C. This reflects the impact of A and C level timings on the projects.

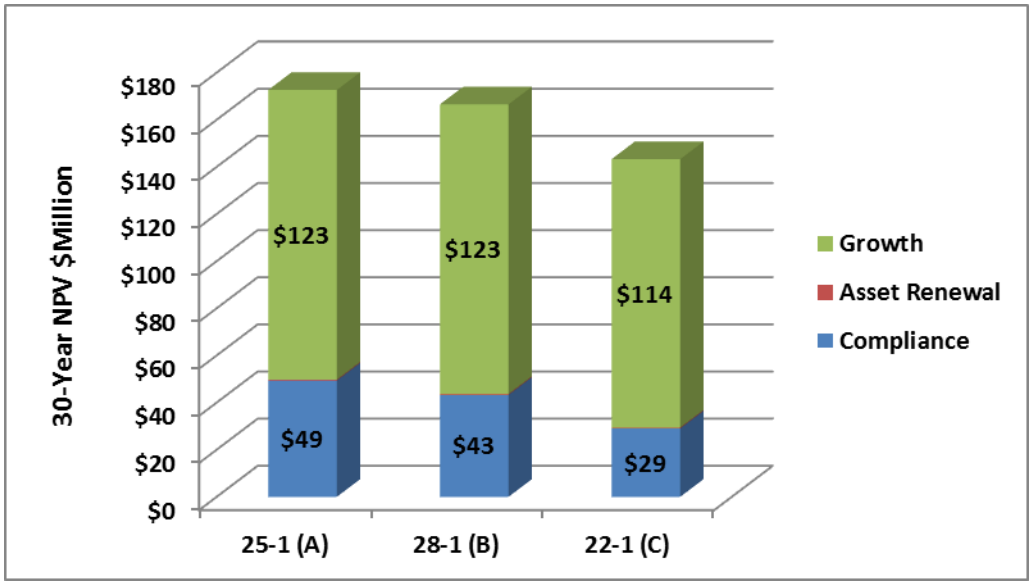


Figure 5.5 Additional O&M Costs

Wastewater Compliance Timing

The impact of wastewater compliance timing on the 30-Year NPV can be seen in Figure 5.6. The IRP expenditures for A, B and C plans with enhanced overflow control and the RWWFP (Plans 25-1, 28-1, 22-1 respectively) are presented in the figure. The major variation is associated with the implementation timing of the Objective 4 projects:

- Upgrade of HHSP facilities to full secondary treatment
- Upgrade of 8 WWTFs (excluding BLT which is presently under upgrade) discharging to limited receiving waters for nutrient reduction
- Consolidation of flows from the BLT and Springfield Lake WWTFs through recommended RWWFP (not included in this total but included as part of RWWFP in Objective 13).

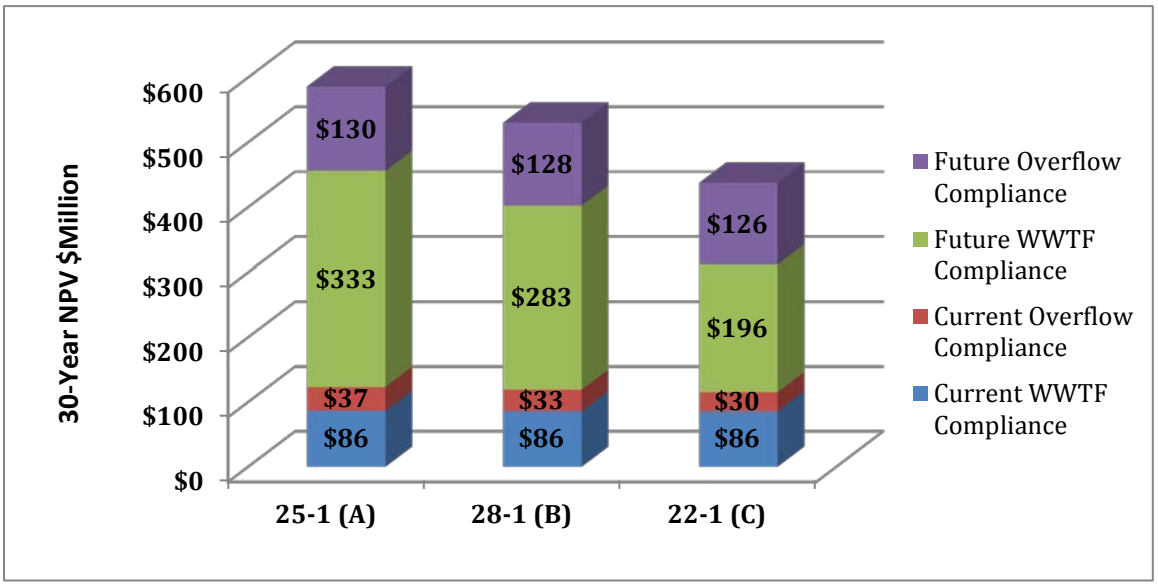


Figure 5.6 Wastewater System Compliance Timing

There is a 41% difference in the 30-Year NPV between C and A level of the future WWTF compliance objective (Objective 4) which corresponds to implementation of HHSP secondary treatment at 20 years and nutrient reduction at the 8 WWTFs (excluding BLT which is currently under upgrade) at 10 years for A level and implementation of HHSP facility upgrades and nutrient reduction at 30 years for C level. Otherwise, the impact of compliance timing for the current WWTF compliance program (Objective 1) and current overflow control program (Objective 3) is small, reflecting the relatively small differences in timing (3 to 7 years for current WWTF and 5 to 15 years for current overflow) and relatively small overall expenditures. Future overflow control (Objective 6) includes a number of projects (essentially the previously identified Enhanced Overflow Control Program), which is fixed at 30 years for all plans.

Recent re-analysis of the risk categories associated with the HHSP facilities (the risk category dictates the timing of upgrades), completed by the IRP team, using the WSER procedures has indicated that all HHSP facilities are considered medium risk requiring compliance by year 20 of the IRP. Accordingly, for purposes of the intermediate analysis the Objective 4 HHSP upgrades are all with fixed timing with costs allocated to year 20 (2032) and additional O&M costs starting in year 21 (2033).

5.8.3 Initial Alternative Resource Plan Environmental and Public Health Impact Analysis

The initial plan analysis also included a high level examination of the environmental and public health impact of the plan based on the timing of compliance of wastewater projects, the level of control associated with wastewater compliance options (e.g. Baseline versus Enhanced Overflow Control), and the WWTF compliance approach being considered for nutrient reduction (Modified RWWFP versus RWWFP).

Table 5.7 shows the colour coding used to describe the relative environmental and health impacts of the plan variations associated with wastewater compliance.

Table 5.7 Relative Environmental or Health Impact

Relative Impact Level	Colour Code	Comment
Elevated		Relatively elevated impact of implementation of WWTF or overflow compliance measures for IRP Objectives 1,3,4 with C timing Relatively elevated impact of Modified RWWFP (Objectives 4,6,13) which will maintain discharge (upgraded) to the limited receiving waters associated with the BLT (Nine Mile River) and Springfield Lake (Lisle Lake) WWTFs Relatively elevated impact of Baseline overflow control program associated with RWWFP which controls only the growth impacted overflows to approximately the current level
Medium		Relatively moderate impact of implementation of WWTF or overflow compliance measures for IRP Objectives 1,3,4 with B timing
Low		Relatively low impact of implementation of WWTF or overflow compliance measures for IRP Objectives 1,3,4 with A timing Relatively low impact of RWWFP (Objectives 4,6,13) which will consolidate the BLT (Nine Mile River) and Springfield Lake (Lisle Lake) WWTF discharges and redirect them to salt water based receivers Relatively low impact of Enhanced Overflow Control Program which adds overflow controls including those addressed in the RWWFP to achieve 10 overflows per year in an average rainfall year at selected overflow locations.

Table 5.8 shows the relative impacts for the 28 initial plans. In general, the plans with deferred compliance timing and elevated relative levels of environmental and health impact were lower cost for a given level of asset renewal. For example, comparing Plan 3-1 with Plan 4-1 (both A level asset renewal) shows that for $169 million in 30-year NPV, the relative environmental and health impact levels for Objectives 1, 3, and 4 are improved as the plans move from C level to A level.

Table 5.8 Initial Alternative Resource Plans Impact Analysis

Bundle	Plan No.	30 Yr. NPV $million	Current WWTF	Current Overflow	Future WWTF CCME	Future WWTF Nutrient	RWWFP	Future Overflow	Asset Renewal
			Objective 1	Objective 3	Objective 4	Objective 4	Objective 4, 6 & 13	Objective 6 & 13	Objective 8
1	1-1	$1,943	C	C	C	C	Modified	Baseline	C
	2-1	$2,113	A	A	A	A			C
	3-1	$2,746	C	C	C	C			A
	4-1	$2,915	A	A	A	A			A
	5-1	$2,461	A	A	B	B			B
	6-1	$1,951	B	B	C	C			C
	7-1	$2,448	B	B	B	B			B
2	8-1	$2,014	C	C	C	C	Modified	Enhanced	C
	9-1	$2,184	A	A	A	A			C
	10-1	$2,818	C	C	C	C			A
	11-1	$2,987	A	A	A	A			A
	12-1	$2,532	A	A	B	B			B
	13-1	$2,022	B	B	C	C			C
	14-1	$2,520	B	B	B	B			B
3	15-1	$1,962	C	C	C	C	RWWFP	Baseline	C
	16-1	$2,129	A	A	A	A			C
	17-1	$2,765	C	C	C	C			A
	18-1	$2,932	A	A	A	A			A
	19-1	$2,479	A	A	B	B			B
	20-1	$1,979	B	B	C	C			C
	21-1	$2,466	B	B	B	B			B
4	22-1	$2,033	C	C	C	C	RWWFP	Enhanced	C
	23-1	$2,200	A	A	A	A			C
	24-1	$2,837	C	C	C	C			A
	25-1	$3,003	A	A	A	A			A
	26-1	$2,550	A	A	B	B			B
	27-1	$2,050	B	B	C	C			C
	28-1	$2,538	B	B	B	B			B

5.9 INTERMEDIATE PLAN DEVELOPMENT AND ANALYSIS

Based on the initial plan analysis described above, the following modifications were applied to the initial plans to develop 18 intermediate plans:

- Plans 1-1 to 14-1 corresponding to Bundles 1 and 2 (modified RWWFP Plans) were eliminated from further consideration as less environmentally sustainable.
- The timing for the HHSP facilities upgrades (Objective 4) was fixed at 20 years consistent with the most recent risk analysis.
- Four plans (19-1, 20-1, 26-1 and 27-1) were modified to create 4 new Intermediate Plans. The enhanced WWTF nutrient program (Objective 4) was changed to the same level (A, B or C) as Objective 1 and Objective 3 to produce a consistent level for all wastewater programs. These new plans were labelled 31-2, 29-2, 35-2 and 33-2 respectively.
- Four additional plans (30-2, 32-2, 34-2 and 36-2) were added to allow examination of the full range of asset renewal and wastewater compliance timing for the Baseline and Enhanced Overflow Control Plan groupings.

The 18 intermediate plans are presented in Table 5.9.

Table 5.9 Intermediate Alternative Resource Plans

Plan No.	30 Yr. NPV $million	Current WWTF	Current Overflow	Future WWTF Nutrient	Future Overflow	Asset Renewal
		Objective 1	Objective 3	Objective 4	Objective 6 & 13	Objective 8
15-2	$2,011	C	C	C	Baseline	C
16-2	$2,129	A	A	A		C
17-2	$2,815	C	C	C		A
18-2	$2,932	A	A	A		A
21-2	$2,466	B	B	B		B
29-2	$2,066	B	B	B		C
30-2	$2,411	C	C	C		B
31-2	$2,528	A	A	A		B
32-2	$2,870	B	B	B		A
22-2	$2,083	C	C	C	Enhanced	C
23-2	$2,200	A	A	A		C
24-2	$2,886	C	C	C		A
25-2	$3,003	A	A	A		A
28-2	$2,537	B	B	B		B
33-2	$2,137	B	B	B		C
34-2	$2,482	C	C	C		B
35-2	$2,599	A	A	A		B
36-2	$2,941	B	B	B		A

The table includes the 30-Year NPV values as well as the colour coded environmental and public health impacts associated with each alternative resource plan.

Table 5.9 shows an overall variation in 30 year NPVs of about $ 990 million (capital and O&M) with Plan 25-2 (with A level compliance timing and asset renewal and Enhanced Overflow Control) being the most expensive and Plan 15-2 (with C level compliance timing and asset renewal and Baseline overflow control) being the least expensive. In general, the plans with deferred compliance timing have higher relative levels of environmental and health impact. For example, comparing Plan 17.2 with Plan 18.2 (both A level asset renewal) shows that for a difference of $117 million in 30-year NPV, the relative environmental and health impact levels for Objectives 1, 3, and 4 are reduced from C level to A level. The Enhanced Overflow Control Program further reduces environmental impacts at an additional 30-year NPV cost of $71 million (Plans 22-2, 23-2, 24-2, 25-2, 28-2, 33-2, 34-2, 35-2 and 36-2).

Asset Renewal

The analysis already presented in Figures 5.3 indicated that asset renewal is the single most significant expenditure within the IRP. The approach to determining the appropriate level for asset renewal had to this point been based on a generalized level of asset performance designated A, B, C.

The refined alternative resource plans in the next analysis step were assembled using the single composite asset renewal strategy as discussed in Volume 1 Appendix F. After eliminating redundant plans, the 10 refined alternative resource plans were prepared and are presented in the next section.

5.10 REFINED ALTERNATIVE RESOURCE PLAN DEVELOPMENT AND ANALYSIS

The 10 refined alternative resource plans including the 30-year NPV values for the component asset renewal plan are presented in Table 5.10.

Table 5.10 Refined Alternative Resource Plans

Plan No.	30 Yr. NPV $ million	Current WWTF	Current Overflow	Future WWTF Nutrient	Future Overflow
		Objective 1	Objective 3	Objective 4	Objective 6 & 13
15-3	$2,403	C	C	C	Baseline
16-3	$2,520	A	A	A	
37-3	$2,421	B	B	C	
21-3	$2,458	B	B	B	
38-3	$2,507	B	B	A	
22-3	$2,474	C	C	C	Enhanced
23-3	$2,592	A	A	A	
39-3	$2,492	B	B	C	
28-3	$2,529	B	B	B	
40-3	$2,579	B	B	A	

Four additional plans (37-3, 38-3, 39-3 and 40-3) were added at this stage to allow for variation in future WWTF nutrient removal. Two each for the Baseline and Enhanced overflow control groups of plans.

The impact of wastewater compliance timing and future level of overflow control was examined. The following observations resulted from the analysis:

- The B level current compliance is perhaps the most realistic approach to the current WWTF compliance timing. Many of the compliance upgrade projects are already underway. Any new projects will require adequate time for engineering, design and construction. The five-year timeframe associated with B level current WWTF compliance is reasonable in this regard.
- The overall program cost for Objective 3 current overflow compliance is $47.7 million 30-year NPV of which approximately $3.6 million 30-year NPV is already identified as part of the Five-Year Capital Plan. The remaining projects are largely associated with a number of storage facilities and nine outfall and pump station screening projects. Given the proposed additional expenditures, these projects would benefit from the comprehensive Wet Weather System Plan, discussed in Section 3 that would incorporate aspects of the RWWFP, the I/I reduction program and the current overflow control program into an integrated wet weather control program. In order to allow time for plan preparation and program development,

the current overflow control program at the B Level corresponding to 10 years was felt to be reasonable.

- The difference in 30-year NPV based on the Baseline and Enhanced Overflow Control Programs (e.g. Plan 15-3 versus Plan 22-3) was $71 million. The Enhanced Overflow Control Program does further reduce environmental impacts for the additional cost.

At this stage in the alternative resource plan development and analysis, the 30-year NPV is similar for all plans. The differences largely lie in the level of environmental and public health impact.

Based on the analysis presented above, it was decided to short-list four of the refined plans. The analysis of the refined plans is discussed in the next section.

5.11 SHORT-LIST PLAN ANALYSIS

The four short-listed alternative resource plans are presented in Table 5.11. The NPV of cost difference between the most and least is $121 million over the 30-year period. This difference is comprised of approximately $71 million difference due to the Enhanced Overflow Control Program and a $50 million difference due to the compliance timing for the Enhanced Nutrient Removal Program.

Table 5.11 Short-Listed Alternative Resource Plans

Plan No.	30 Yr. NPV $million	Current WWTF	Current Overflow	Future WWTF Nutrient	Future Overflow
21-4	$2,458	B	B	B	Baseline
38-4	$2,507	B	B	A	
28-4	$2,529	B	B	B	Enhanced
40-4	$2,579	B	B	A	

The timing of the current WWTF compliance program and the current overflow control program has already been discussed under the refined plan analysis. The remaining decisions in connection with the short-listed plans are associated with the timing of nutrient control implementation and the level of future overflow control.

As far as nutrient control timing is concerned, there is a $50 million cost increase for a program with a 10-year timetable compared to a program with a 20-year timetable.

The expected benefits of the Enhanced Nutrient Removal Program by way of reductions in N and P loadings are shown in Figures 5.7 and 5.8. For illustrative purposes, the BLT and Mill Cove plants were not included in this analysis but would also have substantially reduced loadings with the Enhanced Nutrient Control Program. It should also be noted that operating permits for the WWTFs currently do not have total N limits.

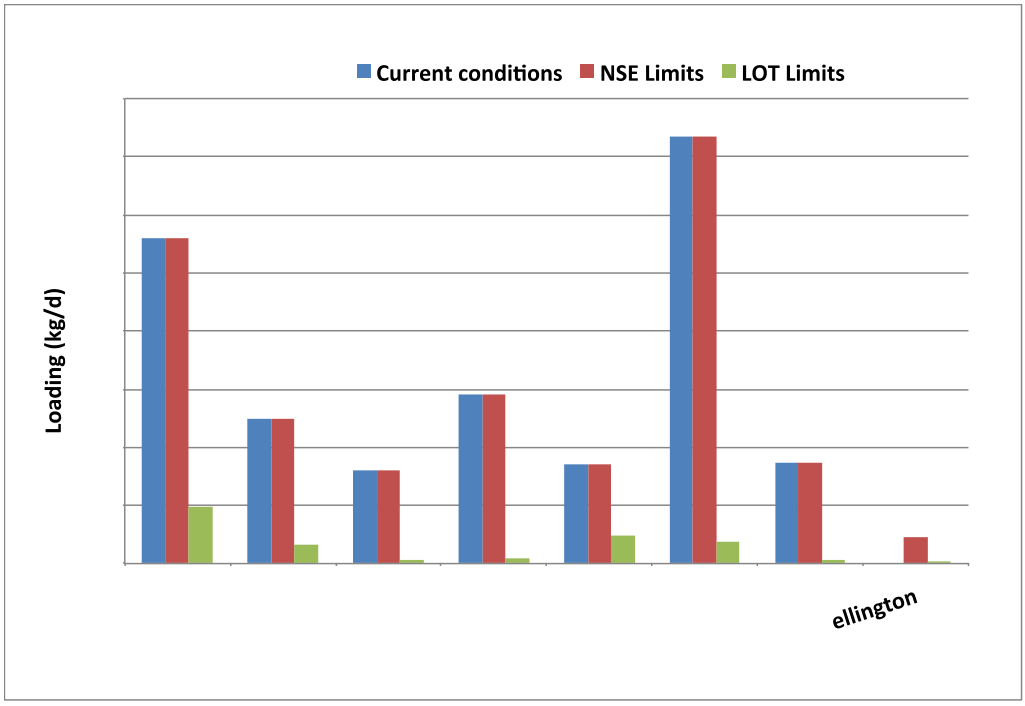


Figure 5.7 Eight Community WWTF Total P Reduction

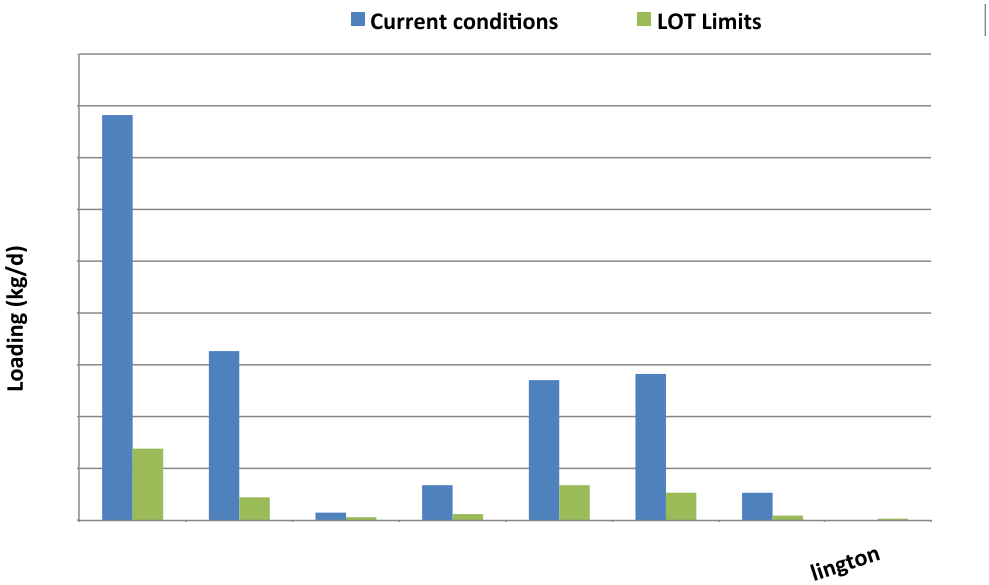


Figure 5.8 Eight Community WWTF Total N Reduction

Consideration should also be given the timing of other major WWTF upgrades and expansions. They include:

- There are about 25 plus current compliance WWTF projects programmed in the early part of the IRP to approximately 2018.
- Under the RWWFP, the expansion of the Herring Cove WWTF will be required to accommodate future growth between 2031 and 2036 and the expansion of the Dartmouth WWTF would be required between 2021 and 2026.
- The WSER will require upgrade of all three HHSP WWTFs to secondary treatment within 20 years (by 2032).
- The Aerotech WWTF will require expansion between 2031 and 2036.

In consideration of the benefits of nutrient control, particularly on the smaller receiving waters, and the schedule of expansions and upgrades in the later planning period, a 10-year or 10 plus year timing for nutrient control seems reasonable. Hence, the A level plans (38-4 and 40-4) were given further consideration.

The Enhanced Overflow Control Program has an additional 30-year NPV of $71 million when compared to the Baseline plan in the RWWFP. The implementation timing in this case has been fixed at 30 years. Figure 5.9 presents the annual average volumes of overflow associated with the Baseline and Enhanced Overflow Control alternatives. As can be seen, the annual overflow volume is reduced by over half. As importantly, the Enhanced Overflow Control Program provides additional control at 19 outfalls not addressed through the RWWFP.

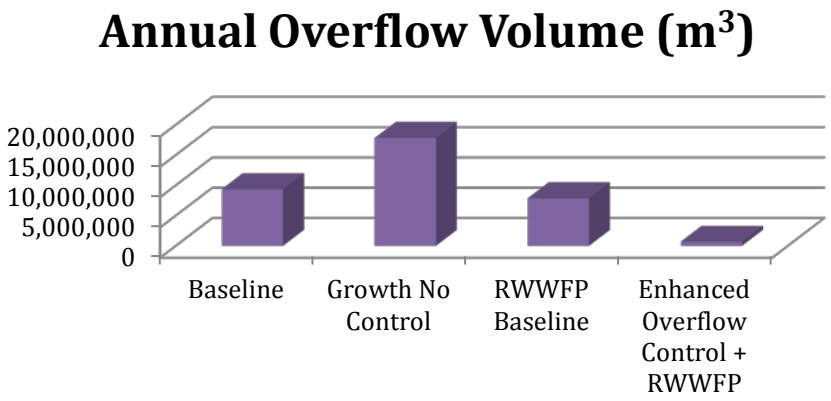


Figure 5.9 Enhanced Overflow Control Program Annual Volume

Consequently, Plan 40-4 with B level (5 year WWTF and 10 year overflow implementation) current wastewater compliance, A level future wastewater nutrient compliance (10 year implementation), the Enhanced level of future overflow control (30 year implementation) and the composite asset renewal program is the Recommended IRP.

6. RECOMMENDED IRP AND ANALYSIS

6.1 PURPOSE

The purpose of this report section is to present an overview of the Recommended IRP including plan benefits. The section also provides analysis of the Recommended IRP with respect to end-of-period value, demand reduction and growth assumptions. All costs are presented as 30-Year NPV unless otherwise noted.

6.2 RECOMMENDED IRP OVERVIEW

Based on the extensive analysis carried out through the IRP preparation a Recommended IRP was identified.

The Recommended IRP components and timing are presented in Table 6.1.

Table 6.1 Recommended IRP Components and Timing

IRP Driver	IRP Objective	Recommended IRP Strategy
Compliance	1. Meet Current Nova Scotia Environment WWTF Permit to Operate.	• Five years to implement current WWTF compliance requirements.
	2. Meet Current Nova Scotia Environment WSP Permit to Operate.	• Currently in full compliance. Continue current WQMP program and integrate into Water Master Plan.
	3. Meet Current Overflow Compliance.	• Ten years to implement current overflow compliance requirements.
	4. Meet Future WWTF Compliance.	• Twenty years to implement future WSER compliance requirements for three HHSP WWTFs. • Ten years to implement future nutrient compliance requirements for 10 WWTFs by upgrading 8 WWTFs (Wellington, Frame, Mill Cove, North Preston, Aerotech Middle Musquodoboit, Lockview-MacPherson Uplands Park) plus BLT (short-term upgrades) and consolidating Springfield Lake into Mill Cove WWTF and BLT (long-term consolidation) WWTFs into the Herring Cove WWTF as per the RWWFP.
	5. Meet Future Drinking Water Compliance.	• Five years for Five-Year Capital Plan projects.
	6. Meet Future Overflow Compliance.	• New program to control selected (19 non-growth and 9 growth already considered in RWWFP) overflows to a uniform level of 10 overflows per average year. • Program is in addition to the RWWFP, which will offset the impact of growth on overflows. • Thirty years to implement enhanced overflow control.
	7. Meet Future Stormwater Quality Compliance.	• Three years for stormwater quality program development.

Table 6.1 Recommended IRP Components and Timing

IRP Driver	IRP Objective	Recommended IRP Strategy
Asset Renewal	8. Implement Optimal Level of Asset Renewal.	• Enhanced asset renewal based on risk-based composite asset renewal program balancing failure consequences and renewal expenditures. The composite specifies an individual level of renewal for each asset category (See Volume 3, Appendix E).
	9. Enhance the Reliability of Critical Water and Wastewater Assets.	• Implement water system security program based on Five-Year Capital Plan modified through the IRP.
	10. Evaluate Existing Stormwater System Adequately Sized for Minor Storm Conveyance.	• Ten years for stormwater capacity evaluation program.
	11. Adapt to Future Climate Change.	• Three years for climate change program development.
	12. Reduce Energy Consumption, Operating Costs and Greenhouse Gas Contributions.	• Implement energy reduction projects based on the Energy Management Plan as per the Five-Year Capital Plan.
Growth	13. Provide Regional Water, Wastewater and Stormwater Infrastructure Needed to Support Planned Growth.	• Timing for wastewater projects/programs as per RWWFP; timing for water projects/programs as per IRP.
	14. Manage Flow Capacity Allocations.	• I/I, water efficiency and other demand reduction projects. • Timing as per RWWFP or as previously programmed in Five-Year Capital Plan.

The total 30-year NPV for the recommended plan inclusive of capital and O&M costs is $2,579 million.

The timing of expenditures (in $2012) is shown in Figure 6.1, which indicates significant expenditures around years 10, 20 and 30. This corresponds to the following projects:

- Year 10 – WWTF Nutrient Upgrades.
- Year 20 – WSER HHSP WWTF Upgrades.
- Year 30 – Enhanced Overflow Control Program.

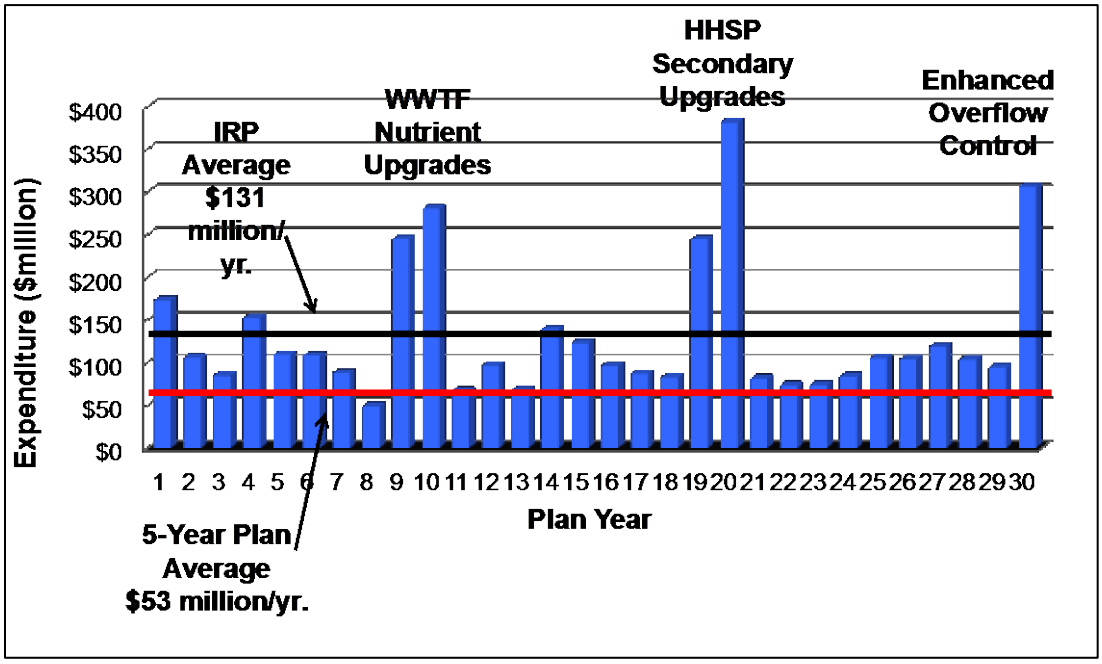


Figure 6.1 Recommended IRP Expenditures by Year ($2012 million)

Over the 30-year period the average expenditure under the Recommended IRP is $131 million/yr. This can be compared to the Five-Year Capital Plan with an annual average of $53 million/yr.

The expenditures by driver are shown in Figure 6.2. Approximately 54% of the expenditures are associated with asset renewal and the remainder split between growth (23%) and compliance (23%).

The details of the Recommended IRP expenditures are presented in the financial model output provided in Volume 1 Appendix H.

Figure 6.2 Recommended IRP Expenditures by Driver (30-year NPV $ million)

6.3 RECOMMENDED IRP ANALYSIS

The Recommended IRP was analysed to assess the impact of three factors:

- The potential benefits of water demand reduction and I/I reduction on the Recommended IRP.
- The level of asset renewal (A, B, C and composite) on end-of-period asset value.
- The population growth rate (high, baseline and low) on plan requirements.

6.3.1 Demand Reduction

One of the key requirements of the IRP Terms of Reference was the examination of demand reduction strategies for both the water and wastewater systems. The purpose was to explore the opportunities to incorporate such strategies as the focus of one or more of the resource plans. Unfortunately, systematic data that would allow a comprehensive examination of I/I reduction in particular were not available. Consequently, a high-level analysis of opportunities was carried out with a view to informing future integrated resource plan evaluation of the potential for incorporating demand reduction strategies. The focus of the analysis was the Dartmouth WWTF, which the RWWFP identified as requiring expansion due to growth.

I/I Programs

The IRP Recommended IRP contains significant investment in infrastructure projects with an I/I reduction focus. Some of these projects are carried forward from the Five-Year Capital Plan. These I/I related projects – including the projects specified in the RWWFP – represent approximately $95 million in capital expenditure. As well, there is $130 million based on the composite level of the renewal program in wastewater

system asset renewal projects. These projects will replace aging sewer infrastructure and will accordingly have an I/I reduction benefit.

Finally, the Recommended IRP includes $1.7 million for funding of the I/I pilot program. This is an initial investment and it is anticipated that it will be necessary to plan for a higher level of on-going funding particularly as the program is implemented. As previously noted, the I/I pilot and Wet Weather System Plan programs are described in Volume 1 Appendix F

Water Use

While population in the HRM has been increasing, water demand has declined a net amount (accounting for population growth) of approximately 1.5% per year over the last ten years. The decline in water demand is due to reduced residential and employment consumption. Figure 6.3 depicts the decline in urban core metered water consumption showing the change in the period from 2001 to 2012.

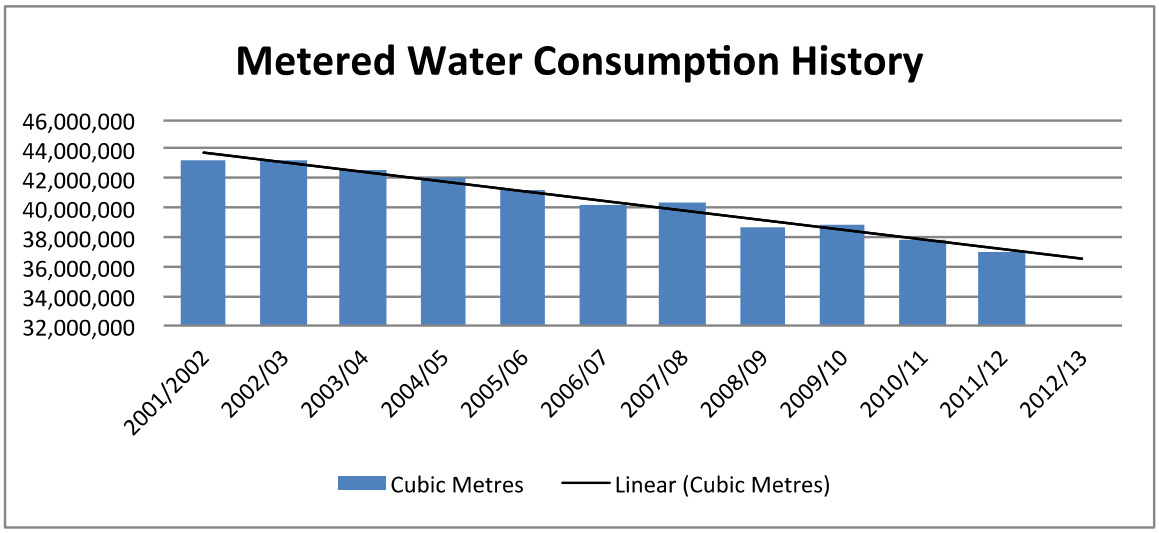


Figure 6.3 Urban Core Metered Water Consumption History

6.3.2 Demand Reduction Case Study

A full business case analysis of demand reduction was not feasible for this IRP due to limitations in available data. A case study approach was taken that examined the benefit gained from water and wastewater demand reduction at the Dartmouth WWTF. The Dartmouth WWTF was chosen since it will require expansion due to growth in the 2021-2026 timeframe as identified in the RWWFP.

The first step in the analysis was to estimate the flow components that comprise wastewater flow under both existing (2011) and future (2046) conditions. The 2046 flows were developed as the basis of analysis in the RWWFP and were used for this analysis. Figure 6.4 presents a schematic of the flow components for the Dartmouth WWTF.

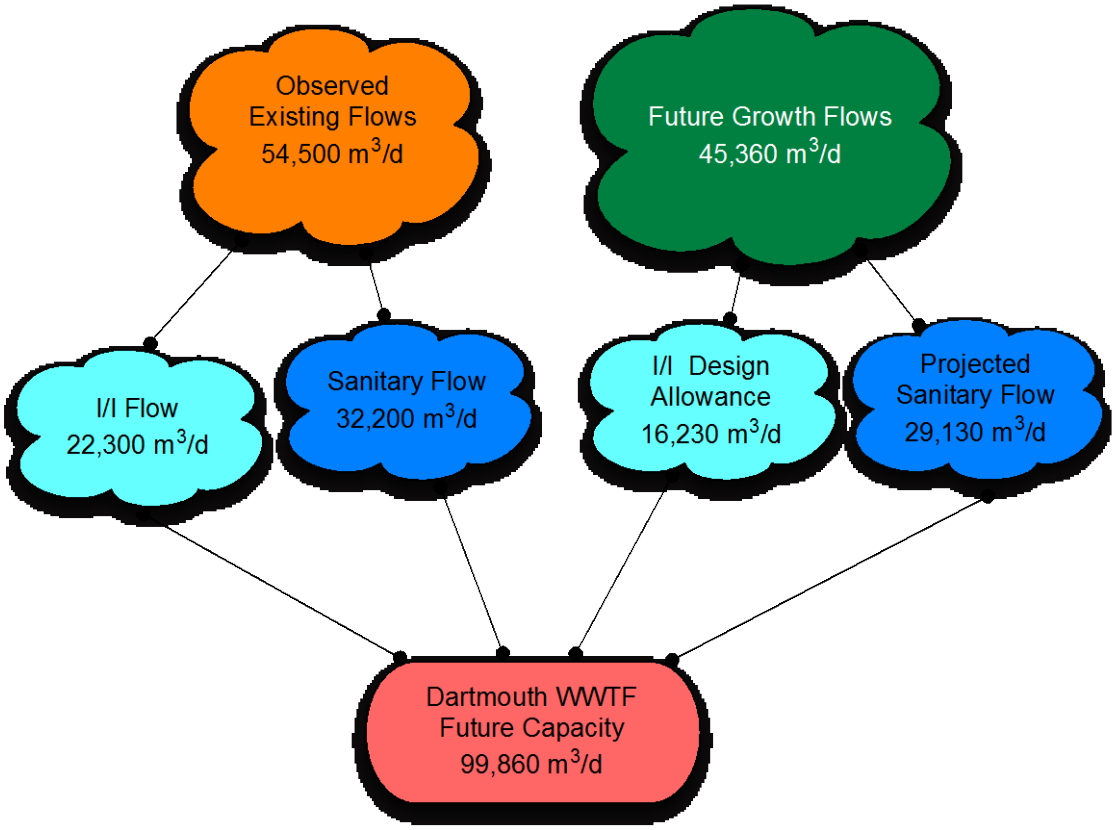


Figure 6.4 Dartmouth WWTF Flow Components

The flow components were determined through an analysis of available WWTF flow data and RWWFP modeling results. They do not account for system overflows as these flows will not reach the WWTFs.

The wastewater flows making up the total projected flows at the Dartmouth WWTF in 2046 have been differentiated in two ways:

- Existing and future flows.
- Sanitary and I/I flows.

Existing flows were measured at the WWTF reflecting the current contribution from the sewershed tributary to the Dartmouth WWTF. Future flows were projected based on design allowances and estimates of population and unit rates. Sanitary flows are comprised of wastewater flows from residential and employment sources while I/I flows are comprised of groundwater infiltration and wet weather inflow and infiltration. It is vital to distinguish among these various flow components as the extent of demand reduction, the method of demand reduction and the costs of demand reduction are all dependent on which component is under consideration.

- Demand reduction for the existing and future sanitary flows occurs through the on-going decline in water use whereby both residential and employment water demand and hence wastewater generation are reduced.
- I/I reduction pertains only to existing I/I flows. Future I/I flows are determined from design allowances that provide part of the margin of safety in wastewater systems design. This is particularly true of long-lived assets such as pipes with a 100-year longevity.
- For the purpose of the demand reduction assessment the following assumptions have been made:
  - Existing sanitary – 10% reduction in existing sanitary flows through water demand reduction. This is a conservative reduction based on retrofit of existing homes and purchase of new water efficient appliances.
  - Future sanitary – 30% reduction in sanitary flows through future water demand reduction.
  - Existing I/I – 30% I/I reduction in existing I/I flows. This is consistent with the targets set for King County Washington. [31]
  - Future I/I – Current design allowance.

Figure 6.5 shows the results of a capacity-demand analysis resulting in a somewhat longer timing (2033 versus 2026) for required expansion of the Dartmouth WWTF than currently being considered in the RWWFP. It nonetheless serves to illustrate the case study and the nature of offsetting capital costs.

The figure shows that the total projected flow at Dartmouth with the -future flow projected by the RWWFP would require a treatment capacity in excess of 99,860 m^3/d or when compared to the current capacity of 83,800 m^3/d an expansion of 16,060 m^3/d. With the demand reduction strategy applied, flows are reduced by about 16% to slightly below current rated capacity at 2046. This has the effect of deferring the expansion requirement to beyond the planning period of this IRP.

[31] *Initial Infiltration Inflow Reduction Project Alternatives Analysis Report,* King County Washington, April 2009

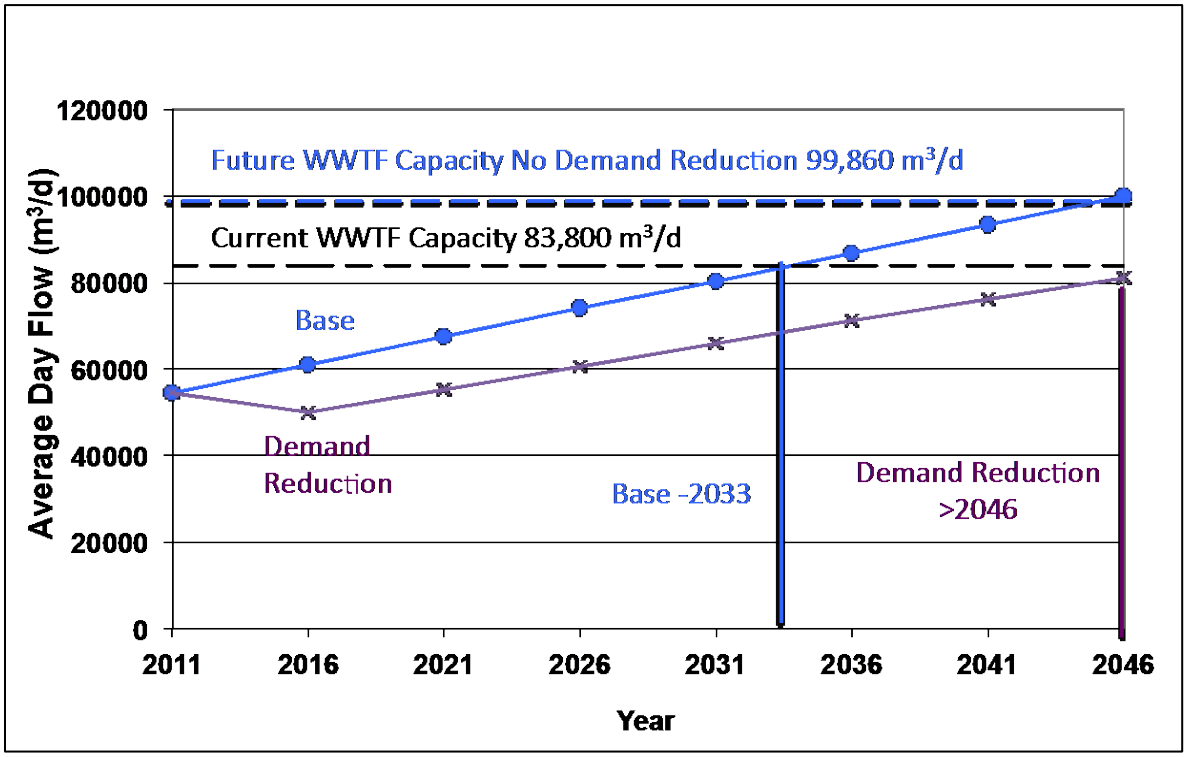


Figure 6.5 Dartmouth WWTF Demand Reduction

In order to assess the potential benefit to cost relationship associated with the demand reduction activity the following assumptions were made:

- The bulk of the cost of the 30% future water/wastewater demand reduction would be incorporated into the cost of the new dwellings and buildings (through low-flow appliances and fixtures) and would not impact on the IRP capital requirements.
- The cost of the demand reduction for existing water/wastewater usage would be small and would be largely achieved through existing public education programs The cost of the I/I program could not be determined precisely due to the absence of Halifax data. Instead a high-level analysis approach was based on the large scale, well resourced, multi-year program in King County, Washington.

The King County program examined a wide range of on-lot and public system measures to achieve flow reductions. The overall goal of the program was a reduction equivalent to 30% of existing I/I rates. The program considered numerous major expansions of wastewater collection, conveyance and treatment facilities. An analysis of the King County costing data for I/I reduction projects was carried out for the IRP and is presented in Figure 6.6. The costs were indexed from 2005 to 2012 using the ENRCCI. The costs include a construction cost multiplier accounting for engineering and contingencies among other factors.

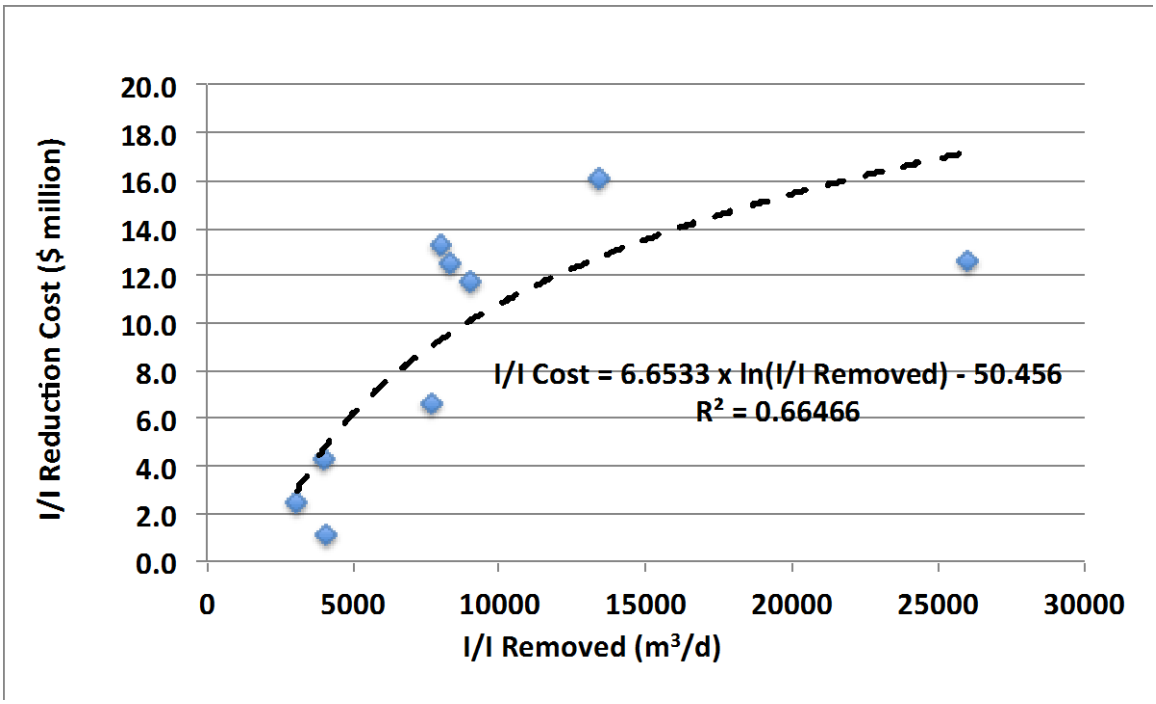


Figure 6.6 King County I/I Reduction Costs

The capital and operating cost reduction with both water demand and I/I reduction is about a NPV of $21.2 million to 2043. Using I/I reduction alone corresponds to about $10 million NPV in cost reduction by 2043.

The flow reduction of 30% in the existing I/I flow would cost about $8.4 million using King County data. This would provide a potential savings in NPV of $1.6 million ($10 million in savings - $8.4 million I/I program cost) for a future I/I reduction program. This of course must be tempered with the recognition that local conditions and costs may prove to be very different than King County and highlights the need for a comprehensive Halifax I/I program.

The case study findings support the importance of including a robust treatment of demand reduction strategies in regional wastewater planning, including the proposed Wet Weather System Plan and Wastewater Master Plan. The results of such analysis may significantly impact the Recommended IRP and should be incorporated when the IRP is updated.

Through a more comprehensive demand reduction analysis, Halifax Water will be able to assess the effectiveness and affordability of a range of demand reduction solutions for the wastewater system that may include additional system storage, sewer separation, sewer twinning, installation of deep storm sewers, and a range of solutions on the private portion of the network. The formal wet weather planning and I/I reduction pilot programs proposed in the current IRP will build on the preliminary

analysis undertaken by Halifax Water for developing a deep storm sewer installation program and the current stormwater inflow reduction (SIR) program in place to address private side contributions to the system. The pilot program will inform the development of an I/I program for inclusion and funding in later years.

6.3.3 End-of-Period Value

End-of-period (EOP) value analysis records the change in the value of all assets (water, wastewater and stormwater) over the course of the thirty-year planning horizon. It can be indicative of over and underinvestment in assets over the planning period particularly through the asset renewal program. Figure 6.7 presents an overview of the analysis methodology used to determine EOP in the IRP.

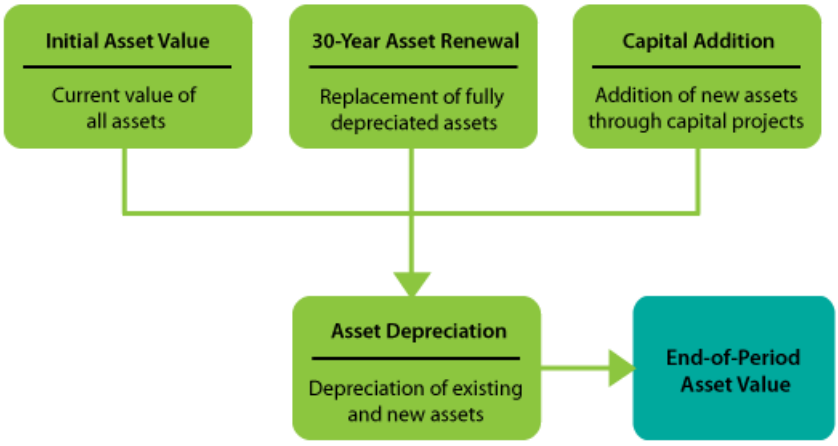


Figure 6.7 End-Of-Period Value Analysis

The major assumptions of the end-of-period value analysis were as follows:

- The starting value of the assets was determined from their replacement value, age profile (i.e. year of installation), and nominal service life. Straight-line depreciation was then used to estimate the current asset value. Volume 3 Appendix C presents details of the costing and service life while Volume 3 Appendix E presents the details of end-of-period value analysis.
- The 30-year asset renewal analysis was carried out as described in Volume 3 Appendix E. The analysis was carried out for four cases: A, B, C and composite levels and includes the renewal of assets added through the IRP capital program over the 30-year period.
- The capital expenditures over the 30-year period were based on the Recommended IRP.
- Straight-line depreciation was used throughout.

Table 6.2 shows the results of the end-of-period value analysis. The current asset value is estimated as $3,838 million ($2012). Comparison of the A, B and C levels of asset renewal show an approximately $600 million difference in end-of-period value across the levels. The A level asset renewal combined with the timing and scale of the Recommended IRP capital additions results in an increased end-of-period value of $1,037 million. In contrast, the C level asset renewal combined with the timing and scale of the Recommended IRP capital additions results in an increased end-of-period value of $419 million. End-of-period asset value increases in all cases for the wastewater system showing the impact of the large capital additions over the 30-year period. Water system end-of-period asset value increases only for the A level asset renewal while the stormwater system end-of-period value stays about the same for all cases with a decline of $128 million in asset value. The composite asset renewal program presents an end-of-period value a little less than the B level plus Recommended IRP capital program. The composite asset renewal is part of the overall Recommended IRP with an increase in end-of-period value of $729 million or about 19% of current asset value.

Table 6.2 End-Of-Period Value Analysis ($ million 2012)

Asset Renewal Level/Plan	Asset System	Starting Asset Value	End-of-Period Value	Change In Asset Value
A Level Asset Renewal Plus Recommended IRP Capital Expenditures	Water	$1,247	$1,379	+$132
	Wastewater	$1,774	$2,807	+$1,033
	Stormwater	$817	$689	-$128
	Total	**$3,838**	**$4,875**	**+$1,037**
B Level Asset Renewal Plus Recommended IRP Capital Expenditures	Water	$1,247	$1,243	-$4
	Wastewater	$1,774	$2,711	+$937
	Stormwater	$817	$689	-$128
	Total	**$3,838**	**$4,643**	**+$805**
C Level Asset Renewal Plus Recommended IRP Capital Expenditures	Water	$1,247	$1,127	-$120
	Wastewater	$1,774	$2,441	+$667
	Stormwater	$817	$689	-$128
	Total	**$3,838**	**$4,257**	**+$419**
Composite Asset Renewal Plus Recommended IRP Capital Expenditures (Recommended IRP Plan)	Water	$1,247	$1,161	-$86
	Wastewater	$1,774	$2,717	+$943
	Stormwater	$817	$689	-$128
	Total	**$3,838**	**$4,567**	**+$729**

6.3.4 Growth Rate Sensitivity

The water and wastewater system planning activities were based on the baseline or medium growth projections. A high level analysis of potential impacts and risks associated with changes in growth rates was carried out. This analysis was used to assess the variations in the Recommended IRP components.

The growth rates used in the analysis corresponded to rates developed for HRM [32] and are as follows:

- High – 1.14%.
- Baseline – 0.81%.
- Low – 0.47%.

Based on these growth rates as presented above, there is about a 53% increase in residential population to the growth horizon of 2046 under the high growth scenario relative to the baseline and a 27% decrease under the low growth scenario relative to the baseline. Assuming that the growth in future flows was proportionate to these population estimates, an analysis was carried out on the requirements for the WSP and WWTFs under these alternative growth scenarios. The smaller community facilities were not included since significant growth in these areas was not expected. Bennery Lake WSP and Aerotech WWTF serve the Airport and Aerotech Park and are subject to their own growth requirements associated with employment growth, and are not included in this analysis.

Table 6.3 presents the results of this high level analysis. The table shows that under the high growth scenario, the WSPs will not require expansion but towards the end of the 30-year planning period will require additional water supply because the supply safe yields will be exceeded. Continuing climate change, which may reduce supply, could exacerbate this. A new program has been proposed to assess impacts of climate change on all systems, update design standards, update operational practices, and integrate findings into Water and Wastewater Master Plans and Wet Weather System Plan. At the same time, these estimates do not account for the continuing reduction in water demand. Considering the reduction in demand is 1.5% after taking into account growth, this may well negate any impacts of an accelerated growth scenario. The low growth scenario would be comfortably within plant capacities and safe yields.

The WWTF expansion requirements are based on the combined impact of WWTF consolidation as well as growth as developed under the RWWFP. The impact of accelerated growth would be two-fold. It would move forward the expansion requirements at the Dartmouth and Herring Cove WWTFs and would increase the size of the required expansion. Again this analysis does not consider the impact of water

[32] *Employment Population and Housing Projections Halifax Regional Municipality: and Update,* Altus Group, July 2009

demand reduction, which could mitigate the expansion requirements and timing. The low growth scenario would delay the timing of expansion and reduce the expansion requirements.

The same conclusions can be applied to the distribution and collection system requirements. The required expansions for transmission mains or wastewater trunk sewers as well as storage and pumping facilities for both systems will either need to be increased and accelerated or reduced and delayed depending on whether the high or low scenario is applied.

Table 6.3 Sensitivity of Treatment Expansion Requirements to Growth Rate

Facility	Current Capacity	Current Flow/Demand (m^3/d)	Future Recommended IRP Capacity (m^3/d)	Future Baseline Growth Scenario Flow/ Demand (m^3/d)	Future High Growth Scenario Flow/ Demand (m^3/d)	Future Low Growth Scenario Flow/ Demand (m^3/d)	Facility Expansion Requirement
Lake Major WSP	94,000	40,000	90,000	63,000	~75,000	~57,000	• No expansion of WSP under baseline scenario required. • No expansion of the WSP required under high and low scenarios. • High scenario demand may exceed Lake Major safe yield of 65,900 m^3/d. Additional supply may be required.
J.D. Kline WSP	227,000	85,000	220,000	128,000	~151,000	~116,000	• No expansion of WSP under baseline scenario required. • No expansion of WSP required under high and low scenarios • High demand may exceed J.D. Kline safe yield of 145,500 m^3/d. Additional supply may be required.
Dartmouth WWTF	83,808	54,500	99,860	99,860	~115,000	~92,000	• Expansion required by 2021-2026 under baseline scenario. • Future WWTF capacity would need to increase under high scenario. Current expansion timing would need to accelerate. • Future WWTF capacity would decrease under low scenario. Current expansion timing could be delayed.

Table 6.3 Sensitivity of Treatment Expansion Requirements to Growth Rate

Facility	Current Capacity	Current Flow/Demand (m^3/d)	Future Recommended IRP Capacity (m^3/d)	Future Baseline Growth Scenario Flow/ Demand (m^3/d)	Future High Growth Scenario Flow/ Demand (m^3/d)	Future Low Growth Scenario Flow/ Demand (m^3/d)	Facility Expansion Requirement
Herring Cove WWTF	28,512	12,500	80,500	80,500	~102,00	~70,000	• Expansion required by 2031-2036 under baseline scenario • Future WWTF capacity would need to increase under high scenario. Current expansion timing would need to accelerate. • Future WWTF capacity would decrease under low scenario. Current expansion timing could be delayed.

At this stage the updated HRM Regional Plan is still under formulation and the current planning projections are an extrapolated estimate. Once these planning estimates are confirmed the water and wastewater functional plans should be reviewed and updated as needed. The sensitivity of the plans to growth should be re-evaluated at this point.

7. IRP IMPLEMENTATION PLAN

The Section presents the IRP Implementation Plan outlining the projects and programs making up the IRP in the 3, 10, 20 and 30-year timeframes and the master implementation schedule. The section also presents a high level view of IRP benefits, as well as discussing the incorporation of the IRP process into Halifax Water business planning. Finally, the section presents a series of recommendations with respect to LOS, programs and other aspects of water, wastewater and stormwater servicing. All costs are presented in $2012 unless otherwise noted.

7.1 RECOMMENDED IRP BENEFITS OVERVIEW

Implementation of the IRP will provide a wide range of benefits addressing the three drivers – regulatory compliance, growth and asset renewal. High-level statements of the benefits derived from the IRP implementation are presented in Table 7.1.

Table 7.1 Overview Recommended IRP Implementation Benefits

Driver	Benefits
Regulatory Compliance	1. Fully compliant wastewater system. 2. Continued fully compliant water system. 3. Enhanced environmental and public health through reduced overflows and WWTF loadings. 4. Continued high quality drinking water. 5. Fully meets LOS.
Asset Renewal	1. Fully functional water, wastewater and stormwater systems meeting their LOS at an acceptable risk and reasonable cost. 2. Provides risk-based prioritized asset renewal expenditures for all infrastructure systems. 3. Balanced capital and O&M expenditures.
Growth	1. Water, wastewater and stormwater systems meeting the servicing needs of planned growth. 2. Sustainable water, wastewater and stormwater systems. 3. Support for continued community vitality through growth and new opportunity. 4. Balanced system expansion needs with reduction in demand for services.

7.2 RECOMMENDED IRP EXPENDITURES 2013 – 2015

The three-year expenditures ($2012) from 2013 to 2015 associated with the Recommended IRP are presented in Table 7.2.

Table 7.2 Recommended IRP Expenditures 2013 -2015 ($2012 million)

Category	FY 2013	FY 2014	FY 2015	Total
Water	$28.2	$30.9	$32.3	$91.4
Wastewater	$129.2	$65.8	$44.3	$239.3
Stormwater	$2.5	$3.2	$3.0	$8.7
Enterprise Programs (1)	$13.5	$5.6	$4.8	$23.9
Total Expenditure	$173.4	$105.5	$84.4	$363.3
Five-Year Plan Capital Plan	**$90.7**	**$49.7**	**$29.9**	**$170.3**

Notes:

1. Enterprise programs include the SCADA Master Plan, Energy Management Plan, Asset Management Assessment as well as other enterprise-wide programs.

The Five-Year Capital Plan budget values have been included for reference purposes.

Under the Recommended IRP, proposed expenditures would more than double over the three-year timeframe. Nearly, $100 million of the total in both the Recommended IRP budget and the Five-Year Capital Plan is associated with major wastewater treatment upgrades at Aerotech, Eastern Passage and BLT, a major wastewater storage facility at Glendale Rd, JD Kline WSP upgrades and a number of water transmission main projects. An additional approximately $135 million of the Recommended IRP budget is associated with the proposed enhanced annual asset renewal program. The remainder consists of projects and programs with an approximate value of $128 million.

Current asset renewal expenditures based on the Five-Year Capital Plan are about $22.4 million/yr. with wastewater representing 44% of expenditures, water 48% and stormwater the remaining 8%. In contrast the proposed asset renewal program is about $45 million/yr. with wastewater representing 63% and water the remainder.

Asset renewal estimates, originating from the asset renewal model, project an expected level of investment for asset renewal based on a range of assumptions. These values, however, do not imply a level of understanding of where specifically the expenditures are required. A significant amount of additional effort will be required to identify the specific asset renewal priorities including implementing the Asset Management Assessment program and a number of activities related to asset inventory and condition assessment.

This increase in expenditure levels for the three-year period will be challenging. Major capital projects are already underway to varying degrees, as are a number of the other infrastructure projects. Any flexibility in timing and required expenditure would likely be associated with overall asset renewal and some of the other programs. The updated AMA program outlined in the “roadmap” is still emerging and currently relies on Halifax Water’s existing available resources. Even with accelerated implementation, it will

require at least 2 to 3 years to have adequate data and systems in place to obtain strong returns from scaled-up asset renewal expenditures.

The three-year outlook will be in large measure determined by funding availability. It expected that the Halifax Water capital planning process would determine the project/program priorities once funding levels have been established.

Other considerations with the first three years of the Recommended IRP include:

- Total program (i.e. planning, business systems improvements and improvements to administrative facilities) related expenditures correspond to about 8% of the overall three-year Recommended IRP expenditures. A significant fraction of this program cost is associated with improvements to the Cowie Hill Operations Facility.
- Additional O&M costs associated with treatment facility or pumping upgrades or expansions are relatively small in this period corresponding to about 1% of expenditures.

Details of all expenditures are presented in the Recommended IRP Financial Model in Volume 1 Appendix H.

7.3 RECOMMENDED IRP EXPENDITURES 2016 -2022

The expenditures for the period 2016 to 2022 are presented in Table 7.3

Table 7.3 Recommended IRP Expenditures 2016 -2022 ($2012 million)

Category	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	Total
Water	$27.9	$47.8	$72.2	$12.6	$14.3	$13.5	$54.0	$242.3
Wastewater	$61.9	$54.6	$30.9	$70.5	$30.2	$226.6	$220.5	$695.2
Stormwater	$14.9	$3.5	$1.6	$1.6	$1.6	$1.7	$3.2	$28.1
Enterprise Programs [1]	$4.7	$3.2	$3.2	$3.2	$3.0	$3.2	$2.6	$23.1
Total Expenditure	$109.4	$109.1	$107.9	$87.9	$49.1	$245.0	$280.3	$988.7

Notes:

1. Enterprise Programs refers to Halifax Water wide programs such as the SCADA Master Plan, the AMA Program and the IRP among others.

Under the Recommended IRP, proposed expenditures would be over $989 million in the 7-year period. Approximately $628 million of the total in the Recommended IRP budget is associated with major wastewater facility upgrades including the $183 million LOT upgrades at the 8 WWTFs plus BLT ($18.9 million) and implementation of a number of RWWFP projects. The 7-year water infrastructure budget is $242 million. Major projects include water transmission upgrades for capacity and system security enhancement,

additional storage facilities and a number of large-scale wind energy generation projects with value in excess of $48 million. The wind energy projects should offset energy costs and will proceed only where there is positive business case model. These cost offsets have not been included in the Recommended IRP financial modeling but will be considered as part of subsequent financial planning as a revenue source. The storm system has a single major (>$10 million) project associated with providing new sewerage for Springfield Lake.

The total capital program net of asset renewal costs is about $1,410 million or approximately $201 million/yr. on average. This substantially exceeds the present capital program based on the Five-Year Capital Plan and again presents challenges with regard to impact on rates, the availability of other funding sources, and the availability of Halifax Water institutional capacity to manage this project volume. The next step in implementation will be to examine the fiscal and practical impacts of the Recommended IRP, evaluate opportunities for external infrastructure funding, and assess the capital delivery resource needs (both internally and within the local consulting and contracting communities).

An additional approximately $349.2 million of the Recommended IRP budget is associated with the proposed asset renewal program. Approximately, 57% of the asset renewal effort is associated with the wastewater system while 34% is associated with the water system and 3% associated with the storm system. The remaining asset renewal effort is associated with enterprise system improvements. The average annual asset renewal expenditure over this period is $64.1 million/yr. This reduction compared to the first three-year period indicates that some of the present asset renewal backlog would have been addressed.

Other considerations with the period 2016 to 2022 of the Recommended IRP include:

- Total program (i.e. planning, business systems improvements and improvements to administrative facilities) related expenditures correspond to about 7.1% of the overall 2016 -2022 Recommended IRP expenditures. This includes a continuation of the asset management improvement program implementation.
- Additional O&M costs associated with treatment facility or pumping upgrades or expansions are still relatively small but increasing in this period corresponding to about 4.9 % of expenditures.

Details of all 2016-2022 expenditures are presented in Volume 1 Appendix H.

7.4 RECOMMENDED IRP EXPENDITURES 2023 -2032 AND 2033 -2043

The Recommended IRP expenditures for the periods 2023 to 2032 and 2033 to 2043 are presented in Table 7.4.

Under the Recommended IRP, proposed expenditures would be about $1,427 million in the 2023 to 2032 period and $1,143 million in the period 2033 to 2043 or average expenditures of about $142 million/yr. and $114 million/yr. respectively.

Approximately $1,125 million of the total in the Recommended IRP 2023 to 2032 budget is associated with wastewater projects including the WSER mandated $286.9 million harbour facility upgrades to secondary treatment, Eastern Passage sewer system improvements, and implementation of a number of RWWFP projects. The wastewater capital program for 2033 to 2043 is about $716 million. The major wastewater project occurs at the end of this period with the $173 million Enhanced Overflow Control Program.

The 2023 to 2032 water infrastructure budget is $231.2 million and the 2033 to 2043 budget is $293 million. Major projects include transmission upgrades for capacity and system security enhancement, additional/upgraded storage facilities. The storm system has expenditures of $43.3 million and $105.6 million in the two ten year periods. The projects are associated with pipe replacement. The relatively low investment in storm system projects reflects the physically limited nature of the system and the relatively young age. It probably also reflects the lack of knowledge regarding system conditions and capacities and as additional asset information is gathered, it is anticipated that investment requirements for the storm system will increase.

Table 7.4 Recommended IRP Expenditures 2023 - 2032 and 2033 - 2043 ($2012 million)

Category	FY 2023 -2032	FY 2033 -2043
Water	$231.2	$293
Wastewater	$1,124.7	$716.6
Stormwater	$43.3	$105.6
Enterprise Programs [(1)]	$28.3	$28.3
Total Expenditure	$1,427.5	$1,143.5

Notes:

1. Enterprise Programs refers to Halifax Water wide programs such as the SCADA Master Plan, the AMA Program and the IRP among others.

The total capital program net of asset renewal is about $88.6 million for 2023 to 2032 and a much more modest $64.8 million for 2033 to 2043 or approximately $8.9 million/yr. and $6.5 million on average respectively. The relatively small capital program in the later years may in fact increase as additional information is gathered and programs and projects are added in the intervening time period.

Approximately $536 million of the Recommended IRP budget is associated with the proposed asset renewal program in the period 2023 to 2032 and $705 million in the period 2033 to 2043. Approximately, 69% of the asset renewal effort in 2023 to 2032 is associated with the wastewater system while 56% is associated with the wastewater system in the period 2033 to 2043. Asset renewal for the water system in the period 2023 to 2032 is approximately 25% of expenditures and 30% in the period 2033 to 2043. Storm system expenditures in the last 20 years of the plan increase considerably in absolute terms but still are relatively small at 5% and 14% respectively. The average annual asset renewal expenditure over this period is $54 million/yr. for the period 2023 to 2032 and $71 million/yr. for the period 2033 to 2043. This increase compared to the period 2016 to 2022 likely results from a number of factors particularly in the last ten-year period. Requirements for short-lived assets such as the M&E and ICA systems in treatment facilities would need a second replacement, additional cohorts of linear assets would reach their service life and require replacement and assets added in the earlier portion of the planning period would begin to require replacement.

Other considerations with the periods for 2023 to 2032 and 2033 to 2043 of the Recommended IRP include:

- Total program (i.e. planning, business systems improvements and improvements to administrative facilities) related expenditures correspond to about 3% of the overall 2023 -2032 Recommended IRP expenditures and 19% of the overall 2033 -2043 Recommended IRP expenditures.
- Additional O&M costs associated with treatment facility or pumping upgrades or expansions are increasing in these periods corresponding to about 6 % of the overall 2023 -2032 Recommended IRP expenditures and 11% of the overall 2033 -2043 Recommended IRP expenditures. At 11% the additional O&M cost represent a significant fraction of the total expenditure for the period.

Details of all expenditures are presented in Volume 1 Appendix H.

7.5 RECOMMENDED IRP IMPLEMENTATION SCHEDULE

The master IRP schedule is presented in Figure 7.1. The figure is organized around the drivers and objectives for each of the three systems. Specific projects are indicated in the timeline as well as on-going programs. The overall plan spans the period 2013 to 2043.

Halifax Water Integrated Resource Plan Schedule 2013 -2043

System	Driver	Objective	Activity	2013 – 2018	2018 – 2023	2023 – 2028	2028 – 2033	2033 – 2038	2038 – 2043
Wastewater	Compliance	1	Current WWTF Compliance	Specific WWTF Compliance Projects to 2018					
		3	Current Overflow Compliance		Specific Overflow Compliance Projects 2018-2023				
		4	WWTF Future Compliance	Specific WWTF Upgrades to 2018		WWTF Nutrient Upgrades 2023		HHSP WWTF Upgrade to Secondary 2033	
		6	Future Overflow Compliance	Overflow Control and Storm Sewer Projects to 2018			Ongoing Wet Weather System Planning		Enhanced Overflow Control Program - 2043
	Asset Renewal	8	Asset Renewal Program	Specific Renewal Projects to 2018			Ongoing Asset Renewal Program		
		9	System Reliability	Specific Reliability Improvement Projects to 2018			Ongoing System Reliability Program		
		10	Minor Storm System Adequacy		Specific Storm/Collection System Upgrades 2015 –2018		Ongoing Storm Sewer Program		
		12	Reduce Energy Consumption	Specific Energy Reduction Projects to 2018			Ongoing Energy Mangement Program		
	Growth	13	Support Planned Growth	Specific Capacity Projects to 2042			Ongoing Wastewater Master Plan and IRP Updates		
		14	Manage Flow Capacity	Specific Flow Management Projects and I/I Pilot Program to 2018					
Water	Compliance	2	Water System Current Compliance	Specific Compliance Projects to 2018					
		5	Water System Future Compliance		Specific Compliance Projects 2014 -2019		Ongoing Water Quality Programs		
	Asset Renewal	8	Asset Renewal Program	Specific Renewal Projects to 2042				Ongoing Asset Renewal Program	
		9	System Reliability	Specific System Reliability Projects to 2018		Specific System Reliability Projects 2023	Specific System Reliability Project 2028	Ongoing System Reliability Program	
		12	Reduce Energy Consumption	Specific Energy Reduction Projects to 2018				Ongoing Energy Mangement Program	
	Growth	13	Support Planned Growth	Specific Capacity Projects to 2018		Specific Capacity Projects 2023 - 2025		Ongoing Water Master Plan and IRP Updates	
		14	Manage Flow Capacity	Water Efficiency Program					
Stormwater	Compliance	3	Current Overflow Compliance		Specific Stormwater Projects 2018 - 2023				
		6	Fututre Overflow Compliance	Stormwater Projects to 2018			Ongoing Wet Weather System Planning		
		7	Future Stormwater Quality Compliance	Stormwater Quality Compliance Assessment 2013 - 2015					
	Asset Renewal	8	Asset Renewal Program	Specific Renewal Projects to 2018		Ongoing Asset Renewal Program			
		10	Minor Storm System Adequacy	Specific Storm Improvement Projects to 2018			Ongoing Storm Sewer Program		
		11	Climate Change	Climate Change Impact Assessment Project 2013 -2015					
	Growth	14	Manage Flow Capacity	Specific Stormwater Projects to 2018			Ongoing Storm System Planning and IRP Updates		
Business Improvement	All Drivers	1 -14	Supporting Technology and Business Process Programs	Specific EnablingTechnology or Business Process Projects to 2022			Ongoing Technology and Business Process Program		

LEGEND:
Specific Wastewater Projects
Specific Water Projects
Specific Stormwater Projects
Specific Business Improvement Projects

Figure 7.1 Master Recommended IRP Implementation Schedule

7.6 IRP INTEGRATION AND PROGRAM PLANNING

One of the central tasks of the IRP was to build a working framework for future integrated resource planning. This in turn required that the IRP process itself to be linked to other Halifax Water and HRM planning and financial processes.

Figure 7.2 presents the generalized steps for IRP development and places the IRP in context with other contemporary planning activities. As shown in the Figure, the HRM Regional Plan provides policy direction on growth and development while provincial regulations and policies drive compliance requirements for the protection of public health and the environment. These drivers in turn inform the specific master plans for the water, wastewater and stormwater systems. Master plans are designed to translate the growth, regulatory compliance and asset renewal drivers into infrastructure projects and programs. Part of the future master plan development should be consideration of sustainable practices such as demand reduction programs. In addition, future IRP updates will require strong integration among the master plans.

Figure 7.2 Halifax Water Planning Overview

As a result of the IRP, Halifax Water is considering consolidating its system planning into comprehensive master plans, which along with other planning activities feed into the IRP. The concept is illustrated in Figure 7.3

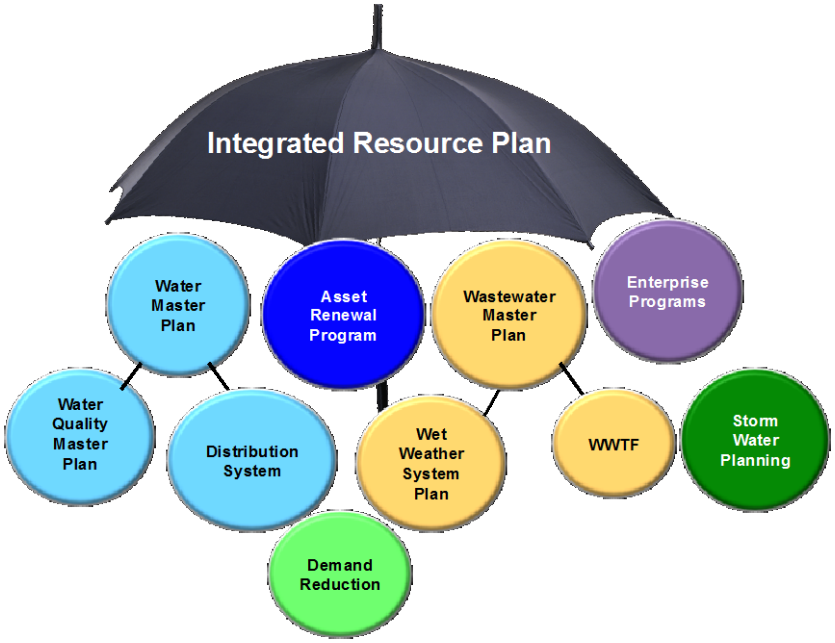


Figure 7.3 Halifax Water IRP Planning Integration

Table 7.5 summarizes the proposed master planning initiatives and gives their relationship to other existing and proposed planning programs and projects.

Table 7.5 Halifax Water Master Planning Initiatives

Master Plan	Description	Inputs
Water System Master Plan	• Master plan integrating compliance, growth and asset renewal for the treatment and distribution systems of the urban core and small systems.	• Water Quality Master Plan (existing) • Water Quality Research Program (existing) • Water system capacity and security planning (existing) • Water efficiency program (existing) • Asset renewal (enhanced) • Energy Management (existing) • SCADA (existing) • HRM Regional Plan (existing) • Climate change impact assessment (new) • Water System Master Plan supported by Integrated Network Model used to evaluate distribution system capacity and operation. Model will require on-going refinement and further calibration.

Table 7.5 Halifax Water Master Planning Initiatives

Master Plan	Description	Inputs
Wet Weather System Plan	• Wastewater wet weather plan focused on system-wide overflow control and reduction of wastewater system I/I. • See Volume 1 Appendix F for additional details	• Overflow compliance program (existing) • I/I reduction program (existing/new) including SIR program • RWWFP (existing) • IRP Enhanced Overflow Control Program (new) • Asset renewal (enhanced) • Energy Management (existing) • SCADA (existing) • Climate change impact assessment (new) • Wet Weather System Plan supported by sewer model used to evaluate collection system capacity and operation and support planning of overflow control alternatives. Model will require on-going refinement and further calibration.
Wastewater System Master Plan	• Master plan integrating compliance, growth and asset renewal for the treatment and collection systems of the urban core and small systems. • Integrates Wet Weather System Plan • Should include ERAs and necessary biosolids and hauled waste studies	• Wet Weather System Plan (new) • RWWFP (existing) • Asset renewal (enhanced) • Energy Management (existing) • SCADA (existing) • Water efficiency program (existing) • WWTF compliance program (existing) • Wastewater system capacity and security planning (existing) • HRM Regional Plan (existing) • Climate change impact assessment (new) • Supported by sewer model used to evaluate collection system capacity and operation and support planning of overflow control alternatives. Model will require on-going refinement and further calibration.
Stormwater System Plan	• Planning of capacity and asset renewal requirements/improvements to the components of the stormwater system owned and operated by Halifax Water • This plan should be carried out in conjunction with HRM to ideally prepare an overall Stormwater System Master Plan	• Drainage remediation project (existing) • Stormwater quality assessment (new) • Climate change impact assessment (new) • Regional Stormwater Functional Plan (prepared by HRM) (new)

The costs of the new planning related program activities in the IRP are presented in Table 7.6 The IRP includes other existing program costs that are associated with program implementation such as GIS upgrade and the lead services replacement program. These costs are not shown in the Table but are incorporated into the IRP through the Five-Year Capital Plan

Table 7.6 New Planning Program Expenditures

Program	2013-2015	2016-2022	2023-2032	2033 - 2043	Program Details
IRP Update	$0.4	$1.2	$1.7	$1.7	• Periodic updates assuming initial IRP update at 3 years and every 5 years thereafter
Wet Weather System Planning	$0.8	$3.5	$5.0	$5.0	• On-going wet weather system planning including monitoring and model updates/refinements
Wastewater System Master Plan	-	$0.8	$1.5	$1.5	• Wastewater Master Plan update every 5 years
Stormwater Quality Assessment	$0.2	$0.1	-(1)	-	• Project to define likely stormwater quality requirements (additional expenditures may result from the assessment outcomes)
Climate Change Impact Assessment	$0.7	-(1)	-	-	• Project to define impacts of future climate change and resulting vulnerabilities on water, wastewater and stormwater systems (additional expenditures may result from the assessment outcomes)
Asset Management Program	$2.7	$3.6	$5.0	$5.0	• Implementation of the asset management roadmap and on-going program updates and refinements
I/I Reduction Pilot Program	$1.2	$0.5	-(1)	-	• I/I pilot program aimed at developing I/I source contribution and remediation cost data specific to the Halifax area
Water Master Plan	-	$0.8	$1.5	$1.5	• Water Master Plan update every 5 years
Total	**$6.0**	**$10.5**	**$14.7**	**$14.7**	

Notes:
1. Expenditures are for program development only. Additional expenditures will be required for program implementation.

7.7 LEVELS OF SERVICE

One of the IRP outcomes was the presentation of the 14 IRP planning objectives. Some of these objectives are linked to current Halifax Water LOS. Table 7.7 presents a series of recommendations for updating/expanding the current LOS to allow a full evaluation of program implementation.

The updated/expanded LOS once developed will require support for LOS monitoring, data analysis and reporting. Halifax Water will need to consider the impact on operating staff for this additional data collection, analysis, and reporting.

In a number of cases, no change or addition to the LOS have been recommended.

Table 7.7 Recommended LOS Updates or Additions

Driver	Objective	Proposed LOS Update or Addition
Compliance	1. Meet Current Nova Scotia Environment WWTF Permits to Operate	• Update to include additional compliance parameters associated with new programs e.g. nutrient control. • Review percentage compliance criteria.
	2. Meet Current Nova Scotia Environment WSP Permits to Operate	• Update to include any additional compliance parameters.
	3. Meet Current Overflow Compliance	• Develop frequency and volume targets for RWWFP overflows.
	4. Meet Future WWTF Compliance	• See Objective 1 for LOS.
	5. Meet Future Drinking Water Compliance	• See Objective 2 for LOS.
	6. Meet Future Overflow Compliance	• Develop frequency and volume targets for long term overflow program. • May require updated LOS for site specific overflow frequency and volume targets, e.g. NW Arm.
	7. Meet Future Stormwater Quality Compliance	• Consider preliminary stormwater quality monitoring LOS, e.g. number samples/sites.
Asset Renewal	8. Implement Optimal Level of Asset Renewal	• Develop specific asset renewal targets and LOS. This will require a new monitoring system to provide reporting on progress.
	9. Enhance the Reliability of Critical Water and Wastewater Assets	• No changes suggested.
	10. Ensure Existing Stormwater System Adequately Sized for Minor Storm Conveyance	• Develop specific pipe and culvert capacity LOS. • At a minimum apply customer satisfaction LOS.
	11. Adapt to Future Climate Change	• Incorporate future climate change impacts into existing LOS where appropriate.
	12. Reduce Energy Consumption, Operating Costs and Greenhouse Gas Contributions	• Consider specific energy reduction targets and incorporate into more detailed LOS.
Growth	13. Provide Regional Water, Wastewater and Stormwater Infrastructure Needed to Support Planned Growth	• No changes suggested.
	14. Manage Flow Capacity Allocations	• Develop specific targets for I/I reduction at WWTFs and in major pumping stations and other locations, e.g. overflows. • Consider water demand targets.

7.8 IRP RECOMMENDATIONS

Based on the analysis carried out through the course of the IRP the following 17 recommendations are presented:

IRP Next Steps

1. Implement the IRP as per Table 6.1 components and timing.
2. Finalize the overall integrated planning approach and future schedule (i.e. HRM Regional Plan updates, master plans and Asset Management Assessment, and financial planning) within the IRP framework.
3. Evaluate the adequacy of Halifax Water's existing institutional capacity and staffing to implement the - programs and projects identified in the IRP.
4. Continue IRP public outreach with stakeholders and the public at large.
5. Update the IRP periodically, as needed.

Wastewater System

6. Implement I/I Pilot Program and integrate results into Wet Weather System Plan and Wastewater Master Plan.
7. Develop Wet Weather System Plan through integrating RWWFP, Enhanced Overflow, I/I Pilot program and other wet weather related wastewater projects/programs.
8. Undertake remaining ERAs for WWTFs requiring nutrient control and confirm effluent and technology requirements.
9. Develop Wastewater Master Plan.

Water System

10. Develop Water Master Plan.
11. Apply water use trends to water and wastewater design criteria and integrate into Water and Wastewater Master Plans.

Stormwater System

12. Assess stormwater quality compliance requirements.
13. Clarify role and mandate of Halifax Water in stormwater planning and management.

All Systems

14. Assess impacts of climate change on all systems, update design standards, update operational practices, and integrate findings into Water and Wastewater Master Plans and Wet Weather System Plan.

Corporate Balanced Scorecard and Level of Service

15. Implement recommendations for LOS update/expansion and update CBS.
16. Develop monitoring, analysis and reporting framework to support the updated/expanded LOS.
17. Identify needed resources to support updated/expanded LOS program.

8. NSUARB IRP COMPLIANCE

8.1 PURPOSE

The IRP was prepared in response to a NSUARB order. It was on the basis of this order that the plan Terms of Reference (ToR) were developed. The following section summarizes compliance with the IRP ToR.

8.2 COMPLIANCE ASSESSMENT

The detailed IRP terms of reference was compared with the contents of the IRP report and location within the report addressing the ToR component was presented. The detailed compliance tables are presented in Volume 1 Appendix G.

APPENDIX A

Halifax Water Integrated Resource Plan
Terms of Reference

1.0 OBJECTIVE

HRWC's objective is to develop an integrated resource plan (IRP) that identifies the long-term servicing needs for Halifax Water's water, wastewater and storm water infrastructure in a cost-effective and reliable manner. The plan will identify upgrade needs to address system reliability and safety, current and future capacity, and regulatory compliance. The Plan will consider the interrelationship of the water, wastewater, and stormwater systems. It will consider supply-side and demand-side management in addition to economic and environmental constraints of the long term servicing needs. This IRP will use a minimum 30 year planning horizon, recognizing that a longer planning horizon may be required to address some service and funding requirements.

The focus of Halifax Water's first IRP is to identify the key issues facing Halifax Water and to outline the long-term implementation plan and the necessary funding regime to support it. ***Halifax Water acknowledges that the available data and system understanding for the three infrastructure systems are at different levels and thus the IRP will need to address each to the appropriate level.***

2.0 INTEGRATED RESOURCE PLAN – APPROACH

In developing the IRP, Halifax Water will:

- Work collaboratively with the Nova Scotia Utility and Review Board (UARB) staff and consultants led by James Goldstein (Tellus Institute), and the consulting team hired by Halifax Water to assist with the IRP development;
- Use the IRP framework as described in the "Scope" section below to develop the plan;
- Coordinate the work for the IRP with other ongoing Halifax Water initiatives including the Regional Wastewater Functional Plan, the Asset Management Assessment, and the proposed Debt Study;
- Identify assumptions necessary to plan for uncertainties related to environmental compliance (e.g., changes in wastewater effluent and biosolids management regulations resulting from the Canadian Council of Ministers of the Environment (CCME) efforts, change, increasing power costs, etc.);
- Consult with stakeholders (including, but not limited to, the formal interveners in Halifax Water's 2010 rate hearing, Halifax Regional Municipality, Nova Scotia Environment, and the Urban Development Institute);
- Share information with the UARB and stakeholders (and their respective advisors) to support the planning process subject to confidentiality agreements as appropriate;
- Maintain compliance with the UARB regulatory framework;
- Maintain compliance with the environmental regulatory framework.

Halifax Water intends to engage an external consultant to provide technical assistance in the development of the IRP. Halifax Water will be leading this project and will be wholly accountable

for making substantive decisions for the IRP. Halifax Water and its consultants will work in a collaborative manner with UARB staff and consultants throughout the development of the IRP, with ongoing real-time communications regarding all aspects of the plan.

A request for qualifications is planned to shortlist the field of qualified consultants followed promptly by a request for proposals process including a detailed terms of reference outlining the necessary scope of work. Halifax Water will manage the project to ensure it stays on scope, budget, schedule and that the requirements as stipulated in the request for proposals (or as subsequently negotiated and agreed to) are delivered to our satisfaction.

This process will enable Halifax Water to develop and enhance in-house capabilities related to strategic infrastructure planning that will be invaluable in future planning and operations.

3.0 SCOPE

The IRP will consider a minimum 30-year planning horizon (2011-2040) with anticipated periodic updates. The primary components of the IRP process include:

1. Characterize current condition of the infrastructure assets, and identify information gaps.
2. Document existing capacity of infrastructure system components.
3. Develop demand forecasts for future water supply, and future wastewater and storm water flows and capacity requirements.
4. Identify jurisdictional responsibilities and policies related to overall water resources management (including water supply and extraction rates, source protection, groundwater resources, groundwater recharge practices, flood and stormwater management, flood protection, etc.).
5. Identify risks and uncertainties that may influence Halifax Water's delivery of water, wastewater and storm water services.
6. Develop a set of performance requirements (including social and environmental constraints) and criteria for prioritizing needs and evaluating the various plans.
7. Develop realistic supply-side and demand-side options to meet current supply and capacity constraints and needs, future growth, and current and projected environmental requirements.
8. Perform and document a screening analysis to determine which options are to be evaluated further in the IRP process and which can be removed from further consideration.
9. Identify all assumptions used for the IRP process including planning, forecast, and financial assumptions.
10. Develop the resource plans.
11. Evaluate the resource plans to determine the preferred alternative based on the least cost plan that meets the defined performance requirements and criteria. Least cost is defined as the lowest cumulative present worth of the annual revenue requirements.

12. Perform sensitivity analysis to determine the impacts of realistic variations to the input assumptions.
13. Identify an implementation and financing schedule for actions required over the next 3 years (through 2015) to meet demand projections as well as reliability, safety, capacity, regulatory, and environmental requirements.
14. Identify the longer-term implementation activities and estimated financing needs as currently known through the end of the planning horizon.
15. File final IRP with the UARB.

4.0 INTEGRATED RESOURCE PLAN FRAMEWORK

The proposed framework for the IRP is outlined in the following sections.

4.1 Process

The primary objective of the IRP process is to develop a plan for delivering water, wastewater, and stormwater services that minimizes the cumulative present worth of annual revenue requirements, while meeting various performance requirements and regulatory constraints.

Halifax Water will review its current modeling practices and identify future modeling programs and resources. Where current models are available, Halifax Water will use them to evaluate the developed resource plans against the IRP objective and constraints. Modeling may include financial assumptions, regulatory constraints, water demand and wastewater/stormwater flow and capacity forecasts, supply-side and demand-side options. Through the IRP, Halifax Water will identify the future program needed for management of stormwater (infrastructure, flows, capacity, flood protection, stormwater quality issues, retention/storage needs, etc). Where feasible and appropriate, Halifax Water will use sensitivity analysis to address a range of reasonable assumptions.

Halifax Water will consider technically, economically, and environmentally viable supply-side technologies including operating practices (optimizations), capital and operating costs, and operating assumptions. Halifax Water will critically assess the potential role of demand-side management (DSM) practices and review the estimated impacts on costs, demand, and capacity.

The initial IRP will be completed consistent with the data that will be available to Halifax Water within the time line of this project. Future enhancements to the IRP will improve the accuracy and detail of the outcomes.

4.2 IRP Deliverables

4.2.1 Demand and Capacity Forecasts

Existing water supply demand forecasts (e.g. average and peak) over the proposed planning horizon will be reviewed and confirmed relative to identified alternative growth scenarios and system enhancements or constraints. Effects from Halifax Water's ongoing water loss control

program will be documented. Requirements for augmenting the current water supply to meet growth projections will be reviewed if needed.

For the wastewater system, outputs from the ongoing Regional Wastewater Functional Plan (RWWFP) will provide a solid baseline concerning existing conditions and available wastewater system capacity. Different flow scenarios will be examined as outlined in the RWWFP including dry weather flows and a range of wet weather events as well as a range of antecedent conditions. Using growth projections provided by Halifax Regional Municipality (HRM), the impacts on the existing collection system capacity will be evaluated. These activities will inform Halifax Water with respect to the current state of the infrastructure from a capacity perspective and identify necessary capacity upgrades to meet regulatory compliance requirements and future growth.

The stormwater system is not currently modeled. Halifax Water's responsibility for stormwater is limited to the ownership, operation, and maintenance of the public stormwater infrastructure (pipes, ditches, and retention ponds). The Province of Nova Scotia has regulatory authority for activities affecting lakes and rivers in Nova Scotia. The Halifax Regional Municipality (HRM) has responsibility for planning and approving overall stormwater management systems and facilities, grading and drainage of subdivisions and site plans, road drainage design and implementation, and overall stormwater policy. Currently, there are limited water quality requirements in place for stormwater.

The IRP will document the existing responsibilities for stormwater and seek clarity around organizational jurisdiction for these elements on a go-forward basis. Through the IRP, the current Asset Management Assessment, and ongoing asset and data management activities, Halifax Water will identify what activities need to be undertaken to improve overall stormwater system knowledge, policy and practices. This may include activities such as (but not limited to) developing the asset inventory, conducting condition assessments, ensuring data is available in the GIS and any future work management system that Halifax Water may implement, and analysis related to overall storm system operations and optimization. In the future, Halifax Water will be participating in and relying on outputs from HRM's proposed Stormwater Management Functional Plan (SWMFP) to update and refine stormwater aspects in subsequent versions of the IRP.

At a minimum, Halifax Water will provide approximate information on length of stormwater piped systems, length of ditched infrastructure, number of driveway culverts, a high level estimate of the number of cross-culverts owned by Halifax Water, and general assumptions on condition and capacity constraints.

4.2.2 Supply-side Options

Halifax Water will identify appropriate and practical supply-side options that may include methods and technologies to reduce water production volumes, wastewater overflows, manage flood levels, strengthen standards for system expansion, and manage power consumption. In

summarizing the available options, Halifax Water will identify regulatory constraints, environmental impacts, and both capital and operating costs associated with each set of options.

The supply-side assessment may include but not be limited to the following technologies and methods:

Water	Wastewater	Stormwater
• Enhanced redundancy and optimization routing • Leak detection surveys • Leak reduction program • Master meter calibration • Water Treatment Plant operational uses • Additional treatment capacity or upgrades • Transmission main upgrades • Source protection • Strategic land management	• CSO / SSO management • Optimize number and configuration of pumping stations • Over-sizing pipes / storage • System optimization and flow routing • Optimize power requirements • Additional treatment capacity or upgrades • Regulatory upgrades • Receiving water quality • Strategic land management	• On-site reduction of run-off • Optimization of drainage paths / corridors • Retention / storage • System optimization and flow routing • Deep storm sewer installation • Receiving water quality • Strategic land management

4.2.3 Demand-side Options

Halifax Water will investigate demand-side management options through the IRP to reduce finished water requirements and wastewater flows. Demand-side assessment will include cost, supply and capacity needs, and usage impacts. The demand-side assessment may include but not be limited to the following technologies and methods:

Water	Wastewater	Stormwater
• Customer leak reduction • Service meter calibration • Non-revenue water • Water conservation (outdoor water use reductions, xeriscaping, plumbing code modifications, water audits, etc) • Rate incentives	• I/I reduction (illegal connections, cross-connections, storage, retention, water movement optimization, etc) • Water recycling • Rate incentives • Lateral repairs • Source control • Construction standards	• Grading requirements • Comprehensive controlled drainage management • Source control • Sediment / erosion management • Storm water rate structure • Construction standards

4.2.4 Screening of Supply & Demand-side Options

Where possible, Halifax Water will establish performance metrics for the supply-side and demand-side options. The options will undergo a screening test to determine whether they will advance to more detailed analysis as part of the resource plans. The screening will focus on:

- System optimization;
- System reliability;
- Redundancy and flexibility;
- Feasibility;
- Regulatory compliance;
- Need and ability to obtain regulatory approval;
- Total cost.

4.2.5 Financial Considerations

Several financial considerations will be explored in developing the various resource plans including, but not limited to:

- Impacts of declining water usage on rates and the revenue stream.
- Availability of funding assistance through federal and provincial programs.
- Timing impact of capital plan implementation (effect on budgets).
- Using rates to incent ratepayers to use conservation technologies and methods.
- Appropriate debt policy, in coordination with the UARB-approved Debt Study (underway with completion date of October 2012).
- Costs associated with additional staff, information needs, tools, and technology to support capital program growth.

4.2.6 Basic Assumptions and Plan Considerations

Halifax Water will identify the basic assumptions used for supply-side and demand-side options and system impacts related to aging infrastructure, capacity issues, regulatory compliance, and growth. These will be documented together with the proposed resource plans.

Assumptions on the appropriate level of reinvestment by each asset class will be developed and documented. Options may include conventional dig and replace as well as in-situ repairs and lining and other trenchless techniques. Opportunities to rationalize operational practices will be explored.

As a result of the Canadian Councils of Ministers of the Environment (CCME) Wastewater Strategy, new federal regulations are expected to be available in DRAFT form in the summer of 2011. Early indications are that the regulations will come into force sometime in 2012. The IRP will identify system and facility upgrades needed to comply with the new regulations.

Halifax Water follows a “cost-causer” approach to asset construction. In general, the development industry pays for and installs assets related to growth. Where there are

opportunities for over-sizing of infrastructure that benefit the larger community and customer base, Halifax Water participates in cost sharing of the assets. Using growth projections and system information and forecasts, Halifax Water can plan for future growth related assets.

4.2.7 Resource Plans Development and Integration

Using the various supply-side options demand-side options, a series of resource plans will be developed. These resource plans will be evaluated based on:

- System safety and reliability requirements;
- Robustness of the plan (i.e. the sensitivity of the plan to possible variations in the key assumptions);
- Plan resilience (i.e. the degree to which the selection of a preferred plan constrains Halifax Water's future planning options);
- Future regulatory compliance outlook;
- Financial capability.

Planning and financial scenarios will be modeled. The detailed analysis will result in a range of resource plans that meet regulatory and other requirements and will be ranked based on the net present worth of the revenue requirements.

4.2.8 Sensitivity Analysis

In completing the IRP, Halifax Water will make a variety of assumptions. Some of these assumptions may have significant uncertainty and views regarding the assumptions may differ. Consequently, Halifax Water will conduct sensitivity analyses. Least cost resource plans developed through the IRP will be evaluated for robustness by varying key assumptions across a reasonable range.

4.2.9 Final Integrated Resource Plan Report

The ultimate deliverable for the IRP will be a written report filed with the UARB. The final report will include:

1. Background information and an overview of the IRP process.
2. Forecast summaries
3. Description of the supply-side and demand-side options evaluated in the IRP.
4. Description of the screening analysis employed to determine which options would proceed to more detailed analysis.
5. Identification of the plan assumptions.
6. Description of the resource plans and the associated components.
7. Results of the model analysis for the various resource plans demonstrating the least cost plan.
8. Results of the sensitivity analysis.
9. Selection of the recommended resource plan.
10. Recommended Action Plan for the next 3 fiscal years, including capital and operating

costs to address supply and capacity projections, regulatory requirements, and environmental requirements.

11. Longer term recommendations over the planning horizon, including capital and operating costs.
12. Recommended data acquisition, modeling, and analysis required for future enhancements to the IRP.

4.3 Stakeholder Consultation

The IRP framework and resultant plan will be the foundation for Halifax Water's future investment decisions and the keystone for future iterations of integrated resource planning. Involvement of stakeholders will be an integral part of the process. In addition to ongoing information exchange, formal stakeholder consultations will be planned at the following stages.

4.3.1 Phase One

- Purpose and process for the IRP including a review of the Terms of Reference and key uncertainties.

4.3.2 Phase Two

- Model assumptions and plan considerations.
- Review of resource plans.
- Analysis results.
- Draft IRP document review.

4.4 Confidentiality

To the extent feasible, Halifax Water will present information in a fashion designed to inform and engage all stakeholders. The IRP process involves the use of confidential data concerning Halifax Water's current and future operating environments. Components include actual operating characteristics of the assets as well as strategic initiatives Halifax Water may undertake. Certain confidential information including detailed data from the modeling software may be limited to the UARB and its consultants. Summary documents will be distributed to a broader audience.

4.5 IRP Process Timeline Summary

PHASE 1	1	**Host Technical Conference 1** (Overview, Purpose, Review Terms of Reference)	March 24, 2011
	2	Receive Feedback from Technical Conference 1 (Deadline)	April 5, 2011
	3	Prepare & Submit Report to UARB - Proposed Terms of Reference (Technical Memorandum 1)	April 15, 2011
	4	Procurement of Consulting Services	June 15, 2011
PHASE 2	5	Baseline Review	July 20, 2011
	6	Develop Assumptions & Plan Considerations & Issue to Stakeholders	August 11, 2011
	7	**Host Technical Conference 2** (Assumptions & Plan Considerations)	August 25, 2011
	8	Receive Feedback from Technical Conference 2 (Deadline)	September 8, 2011
	9	Issue Technical Memorandum 2 (Assumptions & Plan Considerations)	September 14, 2011
	10	Develop Preliminary Resource Plans and Sensitivities & Issue to Stakeholders	October 20, 2011
	11	**Host Technical Conference 3** (Resource Plans & Sensitivities)	November 3, 2011
	12	Receive Feedback from Technical Conference 3 (Deadline)	November 17, 2011
	13	Issue Technical Memorandum 3 (Resource Plans & Sensitivities)	November 24, 2011
	14	Conduct Resource Plan Analysis & Issue to Stakeholders	January 19, 2012
	15	**Host Technical Conference 4** (Resource Plan Analysis)	February 2, 2012
	16	Receive Feedback from Technical Conference 4 (Deadline)	February 16, 2012
	17	Issue Technical Memorandum 4 (Resource Plan Analysis)	March 22, 2012
	18	Develop DRAFT IRP & Issue to Stakeholders	May 3, 2012
	19	**Host Technical Conference 5** (Present Draft IRP)	May 17, 2012
	20	Receive Feedback from Technical Conference 5 (Deadline)	June 7, 2012
	21	File FINAL IRP Document with UARB	June 28, 2012

APPENDIX B

Halifax Water Five-Year Capital Plan 2012-2016

SUMMARY

Capital Expenditure Program

	All $ in 000's												
	Y1	Y2	Y3	Y4	Y5	Sub Total Y1 to Y5	Y6-10	Y11 - 15	Y16 - 20	Y21 - 25	Y26 - 30	Sub Total Y6 to Y30	Total Y1 to Y30
	2012-2013	2013-2014	2014-2015	2015-2016	2016-17		2017-18 to 2021-22	2022-23 to 2026-27	2027-28 to 2031-32	2032-33 to 2036-37	2037-38 to 2041-42		
Stormwater / Wastewater / Water Budget Summary													
Stormwater - Pipes	$1,438	$1,175	$1,961	$1,575	$2,545	$8,694	$5,138	$1,000	$1,167	$1,333	$1,500	$10,138	$18,832
Stormwater - Culverts/Ditches	$455	$361	$400	$265	$749	$2,230	$574	$0	$0	$0	$0	$574	$2,804
Stormwater - Structures	$0	$350	$150	$200	$300	$1,000	$0	$0	$0	$0	$0	$0	$1,000
Stormwater - Fleet	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Stormwater - IT	$0	$315	$325	$325	$200	$1,165	$0	$0	$0	$0	$0	$0	$1,165
Stormwater - Security	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Stormwater - Equipment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Sub Total - Stormwater	$1,893	$2,201	$2,836	$2,365	$3,794	$13,089	$5,712	$1,000	$1,167	$1,333	$1,500	$10,712	$23,801
Wastewater - Trunk Sewers	$1,350	$850	$250	$2,900	$1,800	$7,150	$18,750	$0	$0	$0	$0	$18,750	$25,900
Wastewater - Collection System	$1,828	$2,193	$3,770	$3,540	$2,915	$14,246	$71,686	$1,000	$1,167	$1,333	$1,500	$76,686	$90,932
Wastewater - Forcemains	$2,320	$1,150	$538	$385	$750	$5,143	$6,881	$1,600	$1,700	$1,800	$1,900	$13,881	$19,024
Wastewater - Structures	$5,783	$5,693	$1,550	$3,175	$2,175	$18,376	$59,800	$0	$0	$0	$0	$59,800	$78,176
Wastewater - Treatment Facilities	$27,119	$61,864	$23,555	$967	$4,085	$117,590	$39,660	$2,195	$1,404	$2,100	$4,400	$49,759	$167,349
Wastewater - Energy	$1,100	$400	$300	$1,050	$1,150	$4,000	$4,350	$0	$0	$0	$0	$4,350	$8,350
Wastewater - Fleet	$1,000	$1,250	$1,000	$1,200	$1,100	$5,550	$0	$0	$0	$0	$0	$0	$5,550
Wastewater - IT	$1,244	$1,974	$1,682	$1,005	$880	$6,785	$0	$0	$0	$0	$0	$0	$6,785
Wastewater - Security	$150	$200	$200	$200	$200	$950	$0	$0	$0	$0	$0	$0	$950
Wastewater - Equipment	$109	$60	$60	$60	$70	$359	$0	$0	$0	$0	$0	$0	$359
Sub Total - Wastewater	$42,003	$75,634	$32,905	$14,482	$15,125	$180,149	$201,127	$4,795	$4,271	$5,233	$7,800	$223,226	$403,375
Sub Total - Stormwater and Wastewater	$43,896	$77,835	$35,741	$16,847	$18,919	$193,238	$206,840	$5,795	$5,437	$6,567	$9,300	$233,938	$427,176
Water - Land	$0	$0	$200	$200	$0	$400	$0	$0	$0	$0	$0	$0	$400
Water - Transmission	$7,413	$805	$930	$1,375	$3,620	$14,143	$57,408	$32,450	$1,167	$1,333	$1,500	$93,858	$108,001
Water - Distribution	$4,273	$4,975	$5,325	$5,425	$5,425	$25,423	$0	$0	$0	$0	$0	$0	$25,423
Water - Structures	$4,410	$3,740	$660	$350	$350	$9,510	$9,600	$13,200	$2,400	$0	$0	$25,200	$34,710
Water - Treatment Facilities	$682	$305	$4,435	$4,125	$305	$9,852	$4,985	$3,800	$0	$0	$0	$8,785	$18,637
Water - Energy	$450	$860	$260	$150	$150	$1,870	$48,600	$0	$0	$0	$0	$48,600	$50,470
Water - Fleet	$250	$200	$460	$450	$465	$1,825	$0	$0	$0	$0	$0	$0	$1,825
Water - IT	$974	$1,859	$1,557	$880	$880	$6,150	$0	$0	$0	$0	$0	$0	$6,150
Water - Security	$50	$50	$50	$50	$50	$250	$0	$0	$0	$0	$0	$0	$250
Water - Equipment	$65	$89	$70	$76	$70	$370	$0	$0	$0	$0	$0	$0	$370
Sub Total - Water	$18,567	$12,883	$13,947	$13,081	$11,315	$69,793	$120,593	$49,450	$3,567	$1,333	$1,500	$176,443	$246,236
TOTALS - Stormwater / Wastewater / Water	$62,463	$90,718	$49,688	$29,928	$30,234	$263,031	$327,433	$55,245	$9,004	$7,900	$10,800	$410,382	$673,413

STORMWATER PROJECTS

Stormwater Projects

Project ID	Project Name	Driver			All $ in 000's													
					Y1	Y2	Y3	Y4	Y5	Sub Total Y1 to Y5	Y6-10	Y11 - 15	Y16 - 20	Y21 - 25	Y26 - 30	Sub Total Y6 to Y30	Total Y1 to Y30	Comments Projects >=$1.5M Estimate prepared or Budget Cost (Estimate not yet prepared)
		AR	G	C	2012-2013	2013-2014	2014-2015	2015-2016	2016-17		2017-18 to 2021-22	2022-23 to 2026-27	2027-28 to 2031-32	2032-33 to 2036-37	2037-38 to 2041-42			
Stormwater - Pipes																		
1.38	Integrated Stormwater Projects - Program	✓			$500	$525	$575	$575	$600	$2,775							$2,775	This line item is for integrated projects with HRM streets projects
1.43	Sullivan's Pond Storm Sewer System Replacement										$2,000					$2,000	$2,000	Based on study/HW internal estimated
1.19	Drainage Remediation Program Surveys/Studies				$50	$50	$200	$250	$300	$850							$850	
1.42	Deep Storm Sewer Installation Program			✓	$800	$300		$450	$500	$2,050							$2,050	Year 1 identified project. Year 2 + placeholders
	Asset Management Implementation Program (W/WW/SW)				$88	$300	$300	$300	$200	$1,188	$833	$1,000	$1,167	$1,333	$1,500	$5,833	$7,021	Years 1 to 5 based on AMA report. Year 6+ placeholder costs
1.21	Crestfield Avenue (Uplands Phase 3) - Deep Storm Sewer Installation			✓			$720			$720							$720	
1.25	Pinehill Drive Embankment Protection						$166			$166							$166	
1.53	Barrington Street Storm Sewer Separation			✓							$300					$300	$300	
1.41	Ellerslie Crescent - Storm Sewer Upgrade	✓									$300					$300	$300	
1.03	Ivylea Crescent - New Storm Sewer			✓					$645	$645							$645	
1.30	Glengary Drive - New Storm Sewer			✓							$300					$300	$300	
1.34	Raymond Street, Phase 2 - Storm Sewer Rehabilitation	✓							$300	$300							$300	
1.14	Perth Street, Wardour Street, Fort Sackville Road - Deep Storm Sewer Installation										$1,205					$1,205	$1,205	
1.28	Cavalier Drive Storm Sewer Outfall - Erosion Remediation										$200					$200	$200	
Stormwater - Pipes -- T O T A L S					**$1,438**	**$1,175**	**$1,961**	**$1,575**	**$2,545**	**$8,694**	**$5,138**	**$1,000**	**$1,167**	**$1,333**	**$1,500**	**$10,138**	**$18,832**	

Stormwater Projects

Project ID	Project Name	Driver			All $ in 000's													
					Y1	Y2	Y3	Y4	Y5	Sub Total Y1 to Y5	Y6-10	Y11 - 15	Y16 - 20	Y21 - 25	Y26 - 30	Sub Total Y6 to Y30	Total Y1 to Y30	Comments Projects >=$1.5M Estimate prepared or Budget Cost (Estimate not yet prepared)
		AR	G	C	2012-2013	2013-2014	2014-2015	2015-2016	2016-17		2017-18 to 2021-22	2022-23 to 2026-27	2027-28 to 2031-32	2032-33 to 2036-37	2037-38 to 2041-42			
Stormwater - Culverts/Ditches																		
1.55	Leeward Avenue - Ditch Regrading and Rock Breaking	✓			$70					$70							$70	
1.27	Lucasville Road Culverts Replacements	✓			$180					$180							$180	
1.57	Diana Drive Stormwater Modifications	✓			$50					$50							$50	
1.58	Spruce Grove Court to Daisy Drive - Drainage Swale	✓			$50					$50							$50	
1.59	561 Herring Cove Road, Culvert Replacement	✓			$105					$105							$105	
1.49	258 Yankeetown Road Culvert Replacement	✓				$75				$75							$75	
1.17	Wilson Drive & Highway 2 - Culvert Replacement	✓				$149				$149							$149	
1.11	Sackville Drive (West of Hamilton) - Culvert Replacement (no civic provided)	✓				$137				$137							$137	
1.04	Tobin Drive Culvert Replacement	✓					$400			$400							$400	
1.22	Parker's Brook - Culvert Condition Assessment (Dartmouth Rd)	✓						$30		$30							$30	
1.24	Mason's Mill Pond Culvert - Condition Assessment	✓						$30		$30							$30	
1.09	183 Lakeview Avenue - Twin Culvert Replacement	✓						$130		$130							$130	
1.15	Hammonds Plains Road & Bluewater Road Intersection Drainage Improvements							$75	$400	$475							$475	
1.18	Waverley Fire Department #41 - Dual Culvert Replacement	✓							$189	$189							$189	
1.23	Cobequid Road @ Sucker Brook - Culvert Replacement	✓							$160	$160							$160	
1.46	Culvert Replacement Program	✓								$0								
1.10	Kipawa Crescent - Culvert Replacement	✓								$0	$121					$121	$121	
1.12	1419 Lucasville Road - Culvert Replacement	✓								$0	$107					$107	$107	
1.16	Holly Court - Culvert Replacement	✓								$0	$116					$116	$116	
1.51	Between 24&28 Seawood Avenue - Culvert Replacement	✓								$0	$30					$30	$30	
1.60	Civic #150 Kaye Street, Lower Sackville - Cross Culvert replacement	✓									$100					$100	$100	
1.61	Civic #1250 Sackville Drive - Cross Culvert Replacement	✓									$100					$100	$100	
										$0								
										$0								
Stormwater - Culverts/Ditches -- T O T A L S					**$455**	**$361**	**$400**	**$265**	**$749**	**$2,230**	**$574**	**$0**	**$0**	**$0**	**$0**	**$574**	**$2,804**	
Stormwater - Structures																		
1.52	Idlewylde Road Storm Sewer Outlet/Embankment Stabilization					$200				$200							$200	
1.47	Stormwater Structure Replacement Program	✓				$150	$150	$200	$200	$700							$700	
1.06	Clement Street Berm - Removal and Inlet Structure Reconfiguration								$100	$100							$100	
Stormwater - Structures -- T O T A L S					**$0**	**$350**	**$150**	**$200**	**$300**	**$1,000**							**$1,000**	

Stormwater Projects

Project ID	Project Name	Driver			All $ in 000's													Comments Projects >=$1.5M Estimate prepared or Budget Cost (Estimate not yet prepared)
					Y1	Y2	Y3	Y4	Y5	Sub Total Y1 to Y5	Y6-10	Y11 - 15	Y16 - 20	Y21 - 25	Y26 - 30	Sub Total Y6 to Y30	Total Y1 to Y30	
		AR	G	C	2012-2013	2013-2014	2014-2015	2015-2016	2016-17		2017-18 to 2021-22	2022-23 to 2026-27	2027-28 to 2031-32	2032-33 to 2036-37	2037-38 to 2041-42			
Stormwater - Fleet																		
Stormwater - Fleet -- T O T A L S					**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**			
Stormwater - IT																		
1.07	Data Collection Project (WW/SW)				$0	$40				$40							$40	
1.08	Lateral Card Database Conversion Project (WW/SW)				$0	$125	$125	$125		$375							$375	
2.135	GIS Data Program Implementation (W/WW/SW)				$0	$150	$200	$200	$200	$750							$750	
Stormwater - IT -- T O T A L S					**$0**	**$315**	**$325**	**$325**	**$200**	**$1,165**							**$1,165**	
Stormwater - Security																		
Stormwater - Security -- T O T A L S					**$0**	**$0**	**$0**	**$0**	**$0**									
Stormwater - Equipment																		
Stormwater - Equipment -- T O T A L S					**$0**	**$0**	**$0**	**$0**	**$0**									
TOTALS - Stormwater					**$1,893**	**$2,201**	**$2,836**	**$2,365**	**$3,794**	**$13,089**	**$5,712**	**$1,000**	**$1,167**	**$1,333**	**$1,500**	**$10,712**	**$23,801**	

WASTEWATER PROJECTS

Wastewater Projects

Project ID	Project Name	Driver			All $ in 000's													Comments Projects >=$1.5M Estimate prepared or Budget Cost (Estimate not yet prepared)	Comment from
					Y1	Y2	Y3	Y4	Y5	Sub Total Y1 to Y5	Y6-10	Y11 - 15	Y16 - 20	Y21 - 25	Y26 - 30	Sub Total Y6 to Y30	Total Y1 to Y30		
		AR	G	C	2012-2013	2013-2014	2014-2015	2015-2016	2016-17		2017-18 to 2021-22	2022-23 to 2026-27	2027-28 to 2031-32	2032-33 to 2036-37	2037-38 to 2041-42				
Wastewater - Trunk Sewers																			
2.35	CN Quinpool Bridge Structure - Replacement of 450mm Combined Sewer	✓			$100					$100							$100		
	Bedford West (CCC)		✓		$1,250	$750				$2,000							$2,000	Costs from CBCL study	KM
2.01	Barrington Street Extension - Access Manhole Replacement	✓				$100				$100							$100		
2.67	Northwest Arm Sewer Rehabilitation	✓					$250	$1,800	$1,800	$3,850	$11,000					$11,000	$14,850	Extrapolated from the pilot prject which cost $1.3M for 450m ($2900/m)	DE
2.69	Jamieson Street Trunk Sewer Outfall Replacement - Phase 2 - Construction	✓						$1,100		$1,100							$1,100		
2.70	Bedford Sackville Trunk Sewer - Maintenance Access Routes	✓								$0	$1,500					$1,500	$1,500	Estimate from Genivar report + inflation	VW
2.63	Freshwater Brook Phase 4	✓								$0	$6,250					$6,250	$6,250	Extrapolated from costs incurred for phases 1,2,3	DE
										$0									
										$0									
										$0									
										$0									
Wastewater - Trunk Sewers -- T O T A L S					**$1,350**	**$850**	**$250**	**$2,900**	**$1,800**	**$7,150**	**$18,750**	**$0**	**$0**	**$0**	**$0**	**$18,750**	**$25,900**		

Wastewater Projects

Project ID	Project Name	Driver			All $ in 000's													Comments Projects >=$1.5M Estimate prepared or Budget Cost (Estimate not yet prepared)	Comment from
					Y1	Y2	Y3	Y4	Y5	Sub Total Y1 to Y5	Y6-10	Y11 - 15	Y16 - 20	Y21 - 25	Y26 - 30	Sub Total Y6 to Y30	Total Y1 to Y30		
		AR	G	C	2012-2013	2013-2014	2014-2015	2015-2016	2016-17		2017-18 to 2021-22	2022-23 to 2026-27	2027-28 to 2031-32	2032-33 to 2036-37	2037-38 to 2041-42				
Wastewater - Collection System																			
2.52	Integrated Wastewater Projects - Program	✓			$1,250	$1,000	$1,050	$1,100	$1,500	$5,900							$5,900	This line item is for integrated projects with HRM streets projects	
2.130	Integrated Resource Plan split 50/50 WW/W				$165			$200	$200	$565							$565		
	Springfield Lake Collection Upgrade	✓		✓	$150		$250	$250		$650							$650		
	Outfall Elimination Program			✓	$100	$100	$100	$100	$100	$500							$500		
	Asset Management Implementation Program (W/WW/SW)				$88	$300	$300	$300	$200	$1,188	$833	$1,000	$1,167	$1,333	$1,500	$5,833	$7,021	Years 1 to 5 based on AMA report. Year 6+ placeholder costs	VW
2.66	Grit Management Facility			✓	$60					$60							$60		
2.74	Bedford West Collection System (CCC)		✓		$15	$75		$140	$25	$255	$153					$153	$408		
2.73	Portland Hills Collection System (CCC)		✓		$0	$18	$70			$88							$88		
2.43	Overflow Monitoring Program		✓			$200	$250	$250	$250	$950							$950		
	Alder Crescent Collection System - reverse graded pipe, 300m plus watermain	✓				$500				$500							$500		
2.117	Deacon Street, Gateway Avenue, Green Street, Leeds Street and Pembrooke St- Sewer Lining	✓					$750			$750							$750		
2.13	Wanda Lane Sanitary Sewer Replacement	✓					$1,000	$1,200		$2,200							$2,200	Cost from detailed design study	IG
2.72	Russell Lake West Collection System (CCC)		✓						$165	$165	$1,600					$1,600	$1,765	Costs from CBCL study	KM
2.76	Kempt Road Sewer Replacement	✓							$475	$475							$475		
2.09	North Preston Sewershed - Wastewater Collection System Replacement Program	✓		✓						$0	$3,200					$3,200	$3,200	Cost from detailed design study	IG
2.86	Ellenvale Holding Tank Sewershed			✓						$0	$7,000					$7,000	$7,000	Staff Budget Estimate - note cost for Holding Tank Only - not sewershed	IG
2.11	Eastern Passage Sewage Collection System Upgrades	✓		✓						$0	$54,500					$54,500	$54,500	Estimate based on EP WW management plan report costs + 10% $49.6M for coll. system improvements	IG
2.145	Dorothea Drive Sanitary Sewer Upgrade	✓								$0	$300					$300	$300		
2.75	Beaver Crescent Collection System Replacement	✓		✓						$0	$4,100					$4,100	$4,100	Cost from detailed design study	IG
	Sewer Lining Program	✓								$0									
										$0									
										$0									
Wastewater - Collection System -- T O T A L S					**$1,828**	**$2,193**	**$3,770**	**$3,540**	**$2,915**	**$14,246**	**$71,686**	**$1,000**	**$1,167**	**$1,333**	**$1,500**	**$76,686**	**$90,932**		

Wastewater Projects

Project ID	Project Name	Driver			All $ in 000's													Comments Projects >=$1.5M Estimate prepared or Budget Cost (Estimate not yet prepared)	Comment from
					Y1	Y2	Y3	Y4	Y5	Sub Total Y1 to Y5	Y6-10	Y11 - 15	Y16 - 20	Y21 - 25	Y26 - 30	Sub Total Y6 to Y30	Total Y1 to Y30		
		AR	G	C	2012-2013	2013-2014	2014-2015	2015-2016	2016-17		2017-18 to 2021-22	2022-23 to 2026-27	2027-28 to 2031-32	2032-33 to 2036-37	2037-38 to 2041-42				
Wastewater - Forcemains																			
2.04	Bayers Lake Forcemain Upgrade & Twinning	✓			$2,160	$1,000				$3,160							$3,160	Estimate prepared (in e.project file)	
2.51	Cathodic Protection Program (Various Locations)	✓			$150	$150	$150	$150	$150	$750							$750		
2.144	Bedford West - FM Design to redirect WW (Hollyhock PS) from Mill Cove to Halifax		✓		$10					$10							$10		
2.33	MacPherson Forcemain Replacement and twinning	✓					$388			$388							$388		
2.32	Shore Drive Golf Links - Forcemain Replacement and Twinning	✓						$235		$235							$235		
2.80	Forcemain Replacement Program	✓							$600	$600	$1,500	$1,600	$1,700	$1,800	$1,900	$8,500	$9,100	Budget Cost (placeholders)	VW
2.79	North Preston #3 - Johnson Rd Forcemain - Capacity Upgrade		✓							$0	$800					$800	$800		
2.22	Fish Hatchery Park - Forcemain Replacements	✓								$0	$4,581					$4,581	$4,581	Budget Cost	VW
										$0									
										$0									
Wastewater - Forcemains -- T O T A L S					**$2,320**	**$1,150**	**$538**	**$385**	**$750**	**$5,143**	**$6,881**	**$1,600**	**$1,700**	**$1,800**	**$1,900**	**$13,881**	**$19,024**		

Wastewater Projects

Project ID	Project Name	Driver			All $ in 000's													Comments Projects >=$1.5M Estimate prepared or Budget Cost (Estimate not yet prepared)	Comment from
					Y1	Y2	Y3	Y4	Y5	Sub Total Y1 to Y5	Y6-10	Y11 - 15	Y16 - 20	Y21 - 25	Y26 - 30	Sub Total Y6 to Y30	Total Y1 to Y30		
		AR	G	C	2012-2013	2013-2014	2014-2015	2015-2016	2016-17		2017-18 to 2021-22	2022-23 to 2026-27	2027-28 to 2031-32	2032-33 to 2036-37	2037-38 to 2041-42				
Wastewater - Structures																			
2.46	Wastewater Pumping Station Upgrade Program - Various Locations	✓					$550	$400	$550	$1,500							$1,500		
	West Region	✓			$133	$23				$156							$156		
	East Region	✓			$125	$125				$250							$250		
	Central Region	✓			$100	$145				$245							$245		
2.87	Quigley's Corner Pump Replacement and PS Upgrade	✓			$300					$300	$5,500					$5,500	$5,800	Budget Estimate - preliminary design brief due end Dec 2011	IG
2.85	Balcome Drive PS	✓			$750					$750							$750		
2.92	Colpitt Lake PS Elimination					$720				$720							$720		
2.41	Pumping Station and Forcemain Update Study					$180				$180							$180		
2.53	PS Elimination Assessment Program					$50		$100		$150							$150		
2.91	Bedford PS Rehabilitation (at Mill Cove WWTF)	✓				$750		$1,375	$1,375	$3,500							$3,500	Study in progress. Estimated cost provided as early delivery	DE
2.88	Russell Lake PS Upgrade	✓					$1,000	$1,000		$2,000							$2,000	Budget Cost - design brief due June 2012	IG
2.38	Roach's Pond Grit Building rehab	✓							$250	$250	$1,250					$1,250	$1,500	Budget Cost	DE
	Cowie Hill Road Extension				$250					$250							$250		
	Cowie Hill Facility - Furniture				$125					$125							$125		
	Cowie Hill Operations Facility				$4,000	$3,700				$7,700							$7,700	Board Report prepared includes cost estimate	
	East Region Operation Facility - Design							$300		$300							$300		
2.118	AST PS - Automated Bar Screen			✓						$0	$900					$900	$900		
2.120	Herring Cove - Automated Bar Screen			✓						$0	$900					$900	$900		
2.121	Melva PS - Automated Bar Screen			✓						$0	$900					$900	$900		
2.122	Jamieson PS - Automated Bar Screen			✓						$0	$900					$900	$900		
2.81	Main Street, Memorial Drive, O'Dell Drive, Humber Park PS Upgrades	✓								$0	$5,000					$5,000	$5,000	Estimate from EP WW manangement plan	IG
2.89	Fairfield Holding Tank	✓		✓						$0	$4,250					$4,250	$4,250	Costs from CBCL report	DE
2.90	Bedford Sackville Trunk Sewer - Holding Tanks			✓						$0	$20,000					$20,000	$20,000	Budget Cost	VW
2.08	Gaston Rd PS Upgrade	✓								$0	$900					$900	$900		
2.93	Windmill Road PS	✓								$0	$1,500					$1,500	$1,500	Based on design report by SNC. Readjustment required for inflation?	IG
2.05	Autoport Pleasant Street PS Replacement	✓								$0	$1,200					$1,200	$1,200		
2.62	Leiblin Drive PS Generator			✓						$0	$500					$500	$500		
2.06	Valleyford Holding Tank			✓						$0	$1,100					$1,100	$1,100		
2.111	Armdale Roundabout CSO screening			✓						$0	$3,000					$3,000	$3,000	Budget Cost	DE
2.112	Quinpool Road CSO screening			✓						$0	$3,000					$3,000	$3,000	Budget Cost	DE
2.113	Coburg Road CSO screening			✓						$0	$3,000					$3,000	$3,000	Budget Cost	DE
2.114	South Street CSO screening			✓						$0	$3,000					$3,000	$3,000	Budget Cost	DE
2.115	Beaufort Avenue CSO screening			✓						$0	$3,000					$3,000	$3,000	Budget Cost	DE
										$0									
										$0									
Wastewater Structures -- T O T A L S					**$5,783**	**$5,693**	**$1,550**	**$3,175**	**$2,175**	**$18,376**	**$59,800**	**$0**	**$0**	**$0**	**$0**	**$59,800**	**$78,176**		

Wastewater Projects

Project ID	Project Name	Driver			All $ in 000's													Comments Projects >=$1.5M Estimate prepared or Budget Cost (Estimate not yet prepared)	Comment from
					Y1	Y2	Y3	Y4	Y5	Sub Total Y1 to Y5	Y6-10	Y11 - 15	Y16 - 20	Y21 - 25	Y26 - 30	Sub Total Y6 to Y30	Total Y1 to Y30		
		AR	G	C	2012-2013	2013-2014	2014-2015	2015-2016	2016-17		2017-18 to 2021-22	2022-23 to 2026-27	2027-28 to 2031-32	2032-33 to 2036-37	2037-38 to 2041-42				
Wastewater - Treatment Facility																			
2.97	Eastern Passage WWTF Design Build Upgrade	✓	✓	✓	$20,000	$32,300				$52,300							$52,300	Board Report prepared includes cost estimate	
2.40	Beechville, Lakeville, Timberlea WWTF Upgrade	✓	✓	✓	$5,000	$17,500	$12,500			$35,000							$35,000	Very preliminary estimate. Concept study in progress which will provide estimate	DE
2.20	Lockview-MacPherson WWTF - Tertiary Upgrade	✓		✓	$150	$650				$800							$800		
2.50	Wastewater Treatment Facilities Upgrades (Various Locations)	✓			$135		$250	$250	$250	$885							$885		
	- Mill Cove WWTF	✓			$50					$50							$50		
	- Eastern Passage WWTF									$0									
	- Lakeside Timberlea WWTF									$0									
	- Lockview MacPherson WWTF									$0									
	- Frame WWTF									$0									
	- Springfield Lake WWTF									$0									
	- Uplands Park WWTF	✓			$50	$450				$500	$50	$25	$4			$79	$579		
	- Wellington WWTF									$0					$3,000	$3,000	$3,000	Budget Cost (from Operations)	
	- Middle Musquodoboit WWTF	✓							$10	$10	$35					$35	$45		
	- North Preston WWTF									$0									
2.57	HHSP Upgrade Program	✓					$250	$250	$250	$750							$750		
	- Halifax WWTF	✓			$290					$290							$290		
	- Dartmouth WWTF	✓			$180	$150				$330							$330		
	- Herring Cove WWTF																		
	HHSP Deficiency Management			✓	$500					$500							$500		
2.126	N-viro Facility - Upgrade Program	✓			$359	$63	$77	$29		$528							$528		
2.44	Wastewater Treatment Facilities - Backup Power Program (Various Locations)			✓		$176	$278			$454	$1,889					$1,889	$2,343	Budget Cost	VW
2.56	Plant Optimization Audit Program					$125	$180			$305	$375					$375	$680		
2.124	Mill Cove WWTF UV Upgrade	✓							$1,075	$1,075							$1,075		
2.65	Frame WWTF Replacement	✓		✓	$100				$300	$400	$3,000					$3,000	$3,400	Budget Cost	VW
2.39	Bellmont WWTF decommissioning							$400	$1,500	$1,900	$1,250					$1,250	$3,150	Based on study estimate. Readjustment required for inflation?	IG
2.21	Mill Cove WWTF Upgrade	✓	✓							$0	$31,586					$31,586	$31,586	Budget Cost (query $)	VW
	Dartmouth HHSP ARV's				$20					$20							$20		
2.16	Aerotech WWTF Upgrade - Design/Construction				$250	$9,750	$10,000			$20,000							$20,000	Budget Cost	VW
	Aerotech WWTF Upgrades				$35	$700	$20	$38	$700	$1,493	$1,475	$2,170	$1,400	$2,100	$1,400	$8,545	$10,038	Budget Cost (from Operations)	
										$0									
										$0									
Wastewater - Treatment Facility -- T O T A L S					**$27,119**	**$61,864**	**$23,555**	**$967**	**$4,085**	**$117,590**	**$39,660**	**$2,195**	**$1,404**	**$2,100**	**$4,400**	**$49,759**	**$167,349**		

Wastewater Projects

Project ID	Project Name	Driver			All $ in 000's													Comments Projects >=$1.5M Estimate prepared or Budget Cost (Estimate not yet prepared)	Comment from
					Y1	Y2	Y3	Y4	Y5	Sub Total Y1 to Y5	Y6-10	Y11 - 15	Y16 - 20	Y21 - 25	Y26 - 30	Sub Total Y6 to Y30	Total Y1 to Y30		
		AR	G	C	2012-2013	2013-2014	2014-2015	2015-2016	2016-17		2017-18 to 2021-22	2022-23 to 2026-27	2027-28 to 2031-32	2032-33 to 2036-37	2037-38 to 2041-42				
Wastewater - Energy																			
2.136	Roach's Pond PS HVAC Study/Upgrade	✓			$250					$250							$250		
	DWWTF Heat Recovery System Study	✓			$50					$50							$50		
	HCWWTF Heat Recovery System Study	✓			$50					$50							$50		
	Dartmouth WWTF - Ventilation Air Heat Recovery	✓						$750		$750							$750		
	Halifax WWTF - Waste Heat Recovery	✓							$750	$750							$750		
	Herring Cove WWTF - Ventilation Air Heat Recovery	✓			$600					$600							$600		
	Herring Cove WWTF - UV Disinfection System Upgrades	✓		✓		$100				$100							$100		
	Mill Cove WWTF - Reactive Power Correction	✓			$50					$50							$50		
	Mill Cove WWTF - Lighting Upgrades	✓			$100					$100							$100		
	Mill Cove WWTF - Bio-Gas CHP - Study	✓							$100	$100							$100		
	Various PS - HVAC Retro-commissioning	✓			$0	$150	$150	$150	$150	$600	$850					$850	$1,450		
	Various PS - Reactive Power Correction	✓			$0	$150	$150	$150	$150	$600	$450					$450	$1,050		
	Dartmouth WWTF - Waste Heat Recovery	✓								$0	$750					$750	$750		
	Dartmouth WWTF - UV Disinfection System Upgrades	✓		✓						$0	$75					$75	$75		
	Halifax WWTF - Ventilation Air Heat Recovery	✓								$0	$1,000					$1,000	$1,000		
	Halifax WWTF - UV Disinfection System Upgrades	✓		✓						$0	$75					$75	$75		
	Herring Cove WWTF - Waste Heat Recovery	✓								$0	$500					$500	$500		
	Mill Cove WWTF - Bio-Gas CHP - Installation	✓								$0	$650					$650	$650		
										$0									
										$0									
										$0									
Wastewater - Energy -- T O T A L S					**$1,100**	**$400**	**$300**	**$1,050**	**$1,150**	**$4,000**	**$4,350**	**$0**	**$0**	**$0**	**$0**	**$4,350**	**$8,350**		
Wastewater - Fleet																			
2.98	Fleet Upgrade Program				$1,000	$1,250	$1,000	$1,200	$1,100	$5,550							$5,550		
										$0									
										$0									
Wastewater - Fleet -- T O T A L S					**$1,000**	**$1,250**	**$1,000**	**$1,200**	**$1,100**	**$5,550**	**$0**	**$0**	**$0**	**$0**	**$0**	$0	**$5,550**		

Wastewater Projects

Project ID	Project Name	Driver			All $ in 000's													Comments Projects >=$1.5M Estimate prepared or Budget Cost (Estimate not yet prepared)	Comment from
					Y1	Y2	Y3	Y4	Y5	Sub Total Y1 to Y5	Y6-10	Y11 - 15	Y16 - 20	Y21 - 25	Y26 - 30	Sub Total Y6 to Y30	Total Y1 to Y30		
		AR	G	C	2012-2013	2013-2014	2014-2015	2015-2016	2016-17		2017-18 to 2021-22	2022-23 to 2026-27	2027-28 to 2031-32	2032-33 to 2036-37	2037-38 to 2041-42				
Wastewater - IT																			
2.100	Network Infrastructure Upgrades (50/50 split W/WW)	✓			$100	$100	$100	$100	$100	$500							$500		
2.99	Desktop Computer Replacement Program (W/WW)	✓			$130	$130	$130	$130	$130	$650							$650		
2.26	SCADA Master Plan Implementation (50/50 split W/WW)				$594	$1,329	$677			$2,600							$2,600	Estimate prepared (in Asset Mgmt File)	
2.135	GIS Data Program Implementation (W/WW/SW)				$0	$150	$200	$200	$200	$750							$750		
2.18	Data Collection Project (WW/SW)				$0	$40				$40							$40		
2.14	Lateral Card Database Conversion Project (WW/SW)				$0	$125	$125	$125		$375							$375		
2.108	GIS Migration & Development				$250					$250							$250		
	IT Program				$50	$50	$50	$50	$50	$250							$250		
	Computerized Maintenance Management System (50/50 split W/WW)				$50	$50	$400	$400	$400	$1,300							$1,300		
	EMS Software			✓	$70					$70							$70		
										$0									
Wastewater - IT -- T O T A L S					**$1,244**	**$1,974**	**$1,682**	**$1,005**	**$880**	**$6,785**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$6,785**		
Wastewater - Security																			
2.102	Security Upgrade Program				$150	$200	$200	$200	$200	$950							$950		
										$0									
Wastewater - Security -- T O T A L S					**$150**	**$200**	**$200**	**$200**	**$200**	**$950**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$950**		
Wastewater - Equipment																			
2.170	Survey Equipment (50/50 split W/WW)				$15					$15							$15		
	Asphalt Roller				$15					$15							$15		
	Tri-axel Trailer				$30					$30							$30		
	Power Meter/Data Logger (50/50 split W/WW)	✓			$5					$5							$5		
	SIR Program Flow Meters			✓	$44					$44							$44		
	Miscellaneous Equipment Replacement					$60	$60	$60	$70	$250							$250		
										$0									
										$0									
Wastewater - Equipment					**$109**	**$60**	**$60**	**$60**	**$70**	**$359**						**$0**	**$359**		
TOTALS - Wastewater					**$42,003**	**$75,634**	**$32,905**	**$14,482**	**$15,125**	**$180,149**	**$201,127**	**$4,795**	**$4,271**	**$5,233**	**$7,800**	**$223,226**	**$403,375**		

WATER PROJECTS

Water Projects

Project ID	Project Name	Driver			All $ in 000's												Comments Projects >=$1.5M Estimate prepared or Budget Cost (Estimate not yet prepared)
					Y1	Y2	Y3	Y4	Y5	Sub Total Y1 to Y5	Y6-10	Y11 - 15	Y16 - 20	Y21 - 25	Y26 - 30	Sub Total Y6 to Y30	Total Y1 to Y30	
		AR	G	C	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017		2017-18 to 2021-22	2022-23 to 2026-27	2027-28 to 2031-32	2032-33 to 2036-37	2037-38 to 2041-42			
Water - Land																		
3.33	Watershed Land Acquisition			✓	$0	$0	$200	$200		$400							$400	
										$0								
Water - Land -- T O T A L S					**$0**	**$0**	**$200**	**$200**	**$0**	**$400**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$400**	
Water - Transmission																		
3.42	Critical Trans Main Valve Replacement Program	✓				$250	$250	$500		$1,000							$1,000	
3.43	Bedford South CCC - Nine Mile Drive Extension		✓		$35					$35							$35	
3.44	Bedford South Trans Main Oversizing - Non CCC		✓		$40					$40							$40	
3.45	Bedford West CCC - Various Phases		✓		$10	$20	$30	$25	$25	$110	$150					$150	$260	
3.47	Twin Brooks Phase 2 Trans. Oversizing - Non CCC		✓		$110					$110							$110	
3.48	Governor's Brook Phase 3 Oversizing		✓		$65	$35				$100							$100	
2.130	Integrated Resource Plan (split 50/50 WW/W)				$165			$200	$200	$565							$565	
	Asset Management Implementation Program (W/WW/SW)				$88	$300	$300	$300	$200	$1,188	$833	$1,000	$1,167	$1,333	$1,500	$5,833	$7,021	Years 1 to 5 based on AMA report. Year 6+ placeholder costs
	Dunbrack Trans Main Sliplining Phase 2	✓			$6,900	$200				$7,100							$7,100	Estimate prepared in project file
3.08	Pockwock Transmission Main Replacement - Twin Culverts to Bluewater Rd	✓							$2,500	$2,500	$4,500					$4,500	$7,000	Internal Staff Estimate prepared *
	Morris Lake Estates CCC		✓						$15	$15							$15	
	Birch Cove North CCC		✓						$330	$330							$330	
3.19	Lucasville Road Transmission Main - Phase 1	✓	✓				$350	$350	$350	$1,050	$1,750					$1,750	$2,800	) Internal Staff Estimate prepared *
3.20	Lucasville Road Transmission Main - Phase 2	✓	✓							$0	$2,950					$2,950	$2,950	)
	Bedford Connector Transmission Main Phase 3	✓								$0	$2,400					$2,400	$2,400	Internal Staff Estimate prepared *
3.13	Windmill Road Transmission Main Replacement - Ph 1 (Wright to Princess Marg)	✓	✓							$0	$2,700					$2,700	$2,700	) Internal Staff Estimate prepared *
3.14	Windmill Road Transmission Main Replacement - Ph 2 (Princess Marg to Albro Lake Rd)	✓	✓							$0	$2,250					$2,250	$2,250	)
3.10	North End Feeder Tunnel Slip-lining	✓								$0	$3,500					$3,500	$3,500	Internal Staff Estimate prepared *
3.12	Pockwock Transmission Main Replacement-Bluewater Rd to Hammonds-Kearney Control	✓								$0		$7,100				$7,100	$7,100	Internal Staff Estimate prepared *
3.15	Spruce Hill Transmission Main Replacement	✓								$0		$2,750				$2,750	$2,750	Internal Staff Estimate prepared *
3.11	Peninsula Low 24" Sliplining	✓								$0	$7,360					$7,360	$7,360	Internal Staff Estimate prepared *
3.16	Peninsula Low North 27" Sliplining	✓								$0	$7,800					$7,800	$7,800	Internal Staff Estimate prepared *
3.17	Peninsula Intermediate - 15" Rehab	✓								$0	$4,715					$4,715	$4,715	Internal Staff Estimate prepared *
3.18	Port Wallace Transmission Main Connection Phase 1 (Shubie Park Connection)	✓	✓							$0	$2,400					$2,400	$2,400	Internal Staff Estimate prepared *
	Port Wallace Transmission Main Phase 2 (Port Wallace /Caledonia Rd area)	✓	✓							$0		$6,400				$6,400	$6,400	Internal Staff Estimate prepared *
3.21	Burnside - Bedford Connector Transmission Main	✓	✓							$0	$7,800					$7,800	$7,800	Internal Staff Estimate prepared *
	Eastern Passage Transmission Main Replacement - Norah Lane to Cow Bay Road	✓								$0		$2,200				$2,200	$2,200	Internal Staff Estimate prepared *
	Gaston Road Transmission Main Replacement	✓								$0	$1,600					$1,600	$1,600	Internal Staff Estimate prepared *
	Herring Cove Road Transmission Main Replacement Sussex Drive to Princeton Avenue	✓								$0	$4,700					$4,700	$4,700	Internal Staff Estimate prepared *
	Pockwock Transmission Sliplining - Twin Culverts to Highway 102	✓	✓							$0		$13,000				$13,000	$13,000	Internal Staff Estimate prepared *
										$0								
Water - Transmission -- T O T A L S					**$7,413**	**$805**	**$930**	**$1,375**	**$3,620**	**$14,143**	**$57,408**	**$32,450**	**$1,167**	**$1,333**	**$1,500**	**$93,858**	**$108,001**	

Water Projects

Project ID	Project Name	Driver			All $ in 000's													Comments Projects >=$1.5M Estimate prepared or Budget Cost (Estimate not yet prepared)
					Y1	Y2	Y3	Y4	Y5	Sub Total Y1 to Y5	Y6-10	Y11 - 15	Y16 - 20	Y21 - 25	Y26 - 30	Sub Total Y6 to Y30	Total Y1 to Y30	
		AR	G	C	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017		2017-18 to 2021-22	2022-23 to 2026-27	2027-28 to 2031-32	2032-33 to 2036-37	2037-38 to 2041-42			
Water - Distribution																		
3.22	Water Distribution - Main Renewal Program	✓				$3,200	$3,500	$3,600	$3,600	$13,900							$13,900	Place holder - ongoing program
	Chandler Drive	✓			$284					$284							$284	
	Waverley Road Bridge Water Main Replacement	✓			$75					$75							$75	
	Lawnsdale Drive Water Main Renewal (Integrated)	✓			$373					$373							$373	
	Pine Street Water Main Renewal (Integrated)	✓			$433					$433							$433	
	Mountain Drive Water Main Renewal (Integrated)	✓			$198					$198							$198	
	Carver St Service Lateral Relocation	✓			$56					$56							$56	
	Bayers Rd Water Main Renewal (Integrated)	✓			$315					$315							$315	
	Kingfisher Crescent Water Main Renewal (Integrated)	✓			$222					$222							$222	
	CNR Bridge @ Quinpool Road (integrated)	✓			$81					$81							$81	
	Plateau Cr Water Main Renewal (Integrated)	✓			$419					$419							$419	
	Willow Street Water Main Renewal (Integrated)	✓			$125					$125							$125	
	Pleasant Street	✓			$167					$167							$167	
3.66	Cathodic Protection Program	✓			$0	$200	$200	$200	$200	$800							$800	
3.67	Valves	✓			$50	$50	$50	$50	$50	$250							$250	
3.68	Hydrants	✓			$75	$75	$75	$75	$75	$375							$375	
3.69	Service Lines	✓			$240	$240	$240	$240	$240	$1,200							$1,200	
3.35	Meter Program	✓	✓		$1,050	$1,100	$1,150	$1,150	$1,150	$5,600							$5,600	
	Bennery Distribution System Upgrades				$110	$110	$110	$110	$110	$550							$550	
										$0								
										$0								
Water - Distribution -- T O T A L S					**$4,273**	**$4,975**	**$5,325**	**$5,425**	**$5,425**	**$25,423**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$25,423**	
Water - Structures																		
3.23	Chambers and Pumping Stations	✓					$250	$250	$250	$750							$750	
3.24	DMA Program	✓					$100	$100	$100	$300							$300	
	CSE Retrofit - Arkerley Reservoir Chamber	✓		✓	$35					$35							$35	
	Confined Space Retrofit - Orchard Central Chamber			✓		$40				$40							$40	
	PRV Replacement - Prince Albert Road	✓					$310			$310							$310	
	Cowie Hill Road Extension				$250					$250							$250	
	Cowie Hill Facility - Furniture				$125					$125							$125	
	Cowie Hill Operations Facility				$4,000	$3,700				$7,700							$7,700	Board Report prepared includes cost estimate
	Lake Major Dam Replacement	✓		✓						$0	$1,200					$1,200	$1,200	
	Mount Edward Reservoir Replacement	✓								$0	$6,000					$6,000	$6,000	Internal Staff Estimate prepared *
	Herring Cove Reservoir	✓								$0	$2,400					$2,400	$2,400	Internal Staff Estimate prepared *
	Geizer 158 Reservoir Twinning	✓								$0		$13,200				$13,200	$13,200	Internal Staff Estimate prepared *
	Eastern Passage Reservoir	✓								$0			$2,400			$2,400	$2,400	Internal Staff Estimate prepared *
										$0								
										$0								
										$0								
Water - Structures -- T O T A L S					**$4,410**	**$3,740**	**$660**	**$350**	**$350**	**$9,510**	**$9,600**	**$13,200**	**$2,400**	**$0**	**$0**	**$25,200**	**$34,710**	

Water Projects

Project ID	Project Name	Driver			All $ in 000's													Comments Projects >=$1.5M Estimate prepared or Budget Cost (Estimate not yet prepared)
					Y1	Y2	Y3	Y4	Y5	Sub Total Y1 to Y5	Y6-10	Y11 - 15	Y16 - 20	Y21 - 25	Y26 - 30	Sub Total Y6 to Y30	Total Y1 to Y30	
		AR	G	C	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017		2017-18 to 2021-22	2022-23 to 2026-27	2027-28 to 2031-32	2032-33 to 2036-37	2037-38 to 2041-42			
Water - Treatment Facilities																		
3.30	JD Kline WSP Upgrade Program									$0								
3.31	Lake Major WSP Upgrade program									$0								
3.32	Non-Urban Core WSP Upgrade program									$0								
	Miller Lake Small System - Extension of Well Supply Line			✓	$250					$250							$250	
	J D Kline - Chemical Feed Pump Replacement Program	✓			$120	$120	$120	$120	$120	$600							$600	
	J D Kline - Chlorination System Replacement Design	✓			$100					$100							$100	
	J D Kline - Chlorination System Replacement	✓					$2,400			$2,400							$2,400	Internal Staff Estimate prepared *
	Lake Major WSP - Control Room Renovations	✓			$14					$14							$14	
	Lake Major WSP - Lime System Upgrade	✓			$38					$38							$38	
	Lake Major WSP - Ventilation in Motor Control Room	✓			$20					$20							$20	
	J D Kline - Replacement program for Filter Valve Actuators	✓				$45	$45	$45	$45	$180							$180	
	J D Kline - Replace Valve Actuators at the Pumping Station	✓					$95			$95							$95	
	J D Kline - Entrance Road Paving Renewal	✓					$85			$85							$85	
	J D Kline - Mechanical Mixers in the Mixing Tanks			✓			$1,550	$1,000		$2,550							$2,550	Internal Staff Estimate prepared *
	J D Kline - Parking Lot Resurfacing	✓						$120		$120							$120	
	J D Kline - Removal of Aluminium in the process wastewater			✓				$2,700		$2,700	$1,150					$1,150	$3,850	Internal Staff Estimate prepared *
	J D Kline - Lobby Upgrades	✓								$0	$180					$180	$180	
	J D Kline - Replace Pump Motors #1 and #3	✓								$0	$280					$280	$280	
	J D Kline - Flow Splitting Improvements in the Pre-Mix			✓							$1,300					$1,300	$1,300	
	Lake Major WSP - New Diesel Generator	✓									$225					$225	$225	
	Bennery Lake WSP - Future Process Improvements (from 2008 Aerotech Servicing Study)										$1,850					$1,850	$1,850	Internal Staff Estimate prepared *
	Bennery Lake WSP - Raw Water Supply from Grand Lake											$3,800				$3,800	$3,800	Internal Staff Estimate prepared *
	Bennery WTP Upgrades				$140	$140	$140	$140	$140	$700							$700	
										$0								
										$0								
Water - Treatment Facilities -- T O T A L S					**$682**	**$305**	**$4,435**	**$4,125**	**$305**	**$9,852**	**$4,985**	**$3,800**	**$0**	**$0**	**$0**	**$8,785**	**$18,637**	
Water - Energy																		
	Heat Recovery Study and Upgrade	✓			$300	$300				$600							$600	
	JD Kline - Industrial Process Pumps Upgrade	✓					$110			$110							$110	
	JD Kline - Raw Water Supply Pump Energy Study	✓			$50					$50							$50	
	Various - Chamber HVAC Retro-commissioning	✓				$150	$150	$150	$150	$600							$600	
	JD Kline - Wind Energy Development - 4.6 MW	✓								$0	$11,200					$11,200	$11,200	Estimate with Jeff Knapp
	Lake Major - Wind Energy Development - 11.5 MW	✓								$0	$26,200					$26,200	$26,200	Estimate with Jeff Knapp
	Long Lake - Wind Energy Development - 4.6 MW	✓								$0	$11,200					$11,200	$11,200	Estimate with Jeff Knapp
	PRV Energy Recovery Pilot Project - Orchard Central Chamber	✓			$100	$410				$510							$510	
										$0								
										$0								
Water - Energy -- T O T A L S					**$450**	**$860**	**$260**	**$150**	**$150**	**$1,870**	**$48,600**	**$0**	**$0**	**$0**	**$0**	**$48,600**	**$50,470**	

Water Projects

Project ID	Project Name	Driver			All $ in 000's													Comments Projects >=$1.5M Estimate prepared or Budget Cost (Estimate not yet prepared)
					Y1	Y2	Y3	Y4	Y5	Sub Total Y1 to Y5	Y6-10	Y11 - 15	Y16 - 20	Y21 - 25	Y26 - 30	Sub Total Y6 to Y30	Total Y1 to Y30	
		AR	G	C	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017		2017-18 to 2021-22	2022-23 to 2026-27	2027-28 to 2031-32	2032-33 to 2036-37	2037-38 to 2041-42			
Water - Fleet																		
2.98	Fleet Upgrade Program				$250	$200	$460	$450	$465	$1,825							$1,825	
										$0								
										$0								
Water - Fleet -- T O T A L S					**$250**	**$200**	**$460**	**$450**	**$465**	**$1,825**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$1,825**	
Water - IT																		
2.99	Desktop Computer Replacement Program (W/WW)	✓			$130	$130	$130	$130	$130	$650							$650	
3.41	SCADA Control System Upgrades				$50	$50				$100							$100	
3.02	SCADA Master Plan Implementation (50/50 split W/WW)				$594	$1,329	$677			$2,600							$2,600	Estimate prepared in Asset Mgmt File
2.100	Network Infrastructure Upgrades (50/50 split W/WW)	✓			$100	$100	$100	$100	$100	$500							$500	
2.135	GIS Data Program Implementation (W/WW/SW)					$150	$200	$200	$200	$750							$750	
	IT Program				$50	$50	$50	$50	$50	$250							$250	
	Computerized Maintenance Management System (50/50 split W/WW)				$50	$50	$400	$400	$400	$1,300							$1,300	
										$0								
Water - IT -- T O T A L S					**$974**	**$1,859**	**$1,557**	**$880**	**$880**	**$6,150**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$6,150**	
Water - Security																		
2.102	Security Upgrade Program				$50	$50	$50	$50	$50	$250							$250	
										$0								
Water - Security -- T O T A L S					**$50**	**$50**	**$50**	**$50**	**$50**	**$250**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$250**	
Water - Equipment																		
2.170	Survey Equipment (50/50 split W/WW)				$10					$10							$10	
	Power Meter/Data Logger (50/50 split W/WW)	✓			$5					$5							$5	
	Scissor-Lift Equipment - Lake Major WSP				$20					$20							$20	
	Miscellaneous Equipment Replacement				$30	$55	$60	$60	$45	$250							$250	
	Large tapping machine c/w electric operator and 4" to 12" cutters					$34				$34							$34	
	Trench Box	✓					$10			$10							$10	
	Diesel Plate Compactor	✓						$16		$16							$16	
	Small Hydro Vac for valve box maintenance								$25	$25							$25	
										$0								
										$0								
Water - Equipment -- T O T A L S					**$65**	**$89**	**$70**	**$76**	**$70**	**$370**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$370**	
TOTALS - Water					**$18,567**	**$12,883**	**$13,947**	**$13,081**	**$11,315**	**$69,793**	**$120,593**	**$49,450**	**$3,567**	**$1,333**	**$1,500**	**$176,443**	**$246,236**	

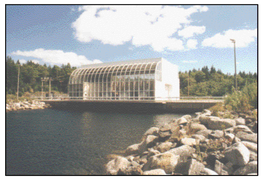
APPENDIX C

Halifax Water Corporate Balanced Scorecard

Halifax Water








HALIFAX WATER CORPORATE BALANCED SCORECARD

The Mission of Halifax Water

"To provide world class services for our customers and our environment"

The Vision of Halifax Water

- 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.

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.

HIGH QUALITY WATER

CSF: High Quality Drinking Water

Organizational Indicator:

- Adherence with 5 objectives from the Water Quality Master Plan for all water systems; we must own system for one year to include results [target of 90% adherence]

Objective	Result to Mar/11	Target	Distrib. Pts.
Disinfection – Chlorine Residual	94%	80 – 100%	14/20
Disinfection By-products (THMs)	74%	< 80 ug/l	0/20
Disinfection By-products (HAAs)	100%	< 80 ug/l	20/20
Particle Removal	93%	<0.2 &< 1.0 NTU	13/20
Corrosion Control	9.8 ug/litre	Lead: <15 ug/l	20/20
Summary Total			67/100

Disinfection - Achieve 0.2 mg/L at all sites (160% of sites achieving residual of 0.2 (or 95% of tests)
TTHMs – Annual Avg. of 1 80 ug/L at all THM sampling sites
HAAs – Annual Avg. of 1 80 ug/L at all HAA sampling sites
Particle removal – Surface water plant achieves turbidity of <0.2 NTU 95% of the time and <1.0 100% of the time
Corrosion Control – Achieve 90th percentile standing lead sample of <15 ug/L for all sample sites

CSF: High Quality Drinking Water

Organizational Indicator:

- Bacteriological tests [Monthly target of 99.3% free of Total Coliform]

	% Samples Free of Coliform	Target
2011/12	99.9 %	99.3 %

CSF: High Quality Drinking Water

Organizational Indicator:

- Customer satisfaction about water quality [Target of 85% rating water quality as good to excellent]

	Survey Results(actual)	Target
From fall 2011 survey	89%	75% - 85%

SERVICE EXCELLENCE

CSF: Service Excellence

Organizational Indicator:

- Customer satisfaction with service [Target of 90% satisfied or very satisfied]

	Survey Result (actual)	Target
From fall 2011 survey	96%	80% - 90%

CSF: Service Excellence

Organizational Indicator:

- Service outages of water [# connection hours / 1000 customers]

	Hours (actual)	Target
2011/12	212	200

CSF: Service Excellence

Organizational Indicator:

- Service outages of wastewater [# connection hours / 1000 customers]. (N.B. the clock starts after we know it is our problem)

	Hours (actual)	Target
2011/12	2	200

CSF: Service Excellence

Organizational Indicator:

- Average call wait time over the year

	Seconds	Target
2011/12	78	70

RESPONSIBLE FINANCIAL MANAGEMENT

CSF: Responsible Financial Management

Organizational Indicator:

- Operating Expense/Revenue ratio [based on annual operating budget]

	Exp/Rev ratio (actual)	Target
2011/12	.663	.715

CSF: Responsible Financial Management

Organizational Indicator:

- Annual Cost per connection (Water)

	Cost/connection	Target
2011/12	$294	$300

CSF: Responsible Financial Management

Organizational Indicator:

- Annual Cost per connection (Wastewater and Stormwater)

	Cost/connection	Target
2011/12	$535	$541

EFFECTIVE ASSET MANAGEMENT

CSF: Effective Asset Management

Organizational Indicator:

- Leakage target of 195 Litres/Service Connection/Day

	Leakage Actual	Target
2011/12	162	195-205

CSF: Effective Asset Management

Organizational Indicator:

- Inflow and Infiltration (I&I) Target of 250 inspections on private property [SIR Program]

	I&I	Target
2011/12	252 inspections	250

CSF: Effective Asset Management

Organizational Indicator:

- # of CSO and SSO events per year [CCME MWES parameter]

	# of CSO and SSO events	Target
2011/12	1022	To be determined

CSF: Effective Asset Management

Organizational Indicator:

- % of asset renewal by asset class. The Asset Classes include: **Water:** distributions mains, chambers & structures, reservoirs, laterals ,**Wastewater:** collection system, pumping stations, retention facilities, culverts, laterals

Asset Class	%age Renewed	Target
Water & Wastewater as noted above for 2011/12	97.9%	80-90%

REGULATORY COMPLIANCE

CSF: Regulatory Compliance

Organizational Indicator:

- # of public health and environmental regulatory infractions resulting in a written warning.

	Public Health & Env. Infract.	Target
2011/12	2	0 - 2 (max.)

CSF: Regulatory Compliance

Organizational Indicator:

- Percentage of samples taken at all wastewater treatment facilities complying with the NSE discharge limit for all parameters [we must own facility for one year to include as a measure].

	% of WWTF samples meeting NSE discharge limits	Target
2011/12	79%	85%

CSF: Regulatory Compliance

Organizational Indicator:

- Percentage of water supply plants meeting product regulations of their permits [we must own facility for one year to include as a measure]

	% water plants meeting regulations	Target
2011/12	100%	100%

ENVIRONMENTAL STEWARDSHIP

CSF: Environmental Stewardship

Organizational Indicator:

- # of businesses in HRM inspected per year

	Actual Inspected	Target
2011/12	412	400

CSF: Environmental Stewardship

Organizational Indicator:

- Energy management [kwh/m³] Target of 1.5% reduction from 2010 base levels for water and wastewater treatment plants

	% Energy Reduction	Target
2011/12	-1.5 % (Water supply plants) 12.2% (Wastewater Treatment Plants)	1.5% (water supply & wastewater treatment plants)

CSF: Environmental Stewardship

Organizational Indicator:

- Bio-solid residuals handling; percentage of sludge meeting solids concentration target - Target of 95% of samples meet a minimum solids concentration of:
  - ✓ **25% from HHSP plants**
  - ✓ **18% from Aercotech Dewatering Facility**

		Target
2011/12	97.3 %	95 % meet solids concentration target

WORKPLACE SAFETY & SECURITY

CSF: Workplace Safety & Security

Organizational Indicator:

- # of *labour* infractions resulting in a written order.

	Labour Infractions	Target
2011/12	2	0 - 2 (max.)

CSF: Workplace Safety & Security

Organizational Indicator:

- Lost time accidents [# of accidents resulting in lost time per 100 employee (FTE pro-rated)]

	Lost time accidents	Target
2011/12	7.11	3 per 100 employees

CSF: Workplace Safety & Security

Organizational Indicator:

- # of traffic accidents per 1,000,000 km

	Traffic Accidents/1,000,000 Kms	Target
2011/12	5.73	3.0

MOTIVATED AND SATISFIED EMPLOYEES

CSF: Motivated and Satisfied Employees

Organizational Indicator:

- % of jobs filled from within Halifax Water (excluding entry level jobs).

	% Jobs filled within	Target
2011/12	59%	80%

CSF: Motivated and Satisfied Employees

Organizational Indicator:

- # of arbitrations divided by total # of grievances. There were a total of 21 grievances filed.

	Arbitrations/Grievances	Target
2011/12	0/21	0 Arbitrations

CSF: Motivated and Satisfied Employees

Organizational Indicator:

- Employee satisfaction survey. 2009 was the benchmark year with a B result.

	Survey Result (actual)	Target
no survey in 2011	N/A	A-

CSF: Motivated and Satisfied Employees

Organizational Indicator:

- Average number of days of absenteeism

	Avg. No. of days absenteeism	Target
2011/12	8.61	< 6 days

APPENDIX D

Volume 1 Maps

Hammonds Plains

Shubenacadie Lakes

Sackville Drive

Sackville Planning Boundary

Hammonds Plains Planning Boundary

Shubenacadie Lakes Planning Boundary

Porters Lake Planning Boundary

North Preston - Lake Major Planning Boundary

Bedford Planning Boundary

Dartmouth Planning Boundary

Cole Harbour Planning Boundary

Halifax Mainland Planning Boundary

Halifax Peninsula Planning Boundary

Timberlea / Lakeside / Beechville Planning Boundary

Prospect Road Planning Boundary

Chebucto Peninsula Planning Boundary

Downtown Dartmouth Planning Boundary

Bedford Basin

Halifax Harbour

Legend

- HRM Planning Areas
- Central Region
- Eastern Region
- Western Region

2 1.5 1 0.5 0 1 2 3 4 km

1 : 35,000

Halifax Water Integrated Resource Plan

Urban Core Boundaries

SEPTEMBER 21, 2012

Hillshade acquired from Google Maps on
September 19, 2011, Priority Water Transmission Main Projects from Halifax Water, Feb. 2010

K:\DARTMOUTH\2011\DA11325 IRP - HALIFAX WATER\DWG\CONCEPT\DA11325-105.DWG

Legend

- HRM Planning Areas
- Pockwock Water Supply
- Lake Major Water Supply

2 1.5 1 0.5 0 1 2 3 4 km

1 : 35,000

Halifax Water Integrated Resource Plan

Water System Boundaries

SEPTEMBER 21, 2012

Hillshade acquired from Google Maps on
September 19, 2011, Priority Water Transmission Main Projects from Halifax Water, Feb. 2010

K:\DARTMOUTH\2011\DA11325 IRP - HALIFAX WATER\DWG\CONCEPT\DA11325-105.DWG

Legend

- HRM Planning Areas
- Service Boundary Urban
- Service Boundary Water
- Service Boundary Sewer

2 1.5 1 0.5 0 1 2 3 4 km

1 : 35,000

Halifax Water Integrated Resource Plan

Waste Water Boundaries

SEPTEMBER 21, 2012

Hillshade acquired from Google Maps on
September 19, 2011, Priority Water Transmission Main Projects from Halifax Water, Feb. 2010

K:\DARTMOUTH\2011\DA11325 IRP - HALIFAX WATER\DWG\CONCEPT\DA11325-105.DWG

Hammonds Plains
Shubenacadie Lakes
Sackville Planning Boundary
Hammonds Plains Planning Boundary
Shubenacadie Lakes Planning Boundary
Porters Lake Planning Boundary
Bedford Planning Boundary
Dartmouth Planning Boundary
North Preston - Lake Major Planning Boundary
Cole Harbour Planning Boundary
Bedford Basin
Halifax Harbour
Halifax Maintland Planning Boundary
Halifax Peninsula Planning Boundary
Downtown Dartmouth Planning Botondary
Timberlea / Lakeside / Beechville Planning Boundary
Prospect Road Planning Boundary
Chebucto Peninsula Planning Boundary

Legend

HRM Planning Areas

Outfall Locations

2 1.5 1 0.5 0 1 2 3 4 km

1 : 35,000

Halifax Water Integrated Resource Plan

Storm Outfall Locations

SEPTEMBER 21, 2012

Hillshade acquired from Google Maps on
September 19, 2011, Priority Water Transmission Main Projects from Halifax Water, Feb. 2010

K:\DARTMOUTH\2011\DA11325 IRP - HALIFAX WATER\DWG\CONCEPT\DA11325-105.DWG

Hammonds Plains

Shubenacadie Lakes

Sackville Drive

Sackville Planning Boundary

Hammonds Plains Planning Boundary

Bedford Planning Boundary

Shubenacadie Lakes Planning Boundary

Porters Lake Planning Boundary

North Preston - Lake Major Planning Boundary

Cole Harbour Planning Boundary

Dartmouth Planning Boundary

Downtown Dartmouth Planning Boundary

Halifax Mainland Planning Boundary

Halifax Peninsula Planning Boundary

Timberlea / Lakeside / Beechville Planning Boundary

Prospect Road Planning Boundary

Chebucto Peninsula Planning Boundary

BOUNDARY NOT FINALIZED BY HRM

ALL OF #25 TO SEWER ON KEARNEY LAKE RD

BOUNDARY NOT FINALIZED

PARTIALLY DEVELOPED

WRIGHT AVE NDTS

BOUNDARY FOR #45 NOT FINALIZED BY HRM

NEEDS TO GET TO PRESSURE SEWER

NO OFFICIAL BOUNDARY HAS BEEN SET

BAYERS LAKE PS

SC1

SC2 1MIGPD

Bedford Basin

Halifax Harbour

Legend

- Priority Water Transmission Main Projects
- HRM Planning Areas
- Urban Service Boundary
- Water Service Boundary
- Sewer Only Service Boundary

2 1.5 1 0.5 0 1 2 3 4 km

1 : 35,000

Halifax Water Integrated Resource Plan

Expected Future Development

OCTOBER 19, 2011

Hillshade acquired from Google Maps on September 19, 2011, Priority Water Transmission Main Projects from Halifax Water, Feb. 2010

K:\DARTMOUTH\2011\DA11325 IRP - HALIFAX WATER\DWG\CONCEPT\DA11325-104.DWG

APPENDIX E

Halifax Water Regional Wastewater Functional Plan Capital Projects

Wastewater Capital Program - Preferred Regional Servicing Strategy

Region	Capital Plan Project No.	Area Project ID	Combined Project Delivery	Implementation Order	Project Description	System	HW Project Type	Project Type	Diameter (mm)	Length (m), Flow (L/s), Volume (m^3)	Unit Rate $/m, $/Lps, $/$m^3$	Base Cost $M (2012)	Other Costs (Crossings etc.) $M (2012)	Total Cost $M (2012)	Year Req'd	Period Req'd	Growth Areas Serviced	Comment
Central	1	AT1	AT5	3	Upgrade Aerotech Drive Pumping station to 145 L/s, from 15 L/s (130 L/s upgrade)	Aerotech	WW - Str	WWPS-U	N/A	130	$6,000	$0.78	$0.00	$1.25	2031	2031-2036	Aerotech	Employment growth. Development of 121 Ha.
Central	2	AT2	AT4	1	Upgrade WWTF to service employment growth flows	Aerotech	WW - TF	WWTF-U	N/A	7.65 MLD	N/A	$13.60	$0.00	$21.76	2031	2031-2036	Aerotech	Employment growth. Development of 121 Ha.
Central	3	AT3		5	Upgrade sewer conveyance to WWTF, from Aerotech Drive PS to WWTF	Aerotech	WW - CS	WWM	450 mm	1,650	$895	$1.48	$0.00	$2.36	2031	2031-2036	Aerotech	Employment growth. Development of 121 Ha.
Central	4	AT4	AT2	2	Re-locate treated effluent discharge location to Soldiers Lake	Aerotech	WW - CS	WWM	450 mm	6,346	$895	$5.68	$5.11	$17.26	2031	2031-2036	Aerotech	Employment growth. Development of 121 Ha.
Central	5	AT5	AT1	4	Upgrade Aerotech Drive PS forcemain to 145 L/s, from 15 L/s (130 L/s upgrade)	Aerotech	WW - FM	WWFM	350 mm	268	$1,193	$0.32	$0.00	$0.51	2031	2031-2036	Aerotech	Employment growth. Development of 121 Ha.
West	27	BL1	BL2	2	450 mm WWFM from BLT PS to 125 m south of Governors Lake Dr	BLT	WW - FM	WWFM	450 mm	2290	$1,629	$3.73	$1.25	$7.97	2021	2021-2026	28	Ongoing study being completed by Dillon Consulting - 1 road crossing (probably opencut)
West	28	BL2	BL1	1	New BLT PS WWPS at Timberlea Village Pky (Site to be confirmed) WWPS	BLT	WW - Str	WWPS-N		220	$6,000	$1.32	$0.00	$2.11	2024	2021-2026	28, 51	
West	29	BL3	BL5	4	New wastewater pumping station at Church St WWPS (Exact site to be determined)	BLT	WW - Str	WWPS-N		220	$6,000	$1.32	$0.00	$2.11	2021	2021-2026	28, 51	
West	30	BL4		3	600 mm WWM from Governor Lake Drive to Church St PS	BLT	WW - CS	WWM	600 mm	1,124	$1,060	$1.19	$0.00	$1.91	2024	2021-2026	28, 51	3 minor creek crossings and 1 road (TBC)
West	31	BL5	BL3	5	450 mm WWFM from Church St PS to upstream of Bayers Lake PS	BLT	WW - FM	WWFM	450 mm	2,831	$1,629	$4.61	$0.51	$8.20	2024	2021-2026	28, 51	1 hwy ramp crossing
West	31	BL6		9	600 mm Hwy 3 WWM from RAMP SSH-4 to Bicentennial Hwy and North West Arm Dr	BLT	WW - CS	WWM	600 mm	783	$1,060	$0.83	$0.00	$1.33	2024	2021-2026	28, 51	
West	55	BL7		7	Upgrade Bayers lake PS	BLT	WW - Str	WWPS-U		220	$6,000	$1.32	$0.00	$2.11	2024	2021-2026	28, 51	
West	57	BL8		8	450mm WWFM from Bayers Lake PS	BLT	WW - FM	WWFM	450 mm	810	$1,629	$1.32		$2.11	2024	2021-2026	28, 51	
West	56	BL9		6	600mm WWM to Bayers lake PS	BLT	WW - CS	WWM	600 mm	513	$1,060	$0.54		$0.87	2024	2021-2026	28, 51	
East	38	DA1		1	Gravity sewer from Little Albro Lake to Jamieson St PS	Dartmouth	SW - Pipe	SWM	450 mm	2,207	$895	$1.98	$0.38	$3.76	2013	2012-2016		to remove albro lake input
East	39	DA2		2	450mm surface water sewer from Fenwick St to Old Ferry Rd PS with the addition of Maynard St	Dartmouth	SW - Pipe	SWM	450 mm	1,681	$895	$1.50	$0.38	$3.01	2014	2012-2016		to remove maynard lake input
East	40	DA3		4	Sewer twinning along existing roads - Albro Lake/Slayter St to Ferry St PS	Dartmouth	WW - TS	WWM	750 mm	3,370	$1,439	$4.85	$1.08	$9.48	2016	2016-2021	3, 4, 5, 6, 13, 15, 16	
East	41	DA4		8	Storage at Shannon Park vicinity	Dartmouth	WW - Str	SF-N		6,800	$2,000	$13.60	$0.80	$23.04	2031	2031-2036	1, 2, 7, 48, 49, 50	
East	42	DA5		9	Storage at Anderson Lake vicinity	Dartmouth	WW - Str	SF-N		5,500	$2,000	$11.00	$0.80	$18.88	2039	2036-2041	48	
East	43	DA6	DA7	5	Upgrade of Ferry Rd PS by 807 L/s to provide total capacity of 900 L/s (existing PS has 93 L/s)	Dartmouth	WW - Str	WWPS-U		807	$7,500	$6.05	$0.00	$9.68	2019	2016-2021	3, 4, 5, 6, 13, 15, 16	
East	44	DA7	DA6	6	825mm Ø Ferry Rd forcemain for 900l/s	Dartmouth	WW - FM	WWFM	825 mm	657	$2,695	$1.77	$0.00	$2.83	2019	2016-2021	3, 4, 5, 6, 13, 15, 16	
East	45	DA8		7	Upgrade of Dartmouth WWTF	Dartmouth	WW - TF	WWTF-U		16.06 MLD	N/A	$24.50	$0.00	$39.20	2021	2021-2026		
East	46	DA9		3	I/I Reduction Program	Dartmouth		I/I				$2.00	$0.00	$3.20	2015	2012-2016		
East	47	EP1		1	I/I Reduction within Eastern Passage Drainage Area	Eastern Passage		I/I				$1.30	$0.00	$2.08	2014	2012-2016	Unknown	Based on the *Eastern Passage Management Study (CBCL, 2006)* that indicates that I/I reduction in the order of 1100 L/s is feasible at a cost of $1.3M
East	48	EP2		8	Upgrade of Eastern Passage WWTF. EP WWTF is currently being upgraded and expanded with allocation for growth considered. Projects to reduce I/I are proposed. Actual growth is to be monitored to confirm impacts on infrastructure	Eastern Passage			N/A			$0.00	$0.00	$0.00			10, 12, 18	Current upgrade being implemented. Capacity of upgraded facility 25MLD (ADF), 75MLD (PWWF). See Appendix L: XCG WWTF Capacity Memo - **no expansion required.**
East	49	EP3		6	Storage Tank at Bissett Lake-Attwood PS	Eastern Passage	WW - Str	SF-U	N/A	1,150	$2,000	$2.30	$0.00	$3.68	2029	2026-2031	18	
East	50	EP4		2	Upgrade Quigley's Corner Pumping Station	Eastern Passage	WW - Str	WWPS-U		10	$6,000	$0.06	$0.00	$0.10	2014	2012-2016	12	Upgrade of Quigley's Corner PS of 10 L/s to maintain baseline volume of overflows
East	51	EP5		7	Twinning of existing Pressure Sewer from Caldwell to terminus	Eastern Passage	WW - CS	WWM	675 mm	7,058	$1,312	$9.26	$1.35	$16.98	2036	2031-2036	10, 18	
East	52	EP6	EP7, EP8	3	Local pipe upgrades throughout system	Eastern Passage	WW - CS	WWM	300 mm	1,554	$783	$1.22	$0.00	$1.95	2026	2026-2031		Local pipe (300mm) upgrades to address existing conveyance limitations
East	53	EP7	EP6, EP8	4	Local pipe upgrades throughout system	Eastern Passage	WW - CS	WWM	450 mm	5,477	$895	$4.90	$0.00	$7.84	2026	2026-2031		Local pipe (450mm) upgrades to address existing conveyance limitations
East	54	EP8	EP6, EP7	5	Local pipe upgrades throughout system	Eastern Passage	WW - CS	WWM	600 mm	896	$1,060	$0.95	$0.00	$1.52	2026	2026-2031		Local pipe (600mm) upgrades to address existing conveyance limitations
West	19	HA1	HA2	7	Upgrade of Kearney Rd PS	Halifax	WW - Str	WWPS-U	N/A	920	$7,500	$6.90	$0.00	$11.04	2021	2021-2026	25, 37, 46	Upgrade of Kearney Rd PS
West	20	HA2	HA1	8	900 mm WWFM from Kearney Rd PS to Bicentennial Hwy (Hill top)	Halifax	WW - FM	WWFM	900 mm	4,708	$2,065	$9.72	$2.55	$19.63	2021	2016-2021	25, 37, 46	3 minor creek crossings, 1 minor road crossing and 1 major road crossing
West	21	HA3		3	900 mm WWM from Bicentennial Hwy (Hill top) to St Margarets Bay Rd	Halifax	WW - TS	WWM	900 mm	2,701	$1,796	$4.85	$5.03	$15.81	2021	2016-2021	23, 24, 25, 27, 28, 37, 46, 51	1 minor creek crossing, 5 minor road crossings, and 1 major road crossing
West	22	HA4		2	Gravity sewer from St Margarets Bay Rd to Armdale Rd PS	Halifax	WW - TS	WWM	900 mm	1,597	$1,796	$2.87	$0.95	$6.11	2019	2016-2021	23, 24, 25, 27, 28, 37, 46, 51	1 minor creek crossing, 1 road crossing (Keating Rd - Probable opencut)
West	23	HA5	HA6	4	Upgrade of Armdale (Rotary) Rd PS	Halifax	WW - Str	WWPS-U	N/A	1,420	$9,000	$12.78	$0.00	$20.45	2021	2021-2026	23, 24, 25, 27, 28, 37, 46	Upgrade of Armdale (Rotary) Rd PS
West	24	HA6	HA5	5	Forcemain from Armdale PS to Punch Bowl Dr (Hill Top)	Halifax	WW - FM	WWFM	1050 mm	2,299	$3,379	$7.77	$6.62	$23.02	2021	2021-2026	23, 24, 25, 27, 28, 37, 46, 51	8 road crossings (Probable opencut)
West	25	HA7		6	Gravity sewer from hill top to Herring Cove diversion	Halifax	WW - TS	WWM	1050 mm	989	$2,941	$2.91	$2.95	$9.38	2021	2021-2026	23, 24, 25, 27, 28, 29, 31, 37, 46, 51	4 road crossings (Probable opencut)
West	26	HA8		1	I/I Reduction Program	Halifax		I/I				$4.00	$0.00	$6.40	2013	2012-2016	25, 37, 46	Kearney Lake Rd, Flamingo, Bayers Lake, Seton Rd, Dutch Village Rd. Would benefit north end of peninsula but not considered a complete solution.

Wastewater Capital Program - Preferred Regional Servicing Strategy

Region	Capital Plan Project No.	Area Project ID	Combined Project Delivery	Implementation Order	Project Description	System	HW Project Type	Project Type	Diameter (mm)	Length (m), Flow (L/s), Volume (m^3)	Unit Rate $/m, $/Lps, $/$m^3$	Base Cost $M (2012)	Other Costs (Crossings etc.) $M (2012)	Total Cost $M (2012)	Year Req'd	Period Req'd	Growth Areas Serviced	Comment
West	32	HC1		2	Gravity sewer from Herring Cove diversion (top end) to Roaches Pond PS	Herring Cove	WW - TS	WWM	1050 mm	3,531	$2,941	$10.38	$4.28	$23.46	2021	2021-2026	23, 24, 25, 27, 28, 29, 30, 31, 32, 34, 37, 46, 51, 52	4 minor creek crossings, 1 road crossing (TBC)
West	33	HC2		3	Gravity sewer from Princeton Rd (70m north of Roaches Pond PS) to Herring Cove PS	Herring Cove	WW - TS	WWM	1050 mm	5,686	$2,941	$16.72	$2.47	$30.71	2026	2026-2031	23, 24, 25, 27, 28, 29, 30, 31, 32, 34, 37, 46, 51, 52	3 minor creek crossings, 2 road crossings (opencut TBC)
West	34	HC3	HC4	4	Upgrade of Herring Cove SPS	Herring Cove	WW - Str	WWPS-U	N/A	1,800	$9,000	$16.20	$0.00	$25.92	2026	2026-2031	23, 24, 25, 27, 28, 29, 30, 31, 32, 34, 37, 46, 51, 52	Lump sum cost estimate - to be verified
West	35	HC4	HC3	5	Forcemain from Herring Cove PS to Herring Cove WWTF	Herring Cove	WW - FM	WWFM	1050 mm	632	$3,379	$2.13	$0.42	$4.09	2026	2026-2031	23, 24, 25, 27, 28, 29, 30, 31, 32, 34, 37, 46, 51, 52	1 minor creek crossing
West	36	HC5		6	Upgrade of Herring Cove WWTF	Herring Cove	WW - TF	WWTF-U	N/A	53.55 MLD	N/A	$84.90	$0.00	$135.84	2031	2031-2036	23, 24, 25, 27, 28, 29, 30, 31, 32, 34, 37, 46, 51, 52	
West	37	HC6		1	I/I Reduction Program	Herring Cove		I/I				$2.00	$0.00	$3.20	2013	2012-2016		allowance for study and implementation of recommendations
Central	11	MC1		1	I/I Reduction Program - manhole sealing	Mill Cove		MH	N/A	N/A	N/A	$0.03	$0.00	$0.05	2015	2012-2016	N/A	Based on the *Sackville Area 5 I/I Study (CBCL, 2006)* that indicates that sealing of manholes could remove approx. 232 L/s, which could result in a 61% reduction of the peak I/I component
Central	12	MC2		2	Storage Facility #1 at Glendale/Old Beaver Bank Road (upstream of Bedford Sackville Trunk Sewer)	Mill Cove	WW - Str	SF-N	N/A	6,000	$2,000	$12.00	$0.00	$19.20	2013	2012-2016	40, 42, 43, 44	Required to alleviate conveyance capacity in the upper 2/3 of the Bedford Sackville trunk sewer
Central	13	MC3		8	Storage Facility #2 at Bedford Range Park (downstream of Bedford Sackville Trunk Sewer)	Mill Cove	WW - Str	SF-N	N/A	7,000	$2,000	$14.00	$0.00	$22.40	2021	2021-2026	39, 38	Required to reduce frequency of overflows at Fish Hatchery PS and alleviate conveyance capacity in the lower Bedford Sackville trunk sewer; limiting the pass forward flow to 900 L/s
Central	14	MC4		5	Localized improvments to Bedford Sackville Trunk Sewer sections - diameters range between 525 mm and 1200 mm over 4.44 km.	Mill Cove	WW - TS	WWM	Ranges	4,436	$2,428	$10.77	$0.00	$17.23	2019	2016-2021	42, 40, 43, 44, 39, 38, 41	Assume twinning of existing trunk sewer to address existing conveyance capacity limitations
Central	15	MC5	MC6	6	New wastewater pumping station at Mill Cove WWTF for diversion to Halifax	Mill Cove	WW - Str	WWPS-N	N/A	330	$6,000	$1.98	$0.00	$3.17	2019	2016-2021	42, 38, 39, 40, 41, 43, 44, 35	Sized to convey 330 L/s from existing service area from Springfield, existing "peel off" area from Mill Cove, and future flows from said growth areas
Central	16	MC6	MC5	7	500mm Wastewater forcemain from Mill Cove WWTF to Mill Cove Diversion Sewer	Mill Cove	WW - FM	WWFM	500 mm	1,139	$1,857	$2.11	$0.00	$3.38	2019	2016-2021	42, 38, 39, 40, 41, 43, 44, 35, 36, 37	Sized to convey 330 L/s from existing service area from Springfield, existing "peel off" area from Mill Cove, and future flows from said growth areas
Central	17	MC7		4	Diversion Sewer from Mill Cove WWTF to Halifax, along Bedford waterfront to Bedford Hwy tunnel	Mill Cove	WW - CS	WWM	600 mm	3,147	$1,060	$3.34	$0.45	$6.05	2016	2016-2021	42, 38, 39, 40, 41, 43, 44, 35, 36, 37	
Central	18	MC8		3	General I/I reduction program allowance	Mill Cove		I/I				$1.00	$0.00	$1.60	2016	2016-2021	42, 38, 39, 40, 41, 43, 44, 35, 36, 37	Monitoring should be implemented now with prgrame for works scheduled in 2016-2021 5yr period
Central	6	SP1	SP2	4	Springfield Lake forcemain pumping south	Springfield	WW - FM	WWFM	200 mm	1,941	$788	$1.53	$0.00	$2.45	2026	2026-2031	42	
Central	7	SP2	SP1	3	New wastewater pumping station at Springfield Lake WWTF to pump flows back to Sackville Dr for diversion to Bedford Sackville Trunk Sewer	Springfield	WW - Str	WWPS-N	N/A	53	$6,000	$0.32	$0.00	$0.51	2026	2026-2031	42	
Central	8	SP3		2	Diversion Sewer from Springfield to Bedford Sackville Trunk Sewer	Springfield	WW - CS	WWM	300 mm	896	$783	$0.70	$0.00	$1.12	2016	2016-2021	42	
Central	9	SP4		5	Decommission Springfield WWTF	Springfield		WWTF-D	N/A	N/A	N/A	$2.00	$0.00	$3.20	2031	2026-2031	N/A	Lump sum cost estimate - to be verified
Central	10	SP5		1	Separation/resewerage - New storm sewers for Springfield Lake Stormwater Collection System	Springfield	SW - Pipe	SWM	Ranges	6,714	$1,000	$6.71	$0.00	$10.74	2016	2012-2016	42	Revised unit cost of $1M / km provided by HW
GRAND TOTAL												**$365.92**	**$37.37**	**$645.26**				

*Sizing and capacities based on 2011 calibrated hydraulic model. More accurate flow monitoring and observed data required for detailed design purposes may produce differing sizing and capacity needs.

APPENDIX F

Halifax Water Integrated Resource Plan
Current and Proposed Programs and Projects

Table of Contents

Tables

Figures

The purpose of this appendix is to present details of selected Halifax Water's current proposed programs and projects developed internally or through the IRP. The appendix is intended as a supplement to Volume 1 as it provides additional information to the body of the main report.

All costs are either $2012 or 30-year NPV as noted. Additional details of all expenditures are presented in Volume 1 Appendix H, Recommended Plan Financial Model.

1. CURRENT PROGRAMS

1.1 ENTERPRISE PROGRAMS

1.1.1 Asset Renewal Management Program

Halifax Water delivers annual planned and reactive maintenance programs to provide a sustainable delivery of core services, which achieves an economical balance between maintenance and capital programs. This program rehabilitates or replaces aging infrastructure is vital to maintaining LOS.

In the recent past Halifax Water recognized its need to enhance its asset management capacities. It initiated the Asset Management Assessment (AMA)[1] which was completed in 2011. The AMA program document recommended 22 initiatives to be implemented over five years (2012 – 2016) to further improve Halifax Water's asset management systems and capacities.

The AMA has a proposed budget allocation for 2012 -2016 in the Five-Year Capital Plan of $5.25 million ($2012).

1.1.2 Climate Change Program

HRM has partnered with the Federation of Canadian Municipalities (FCM), Natural Resources Canada (NRC), Environment Canada (EC) and the Province of Nova Scotia to develop an approach that could be implemented to reduce HRM's contribution to greenhouse gases and manage the impacts of climate change. The result of this initiative was Climate SMART[2] (Sustainable Mitigation and Adaption Risk Toolkit) with the overall objective of mainstreaming climate change into municipal decision-making.

As a public-private initiative, Climate SMART addresses mitigation and adaptation opportunities from a cost-benefit perspective, with special consideration given to the long-term sustainability of the measures to be implemented. The plan encompasses all of HRM's corporate and community assets and activities, and includes a series of tools that are used to incorporate climate change information into its municipal decision-

[1] *Asset Management Assessment*, Halifax Water, June 2011
[2] *HRM Climate SMART Community Action Guide to Climate Change and Emergency Preparedness*, Halifax Regional Municipality, September 2006

making processes. Climate SMART was formally launched in March, 2004 and includes several key deliverables:

1. Vulnerability assessments and sustainability analyses.
2. Cost-benefit assessments.
3. Emissions management and mitigation tool.
4. Climate change risk management plan.
5. An emissions management and adaptation methodology, which includes methodologies for each sector of the community
6. Communications and outreach

While Climate SMART is a good starting point for mitigating and adapting to the effects of a changing climate, Halifax Water will need to do more to assess impacts on its infrastructure, identify the associated risks and develop risk management strategies.

Specific risks, which will directly affect the Halifax Water stormwater, wastewater and drinking water systems include:

- Changing storm intensities may lead to overloading of the combined and storm sewers under Halifax Water's jurisdiction producing additional overflow volume and potentially resulting in sewage back-ups.
- As temperatures warm, the oceans will expand and ice caps and glaciers will melt, releasing much more freshwater into the oceans, causing sea levels to rise. Canadian research suggests that sea levels in Halifax Harbour could rise by 73cm or more by 2100. This will impact the ability of the WWTFs and overflows to discharge into the Harbour and may require either pumping or storage under peak tidal conditions. Increased storm surge would exacerbate this effect.
- Higher temperatures would lead to greater evaporation of our lakes and rivers. This could result in lower flows of water and in turn, lead to poor raw drinking water quality due to increased concentrations of pollutants and algal blooms.

Halifax Water presently has a project examining the impacts of climate change on drainage design and operation. The climate change assessment proposed here would build on those results producing the following:

- Summary of climate change science indicating the likely long-term trends for Halifax region future climate with respect to:
  - Temperature rise
  - Sea level rise
  - Storm surge
  - Future precipitation characteristics including rainfall volume, intensity and frequency as well as snowfall amount

- Impacts of future climate on the water, wastewater and stormwater infrastructure
- Recommendations for changes in infrastructure design and operating practices to mitigate and adapt to future climate change
- Coordination and integration with the development of the Wet Weather System Plan and Water and Wastewater Master Plans

The Recommended IRP includes an early assessment project to further examine climate change impacts. The budgeted amount for this assessment is $0.7 million ($2012).

1.1.3 Energy Management Plan

Through its newly launched Energy Management Program, Halifax Water has committed to creating and ensuring an on-going focus on sustainability and energy efficiency throughout all operating areas. This new program serves to define the goals, objectives, accountabilities, and structure for activities related to sustainability and responsible energy use.

In support of this new program, Halifax Water issued its new Energy Management Policy in June 2011. This policy defines longer-term goals and commits Halifax Water to the principles of responsible energy management including reducing dependence on fossil fuels through energy conservation and best practices; identifying and implementing cost-effective energy-reduction initiatives throughout our operations; developing alternative and renewable forms of energy from utility assets; and reducing pollution by increasing the usage of energy supplied from sources that are less greenhouse gas intensive.

Reporting to the Energy Management Steering Committee (EMSC) on a monthly basis, the Manager, Energy Efficiency is responsible for the creation and implementation of the corporate Energy Management Action Plan (EMAP) and any other activities defined by the EMSC. Reporting typically consists of progress reports on the energy-related activities of Halifax Water including details of energy consumption, key performance indicators, and progress on energy projects and other related activities.

It is believed that this program will be self-sustaining financially using on-going savings gained through energy reduction and generation projects to fund operating expenses and program initiatives.

One of the main tools used in any energy-management program is the energy audit. This can range from a quick, low-level scoping audit to a complex, detailed investment-level audit. To date, mid-level audits are being completed for the three Harbour Solutions WWTFs (Halifax, Dartmouth, and Herring Cove), Mill Cove WWTF, J.D. Kline WSP, and Lake Major WSP. These audits will endeavour to identify potential energy-reduction projects, will provide enough detail to allow a base-level indication of feasibility and project complexity, and will allow the identification and prioritization of projects with the most potential for success and savings to be included in the capital budget over the next five years.

From these mid-level audits, a significant number of energy-reduction opportunities have been identified thus far. These opportunities have the potential to generate significant energy and financial savings in the future. A preliminary list of opportunities identified to date along with an estimate of their implementation status, potential savings, cost benefits, and environmental benefits has been compiled including wind energy (J.D. Kline plant, Lake Major, and Long Lake), hydrokinetic turbines (Robie Street Control Chamber in Halifax and Orchard Control Chamber in Bedford), energy recovery (hydrokinetic turbines, heat exchangers and highly efficient industrial heat pumps, and use of bio-gas).

A number of improvements have been proposed through the Halifax Water Five-Year Capital Plan primarily for the period 2013 to 2017. Recommendations regarding energy related Levels of Service (LOS) are presented in Volume 1 Section 7 under the Implementation Plan.

1.2 CURRENT WASTEWATER SYSTEM PROGRAMS

1.2.1 Current Wastewater WWWTF and Overflow Compliance

There are a number of projects associated with current WWTF and overflow compliance in the Halifax Water Five-Year Capital Plan[3]. The WWTF projects are discussed under a comprehensive compliance program presented in Section 4. The project costs and timing associated with current overflow compliance are presented in the financial model for the Recommended Plan located in Volume 1 Appendix H. In the Five-Year Capital Plan, there is approximately $61.2 million identified for the current WWTF compliance program. The overall capital cost of the current overflow compliance program is $47.7 million ($2012). Major expenditures are associated with collection system upgrades in a number of sewersheds with particular emphasis on sewersheds having high inflow and infiltration (I/I) flows.

1.2.2 Current I/I Program

Halifax Water staff has carried out significant research to identify appropriate techniques to address inflow and infiltration and particularly to establish policy and best practices based on successful examples in other jurisdictions. Industry experience indicates that approximately 50% to 80% of I/I originates from the private system. Halifax Water has estimated the rate of I/I attributable to private side infrastructure approximately 50% mark. To that end, Halifax Water has introduced its Stormwater Inflow Reduction (SIR) program to find ways to reduce private-side contributions to the wastewater system.

[3] *Halifax Water Five-Year Business Plan 2012-2013 to 2016-2017,* Halifax Water, December 2011

For the past several years, Halifax Water staff has been working toward implementing policy to govern how to manage I/I (on both public and private portions of the system). Some of the policy points under consideration include: summary offense tickets, point of sale certification, front-end financing for I/I mitigation, surcharge rates, time limit for compliance, and interruption of water service.

Halifax Water`s SIR program is presently focused on dealing with illegal connections for the MICI (multi-unit dwellings, industrial, commercial, institutional) sector as opposed to single-family dwellings. These MICI contributors are deemed to represent the larger proportion of the private side I/I flows. Private side I/I mitigation requires a long term financial and resource commitment to see meaningful results. As well, from the policy side, there must be a commitment to providing ways for property owners to become compliant (i.e. front-end financing schemes, payback arrangements) and for enforcement activities (this is particularly important for schemes involving disconnects from the existing system). Another essential component to the success of any of Halifax Water`s I/I initiatives (both public and private) is a strong education and promotion campaign, to inform the public of the financial and environmental costs of operating a system with a high I/I component.

Given that the private side generates an estimated 50% of the I/I flows, it may be necessary to expand the inspection, monitoring, and enforcement activities related to the SIR program. Through the proposed I/I Pilot Program (as detailed in the new programs section of this Appendix) staff should coordinate priority areas and activities related to both the private and public portions of the system including any incremental monitoring of the impact on the overall system (flow reductions). Careful coordination of implementation activities will be essential and the program must be resourced appropriately for success.

The Five-Year Business Plan and the Regional Wastewater Functional Plan (RWWFP)[4] contain a significant number of projects aimed at I/I reduction. In total over $122 million ($2012) in I/I projects are under consideration in the IRP.

1.3 CURRENT WATER SYSTEM PROGRAMS

1.3.1 Water Quality Master Plan (WQMP)[5]

The Halifax Water WQMP has been a key tool in establishing drinking water quality goals and setting a baseline for monitoring progress toward these goals. There has been much success in completing a number of the tasks set forth to achieve these goals, and Halifax Water has already adopted some process operational changes and is currently investing in some capital upgrades as a direct result of research conducted as part of this program.

[4] *Regional Wastewater Functional Plan,* Halifax Water, June 2012
[5] *Water Quality Master Plan Version 2*, Halifax Water, 2011

Substantial efforts will be placed on shifting the focus of Halifax Water`s strategic planning partially away from long-term water quality goals and more towards what can be done to support treatment plant operations and improve water quality from a day-to-day perspective. To date, the research program has focused on optimized treatment processes for the J.D. Kline water supply plant. Although several tasks will remain focused on improvements for this facility, several research requirements have been identified in other treatment facilities to address operational challenges and treatment issues. Research efforts will also be focused on adapting a more proactive approach to monitoring and optimizing both treatment operations and treated water quality, and on effort towards monitoring and understanding distribution water quality and performance. Finally, substantial efforts will be made to implement sustainable processes and optimize energy demands during the implementation of all research findings.

The water system is currently fully in compliance with drinking water standards and related Halifax Water LOS. The on-going implementation of the Water Quality Master Plan (WQMP) will ensure continued compliance with anticipated future drinking water standards. From the perspective of the IRP, this program is well established with the WQMP already in its second version. The Halifax Water Five-Year Capital Plan includes projects needed to ensure current and near future compliance, which was incorporated into the IRP.

It is difficult to anticipate what the longer-term trend may be within the industry and hence provide a long-term budget input. At a minimum, the next iteration of the WQMP should address these longer-term requirements.

1.3.2 Other Current Water Programs

There are a number of other drinking water programs presently supported by Halifax Water. They include:

- Halifax Water through the Natural Science and Engineering Research Council of Canada (NSERC) Industrial Research Chair collaborate with Dalhousie University on drinking water quality research. Their research activities have resulted in water treatment process improvements and underpin the WQMP. The Five-Year Capital Plan includes support for this program. The IRP has also included a long-term (to 2043) budget allocation for this purpose.
- Halifax Water has committed to a process of continual improvement towards meeting defined environmental goals and objectives through an Environmental Management System (EMS) program. To date the J.D. Kline, Lake Major and Bennery Lake WSPs have been registered to ISO 14001. Halifax Water plans to expand this program.

- Halifax Water continues to promote water conservation, as it is a sustainable practice that will benefit the utility, customers, and the environment in the long run. The promotion of water conservation is carried out through direct education and partnerships with HRM and other non-governmental organizations (NGOs).

These programs have all been included in the IRP through the Five-Year Capital Plan or additional expenditure recommended under the IRP.

2. NEW PROGRAMS

2.1 ENHANCED ASSET RENEWAL PROGRAM

As was noted above, Halifax Water is presently in the process of implementing the AMA. Once complete it will have the necessary framework and data for developing and managing the asset renewal program.

In the interim, the present IRP needed a methodology to assess the capital needs of asset renewal for all infrastructure systems. The IRP Enhanced Asset Renewal Program evaluation was conducted in two steps:

- Initially, three uniform levels (all assets and all infrastructure systems) of asset renewal, labeled A, B and C, were considered for all point and linear assets.
- The second step involved developing a composite program where the program level was determined for each asset individually using a failure risk assessment. This was labeled the composite program and was used in the formulation of the later refined and short-listed alternative resource plans.

The result of the first stage of the asset renewal modeling is shown in Table 2.1 for the water system assets. The table presents the renewal rates and estimated 30-year net present value (NPV) for the A, B, and C asset renewal variations of the water system assets.

The table data was generated using a proprietary asset renewal model. Details of the modeling procedure are presented in Volume 3 Appendix E.

The asset renewal model evaluated the age of every asset at every model time step and then compared this age with service life of the asset. If the age in the time step exceeded the service life of the asset, the asset was replaced. Ideally, replacement decisions should be based on asset condition information not just on service life alone. In actuality, an asset management program would employ a range of interventions from repair through rehabilitation to extend asset service life rather than always replacing assets at their service life limits. However, given the limitations of available asset data (see Section 3); service life was used as a reasonable surrogate.

This analysis was carried out for each year of the 30-year planning period from 2013 to 2043. The 30-year NPV for each asset was then calculated accounting for every renewal in every time step. This provided a year-by-year asset renewal program cost, which was incorporated into the overall financial model. For the first four-year period, which had a number of specific asset renewal projects identified through the Five-Year Capital Plan, the results of the asset renewal model were compared with the sum of proposed specific expenditures for each asset. If the modeled asset renewal program cost exceeded the sum of specific projects the cost difference was added to the financial model for that time step. If the sum of the specific project costs were equal to or greater than the modeled program cost, the sum of the projects was included as is into the financial model such that asset renewal projects were not double counted. The individual asset renewal NPVs were then accumulated for each system and each variation.

Major model inputs were an estimate of the starting age distribution of the assets and the estimated project replacement cost for each asset.

The major assumptions associated with the asset renewal modeling were as follows:

- The asset service life estimates were based on best industry practice. For complex assets like pump stations and treatment facilities separate service life estimates were made for various system components. Civil (structural) elements had a 50-year life, mechanical-electrical (M&E) components had a 20-year life and instrumentation and control (IC) had a 10-year life. A fraction of the total asset value was assigned to each component e.g. structural represents 60% of total asset value. The asset life data and fractional values are contained in the costing procedures technical memorandum, which is presented in Volume 3 Appendix C of the IRP final report.
- For purposes of the asset renewal modelling the civil-structural components of complex assets such as pump stations and treatment plants were considered to be presently in new condition. Considering the 50-year life of the components they did not figure in the asset renewal requirements over the 30-year IRP planning period. Halifax Water staff reviewed the status of the M&E and IC systems of major water and wastewater treatment facilities and provided specific estimates of current asset age. These were used as the starting point for the modelling of these assets.
- A discount rate of 3% was applied to all asset renewal capital expenditures. The discount rates were calculated as the difference between the current municipal borrowing rate of 5% and an inflation rate of 2% for capital projects estimated from an analysis of ENRCCI[6] index changes for municipal construction projects.

[6] *Construction Cost Index History,* Engineering News Record, July 2012

- The current annual expenditure as a percentage of the asset value was based on the asset renewal expenditures provided in the Five-Year Capital for 2012 to 2017. It was assumed that the budgeted amounts are indicative of current asset renewal expenditures.
- Some special assets with significant site-specific conditions affecting renewal costs such as reservoirs or dams were not modelled but rather subjected to individual analysis to estimate required renewal over the 30-year period. These were high-level estimates. Specific detailed evaluations should be made for each of these structures to establish current condition and replacement requirements.

Based on the below, Table 2.1 shows the following:

- The range of total water asset renewal 30-year NPV costs is from approximately $581 million for A level water system renewal to $312 million for C level renewal. This corresponds to near doubling (1.9 x) of costs in moving from C level to A level
- Approximately 25% -30% of costs are associated with WSP renewal activity depending on the level of renewal.
- Approximately 42% -53 % of costs are associated with linear assets (i.e. distribution and transmission mains) depending on level of renewal.
- The modelled renewal rates significantly exceed the current renewal rates shown in the Five-Year Capital Plan for complex facilities such as WSPs, pumping stations, valves and pressure reducing valves (PRVs).
- Current renewal rates for distribution mains are less than C level while current rates for transmission mains fall between B level and A level.
- Current renewal for metering significantly exceeds modelled rates at all levels.

As noted below, the asset renewal modeling used some simple rules based on asset age. For purposes of evaluating asset renewal effectiveness, two metrics were employed – average asset life at the end-of-period and the fraction of assets above design life.

Table 2.1 Water System Asset Renewal Analysis

Asset Group	Design Asset Life (Years)	Current Annual Expenditure as % of Total Replacement Value	Variation	Annual Asset Renewal Rate % of Replacement Value	Asset Renewal Model 30 year NPV (Discount Rate 3%) ($m)
Water	75	0.23%	A	0.82%	$250.9
			B	0.62%	$188.2
			C	0.35%	$108.0
	75	0.50%	A	0.56%	$58.8
			B	0.44%	$43.0
			C	0.22%	$21.5
	20	3.98%	A	0.40%	$19.2
			B	0.30%	$14.8
			C	0.19%	$8.9
	Civil - 50 M&E - 20	0.26%	A	6.07%	$30.3
			B	5.10%	$24.6
			C	3.73%	$18.3
	75	0.07%	A	0.16%	$2.3
			B	0.11%	$1.5
			C	0.07%	$1.0
	Civil - 50 M&E - 20 ICA - 10	0.54%	A	7.33%	$44.0
			B	6.19%	$36.0
			C	6.30%	$34.0
	varies	0.18%	Reservoirs were assessed on a project-by-project basis		$17.0
	20		Reservoirs were assessed on a project-by-project basis		$7.1
	20	0.00%	Dams were assessed on a project-by-project basis		$6.3
	Civil - 50 M&E - 30 ICA - 10	0.63%	A	3.91%	$139.3
			B	2.63%	$98.6
			C	2.57%	$87.0
	Civil - 50 M&E - 30 ICA - 10		A	3.98%	$6.0
			B	3.95%	$5.3
			C	2.12%	$3.0
Water System Totals				A	$580.7
				B	$442.2
				C	$312.0

Table 2.2 presents the results of this analysis for the water system.

The table also includes the current system average life and fraction above design life statistics based on best available asset age data. The data of Table 2.2 indicate the following:

- At present a significant fraction of the distribution and transmission mains as well as the water meters are beyond design asset life. The M&E and ICA components of the treatment facilities and pumping stations are all presently within design life.
- Modelling results for asset renewal levels A level through C level all maintain a zero % fraction above design life for the pump stations and WSPs at the end-of-period.
- There is some differentiation by level of renewal in the large WSPs. C level shows a larger increase in average age than A level. The small WSP present approximately the same end-of-period average age in all cases. The increase in average age should not necessarily be alarming. It is dependent on a number of factors including the backlog of renewal requirements at the beginning and end of the period. The asset renewal process should be viewed in a dynamic light as not necessarily reaching equilibrium for all assets during the 30-year planning period. Indeed, longer-term analysis spanning 100 to 200 years can be employed to minimize the impact of the current relatively short planning period.
- The asset renewal modelling results for distribution mains show an increase in fraction above design life for all levels of asset renewal. The A level nearly maintains the status quo at 14%.
- The fraction above design life for the transmission mains shows improvement at the A and B levels of asset renewal while the fraction increases at the C level. The average results increase in all cases with smaller increases associated with the A and B levels versus the C level.

Table 2.2 Water System Asset Average Age and Fraction Above Design Life

Asset	Design Asset Life (Years)	Variation	Average Asset Life (Weighted Age) (Years)*	Fraction Above Design Life (Proportion Greater than Expected Life)*	End-of-Period Asset Age (Weighted Age) (Years)*	End-of-Period Fraction Above Design Life (Proportion Greater than Expected Life)*
Distribution Mains	75	A			44.80	14.00%
		B	42.29	12%	49.24	20.00%
		C			56.02	28.00%

Table 2.2 Water System Asset Average Age and Fraction Above Design Life

Asset	Design Asset Life (Years)	Variation	Average Asset Life (Weighted Age) (Years)*	Fraction Above Design Life (Proportion Greater than Expected Life)*	End-of-Period Asset Age (Weighted Age) (Years)*	End-of-Period Fraction Above Design Life (Proportion Greater than Expected Life)*
Transmission Mains	75	A			50.85	2.00%
		B	45.49	10%	53.15	6.00%
		C			60.69	14.00%
Meters	20	A	Residential - 17.62, Commercial - 13.71	Residential - 39%, Commercial - 17%	R-21.27, C-9.91	R-51%, C-0%
		B			R-24.79, C-20.69	R-60%, C-53%
		C			R-31.04, C-25.09	R-74%, C-64%
PRVs	Civil - 50 M&E - 20	A			14.69	0.00%
		B	9.83	0%	15.93	0.00%
		C			17.96	0.00%
Valves	75	A			56.72	27.00%
		B	36.13	4%	58.05	28.00%
		C			59.24	30.00%
Pumping Stations	Civil - 50 M&E - 20 ICA - 10	A			13.59	0.00%
		B	4.88	0%	13.55	0.00%
		C			13.65	0.00%
Concrete Storage Reservoirs	Varies by Reservoir	n/a	Reservoirs were assessed on a project-by-project basis			
					NA	NA
Steel Storage Reservoirs	20	n/a	Reservoirs were assessed on a project-by-project basis			
					NA	NA
Dams	20	n/a	Dams were assessed on a project-by-project basis		NA	NA

Table 2.2 Water System Asset Average Age and Fraction Above Design Life

Asset	Design Asset Life (Years)	Variation	Average Asset Life (Weighted Age) (Years)*	Fraction Above Design Life (Proportion Greater than Expected Life)*	End-of-Period Asset Age (Weighted Age) (Years)*	End-of-Period Fraction Above Design Life (Proportion Greater than Expected Life)*
Large WSPs	Civil - 50 M&E - 30 ICA - 10	A			16.64	0.00%
		B	10.7	0%	21.54	0.00%
		C			21.58	0.00%
Small WSPs	Civil - 50 M&E - 30 ICA - 10	A			15.70	0.00%
		B	6.83	0%	15.40	0.00%
		C			14.99	0.00%

The results of the analysis for the meters generally show an increase in fraction above design life for all levels with an attendant increase in average age.

As Halifax Water collects more meaningful asset information, more detailed analysis can be used to refine the method for determine asset renewal priorities. Presumably this more detailed analysis will consider accurate age profiles, condition assessment information, break history and material performance information. However, in order for this additional level of analysis to be available, significant efforts are needed to gather the necessary information and make it available and accessible in an appropriate format (ideally some form of database). This applies to water, wastewater, and stormwater infrastructure.

The same modeling process was applied to the wastewater and stormwater assets. Table 2.3 presents the asset renewal costs and renewal rate data while Table 2.4 presents asset design life and average results for these two systems.
The results presented in Table 2.3 shows:

- The range of total wastewater and stormwater asset renewal 30-year NPV costs is from approximately $886 million for A level wastewater and stormwater system renewal to $311 million for C level renewal. This corresponds to near tripling (2.9 x) of costs in moving from C level to A level.
- Approximately 39% - 48% of costs are associated with WWTF renewal activity depending on level.
- Approximately 22% - 26% of costs are associated with linear assets (i.e. sewers and forcemains) depending on level.

- The storm system asset renewal represents between 2% and 20% of the total wastewater and stormwater system renewal costs depending on level. Under C Level no expenditures are required for the storm pipe system. This reflects the relatively young starting age of the storm pipes based on the year the service area was developed.
- The modelled renewal rates significantly exceed the current renewal rates for all assets except storm culverts and sanitary trunk and collector sewers, which are close to, modelled rates.

Table 2.3 Wastewater and Stormwater System Asset Renewal Analysis

Asset Group	Design Asset Life (Years)	Current Annual Expenditure as % of Total Replacement Value	Variation	Annual Asset Renewal Rate % of Replacement Value	Asset Renewal Model 30 year NPV (Discount Rate 3%) ($m)
Sewers	100	0.13%	A	0.37%	$111.4
			B	0.25%	$74.3
			C	0.12%	$37.1
Trunk	100	0.21%	A	0.37%	$35.6
			B	0.25%	$23.7
			C	0.12%	$11.9
Forcemains	50	0.74%	A	3.26%	$85.5
			B	2.45%	$56.1
			C	0.83%	$18.8
Pumping Stations	Civil - 50 M&E - 20 ICA - 10	2.10%	A	4.42%	$128.4
			B	3.52%	$101.4
			C	3.19%	$89.5
Treatment Facilities	Civil - 50 M&E - 30 ICA - 10	0.50%	A	3.09%	$342.9
			B	2.76%	$279.4
			C	1.33%	$148.1
Pipes	75	0.06%	A	0.77%	$174.4
			B	0.36%	$64.6
			C	0.00%	$0

Table 2.3 Wastewater and Stormwater System Asset Renewal Analysis

Asset Group	Design Asset Life (Years)	Current Annual Expenditure as % of Total Replacement Value	Variation	Annual Asset Renewal Rate % of Replacement Value	Asset Renewal Model 30 year NPV (Discount Rate 3%) ($m)
Culverts	50	2.41%	A	2.50%	$7.2
			B	2.00%	$5.8
			C	1.66%	$4.8
Wastewater and Stormwater System Totals				A	$885.4
				B	$605.3
				C	$310.2

The results presented in Table 3.4 show the following:

- At present a modest fraction of the sewers and trunk sewers are above design life. The M&E and ICA components of the wastewater treatment facilities and pumping stations, forcemains and the stormwater conveyance assets are all presently within design service life.
- Modelling results for asset renewal levels A through C all maintain a zero % fraction above design life for M&E and ICA components of the wastewater treatment facilities, pumping stations, forcemains and the stormwater conveyance assets at the end-of-period.
- The asset renewal modelling results for the trunk sewers and collectors show a decrease in fraction above design life for the A and B levels of asset renewal. The C level shows a slight increase. The average results increase in all cases with smaller increases associated with the A and B levels versus the C level.

Table 2.4 Wastewater and Stormwater System Asset Average Age and Fraction Above Design Life

Asset	Design Asset Life (Years)	Variation	Average Asset Life (Weighted Age) (Years)*	Fraction Above Design Life (Proportion Greater than Expected Life)*	End-of-Period Asset Age (Weighted Age) (Years)*	End-of-Period Fraction Above Design Life (Proportion Greater than Expected Life)*
Sewers	100	A	43.81	7%	56.77	1.00%
		B			60.46	5.00%
		C			64.62	8.00%
Trunk	100	A	43.81	7%	56.78	1.00%
		B			60.46	5.00%
		C			64.63	8.00%
Forcemains	50	A	28.17	0%	15.59	0.00%
		B			23.85	0.00%
		C			38.81	0.00%
Pumping Stations	Civil - 50 M&E - 20 ICA - 10	A	4.5	0%	13.73	0.00%
		B			13.67	0.00%
		C			13.40	0.00%
Treatment Facilities	Civil - 50 M&E - 30 ICA - 10	A	4.65	0%	9.33	0.00%
		B			12.02	0.00%
		C			13.45	0.00%
Pipes	75	A	28.3	0%	38.05	0.00%
		B			46.76	0.00%
		C			53.30	0.00%
Culverts	50	A	24.3	0%		0.00%
		B				0.00%
		C				0.00%

As noted previously, the first stage of the IRP analysis was carried out for the initial and intermediate alternative resource plans. It explored the A, B, C (monolithic) level for all asset systems (i.e. water, wastewater and stormwater) and all components within each system (e.g. distribution mains).

In reality, the risk of failure has significantly different impacts depending upon which asset system or component is under consideration. For example, the failure of a single sewer pipe, while inconvenient, does not have a widespread or generally high impact. In contrast, the failure of a major water transmission main will have a significant and widespread impact on water supply. Since asset renewal resources are constrained, it is appropriate to have a higher level of asset renewal for those assets that are "high risk" and a lower level of renewal for those whose failure poses a "low risk". An asset component-by-component risk analysis was conducted to determine the acceptable levels of asset renewal for each component. This was the second stage of the asset renewal program analysis and was undertaken for the intermediate plans creating a single optimized component asset renewal strategy.

The risk analysis was based on methodology originally developed by the City of Edmonton [7]to assess the risks of failure associated with all municipal assets – not just water, wastewater and stormwater infrastructure. The failure impact of each asset component was assessed on the basis of best professional judgment by the study team (Halifax Water and consultants). A high (red), medium (yellow) and low (blue) coding scheme was used. The meaning of failure impact was understood to be *"the impact of the failure of the system component (e.g. distribution main) on the ability to meet the asset system (e.g. water system) LOS".* Accordingly, the failure of a major WSP would have a high impact on the ability to meet the LOS for service outages while the failure of a single distribution main would have a relatively low impact on the LOS from a system-wide perspective.

The failure severity is defined as "the impact of a single failure x the failure amount". The failure amount is in turn related to the likelihood or probability of one or more components failing. This has most relevance to asset systems with multiple components such as distribution mains or sewers. For example, water transmission mains have a high failure impact. If it were determined that due to condition, age and other factors that multiple mains have an elevated probability of failure, then the overall failure severity would be high. Condition data are limited and hence decisions in this IRP rely on the knowledge of asset age and an estimate based on industry norms of expected remaining life. This was, in fact, the basis of the scoring for the failure severity for each asset component. Two metrics derived from Table 2.2 for water assets and Table 2.4 for wastewater and stormwater assets were applied – average weighted asset age at the

[7] *Edmonton Bridges the Gap – A Risk Analysis Approach to the Municipal Infrastructure Gap,* S. AbouRizk et al., Summit, Jan/Feb 2005

end of the planning period compared to the age at the beginning of the planning period and the fraction of the assets at the end of the planning period above design life. These two metrics in conjunction with the failure impact was used to qualitatively rate failure severity. Table 2.5 presents the scoring methodology.

Table 2.5 Asset Component Failure Severity Score

Failure Severity Score	Colour Code
0-150	
151-350	
351-600	

Table 2.6 presents the results of the asset risk analysis for the water assets.

Table 2.6 Water Asset Component Risk Analysis

Asset	Design Asset Life (Years)	Failure Impact	Failure Severity Index Under Current Conditions	Failure Severity Under A Level Renewal Conditions	Failure Severity Under B Level Renewal Conditions	Failure Severity Under C Level Renewal Conditions	Preferred Asset Renewal Level
Distribution Mains							
	75	low	150	100	125	150	C
Transmission Mains							
	75	high	350	250	300	350	A
Meters	20						
		low	50	50	60	75	C
PRVs	Civil - 50 M&E - 20						
		low	50	50	60	75	C
Valves	75						
		low	50	50	60	75	C

Table 2.6 Water Asset Component Risk Analysis

Asset	Design Asset Life (Years)	Failure Impact	Failure Severity Index Under Current Conditions	Failure Severity Under A Level Renewal Conditions	Failure Severity Under B Level Renewal Conditions	Failure Severity Under C Level Renewal Conditions	Preferred Asset Renewal Level
Pumping Stations	Civil - 50 M&E - 20 ICA - 10	medium	150	150	175	200	C
Concrete Storage Reservoirs	Varies by Reservoir	high	250	n/a	n/a	n/a	project by project
Steel Storage Reservoirs	20 [2.]	high	250	n/a	n/a	n/a	project by project
Dams	20 [3.]	high	350	n/a	n/a	n/a	project by project
Large WSPs	Civil - 50 M&E - 30 ICA - 10	high	250	250	300	350	C
Small WSPs	Civil - 50 M&E - 30 ICA - 10	medium	150	150	175	200	C

Table 2.7 presents the results of the risk analysis for the wastewater and stormwater systems.

Best professional judgment was used to determine the preferred level of asset renewal for each asset category.

Table 2.7 Wastewater and Stormwater Asset Component Risk Analysis

Asset Group	Asset	Design Asset Life (Years)	Failure Impact	Failure Severity Index Under Current Conditions	Failure Severity Index Under A Level Renewal Conditions	Failure Severity Index Under B Level Renewal Conditions	Failure Severity Index Under C Level Renewal Conditions	Preferred Asset Renewal Level
Wastewater	Sewers	100	Low	150	100	125	150	B
	Trunk	100	Medium	250	150	200	250	C
	Forcemains	50	Medium	250	150	200	250	B
	Pumping Stations	Civil – 50 M&E – 20 ICA - 10	Medium	250	150	200	250	A
	Treatment Facilities	Civil – 50 M&E – 30 ICA - 10	High	250	150	200	250	A
Stormwater	Pipes	75	Low	100	100	150	200	B
	Culverts	50	Low	250	200	250	300	A
	Stormwater Structures	n/a	Low	100	n/a	n/a	n/a	Project by project

Based on this analysis a composite asset renewal was developed. Table 2.8 presents a summary of the composite program. The composite program corresponds to expenditure between the B and C levels for the water system and between the A and B levels for the wastewater and stormwater systems. The second step of asset renewal modeling, the composite asset renewal approach, was used in the financial model for the refined and short-listed plan analyses.

Table 2.8 Composite Asset Renewal Program

System	Component	Level	30-Year NPV $ million
Water	Distribution Mains	C	$108
	Transmission mains	A	$59
	Meters	C	$9
	PRVs	C	$18
	Valves	C	$1
	Pumping Stations	C	$29
	Concrete Storage Reservoirs	Project-by-project	$17
	Steel Storage Reservoirs	Project-by-project	$7
	Dams	Project-by-project	$6
	Large WSPs	C	$77
	Small WSPs	C	$3
Wastewater	Sewers	B	$74
	Trunks	C	$12
	Forcemains	B	$56
	Pumping Stations	A	$127
	Treatment Facilities	A	$332
Stormwater	Pipes	B	$65
	Culverts	A	$7
		Total	**$1,007**

2.2 WET WEATHER SYSTEM PLANNING

Halifax Water faces a number challenges associated with wet weather impacts on the sanitary and combined wastewater systems. In response they have created a range of programs for I/I reduction, improved flow control at WWTFs and pumping stations and the offset of growth impacts on overflows as proposed in the RWWFP. There is need to consolidate these initiatives into a Wet Weather System Plan. The Wet Weather System Plan will include the following components:

- Identification of wet weather related sanitary and combined system drivers and development of wet weather management objectives supported by LOS statements and metrics.
- Review and analysis of existing information and data and identification/confirmation of gaps.

- Review of system models and other tools such as asset inventories and GIS data and identification and/confirmation of gaps.
- Review of the characteristics of waters receiving wet weather discharges.
- Data and information collection designed to fill vital gaps.
- System model update and refinement.
- Development and analysis of alternative system-wide wet weather management strategies in consideration of receiving water characteristics. The alternatives would incorporate the new information and data developed during the Wet Weather System Plan as well as the previous studies. Demand reduction strategies would be assessed as part of this activity.
- Recommendation of a preferred Wet Weather System Plan. This would be incorporated into the overall Wastewater Master Plan.

A total of $14.3 million has been budgeted for Wet Weather System Plan development for the 30-year period including initial plan development and updates every five years. This total also includes funds for ongoing monitoring for wastewater system model calibration and the further expansion and refinement of the model. The details of the costs are presented in Volume 1 Appendix H.

Two specific programs that would be additional inputs to the Wet Weather System Plan are discussed below. The additional costs above and beyond the Wet Weather System Plan preparation are presented for the two components. Cost details and distribution by year are presented in Volume 1 Appendix H.

An Enhanced Overflow Control Program is recommended to address a comprehensive strategy for control of all active overflows. This goes beyond the good starting point provided by the RWWFP. The discussion below provides a high-level presentation of the program basis and the potential costs of additional overflow control (beyond RWWFP). It will need to be refined through the development of the Wet Weather System Plan.

An I/I pilot program is also recommended to provide the necessary data to establish the benefits and costs of extraneous flow (i.e. wastewater demand) reduction.

2.2.1 Enhanced Overflow Control

Based on data collected by Halifax Water there are presently a total of 216 known potential overflow locations within the wastewater system approximately 105 of which are known to have been active at any time. Twenty-nine (29) of the 105 active overflows locations are associated with the combined sewer system.

The RWWFP modelled a total of 96 of the potential overflow locations and determined based on the modeled results, 59 overflows are active during a year with average rainfall. The RWWFP modeling further determined that 28 of the 59 overflows active during an average rainfall year would be impacted by future growth. The RWWFP includes measures

to control only those 28 overflow locations that are expected to experience growth in their tributary sewersheds and only to a level sufficient to offset the effects of growth.

Halifax Water has produced an evaluation of the environmental and public health risks associated with known overflow locations. It has categorized each location according to the categories presented in Table 2.9.

Table 2.9 Receiving Water Risk Categories

Risk Category	Risk Description
A	Drinking water
B	Supervised HRM beach or on-ground with high potential for human contact
C	Known unsupervised swimming areas and designated recreational areas (boat clubs, parks etc.)
D	Other freshwater bodies and/or ground with low potential for human contact
E	Other marine bodies

The average year overflow volumes associated with current conditions, future growth with no controls, and future growth under the RWWFP preferred scenario are summarized for the 28 overflows impacted by growth in Table 2.10. The Table also includes the 31 non-growth impacted overflow volumes for the same scenarios as well as differentiating. All overflow locations by risk level.

Table 2.10 Average Year Overflow Volumes

Category	Receiving Water Risk Level	Number of Outfalls	Baseline (1000 m^3/yr.)	Growth No Controls (1000 m3/yr.)	Preferred RWWFP (1000 m^3/yr.)
Non-Growth Outfalls (31)	E	12	7,891	8,021	9,47 1
	D	0	0	0	0
	C	6	74	74	74
	B	13	697	696	667
	A	0	0	0	0
	Total	31	1,560	1,572	1,688
RWWFP Growth Impacted Outfalls (28)	E	15	6,772	10,935	5,449
	D	4	46	355	43
	C	5	935	4,895	646
	B	4	29	51	28
	A	0	0	0	0
	Total	28	7,782	16,236	6,166
Total System Outfalls		59	9,342	17,808	7,854

The results presented in Table 2.10 show that under current (baseline) conditions approximately 7.8 million m^3/yr is discharged through the 28 outfalls addressed in the RWWFP with an additional 1.6 million m^3/yr. discharged through the remaining 31 active overflows. It is noteworthy that 49% of the non-growth baseline volume is discharged to B or C risk level receiving waters while about 12% of the growth impacted volume is discharged to B and C risk level receiving waters. The impact of growth with no additional controls is evident with an over 100% increase in overflow volumes between the baseline and growth with no controls cases. The preferred RWWFP strategy however reduces the average annual overflow volume for the 28 outfalls by 16% for the total systems outfalls, thus already achieving a substantial improvement.

It is for these reasons that an Enhanced Overflow Control Program was developed and is proposed for implementation through the IRP. A high level analysis of the Enhanced Overflow Control Program was carried out using the following assumptions:

- Additional overflow control used a technology based on storage coupled to pumping and secondary treatment for purposes of estimating capital costs.
- Storage was sized to capture all but 25, 15 and 5 overflow events per average year
- Pumping and secondary treatment requirements were sized to empty full storage in 48 hours
- Costs were estimated using the same procedures as throughout the IRP (documented in Volume 3 - Appendix C).

The additional (beyond the RWWFP) capital costs to achieve a uniform level of 5, 15 and 25 overflow events for all risk levels of receiving water are presented in Figure 2.1.

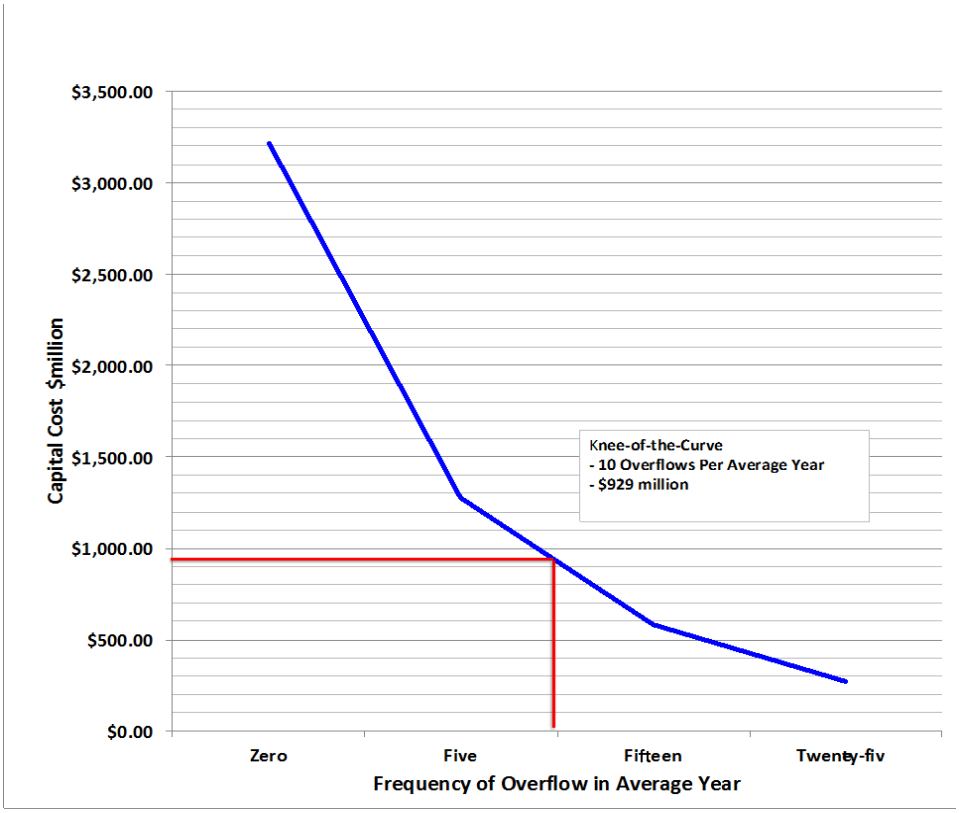


Figure 2.1 Capital Cost of Enhanced Overflow Control

The figure shows a "knee" or inflection point where the marginal costs of further reductions in overflow frequency start showing diminishing return. The "knee" in this case occurs at about 10 overflow events per average year, which would typically correspond to between 1-2 events per month depending on the rainfall distribution. The additional capital cost (above the RWWFP) of the storage-pumping-treatment facilities would be $929 million if all outfalls were included. A second step of the analysis examined the sensitivity of the results to the level of receiving water risk. Figure 2.2 presents the cumulative capital cost to achieve 10 overflows per average year for the outfalls discharging to each receiving water risk level. The A level has not been included since no overflows discharge to A level receiving waters.

The figure shows that a 10 overflow per average year control level would require a capital cost of about $173 million to control the B and C risk level outfalls. A relatively small increase would be required to add the D level outfalls but a quadrupling of costs is required to address all the outfalls (i.e. A to E level).

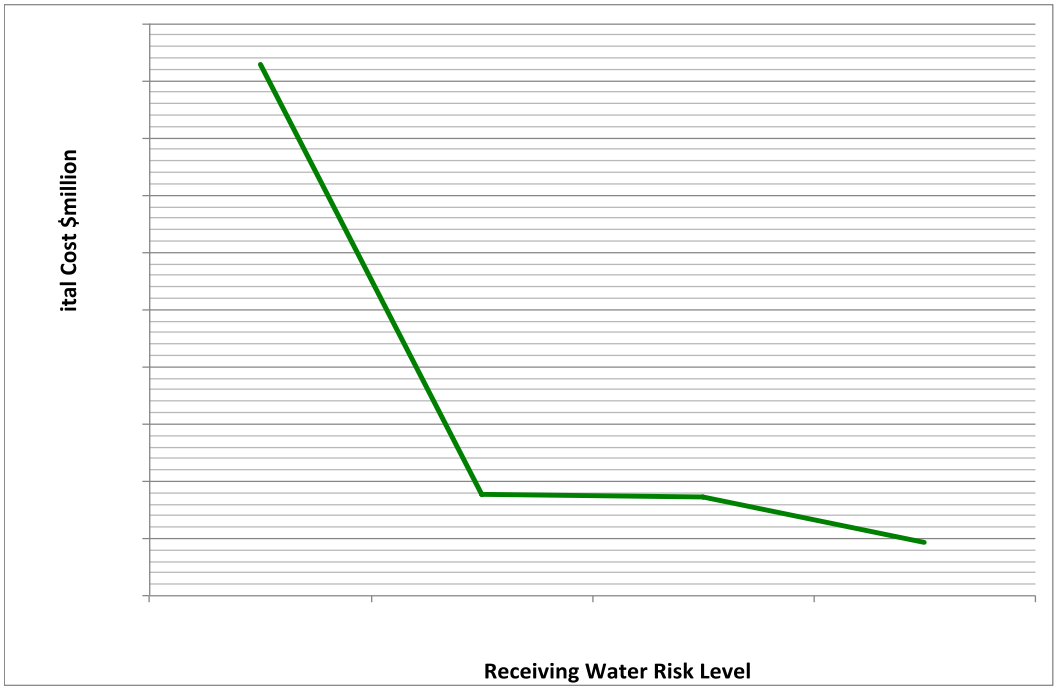


Figure 2.2 Cumulative Capital Cost for 10 Overflows per Average Year

For purpose of the IRP, the B plus C level projects were used for the Enhanced Overflow Control Program.

Figure 2.3 shows the further reduction of total overflow volume (growth plus non-growth) to 665,000 m^3 through the application of the Enhanced Program.

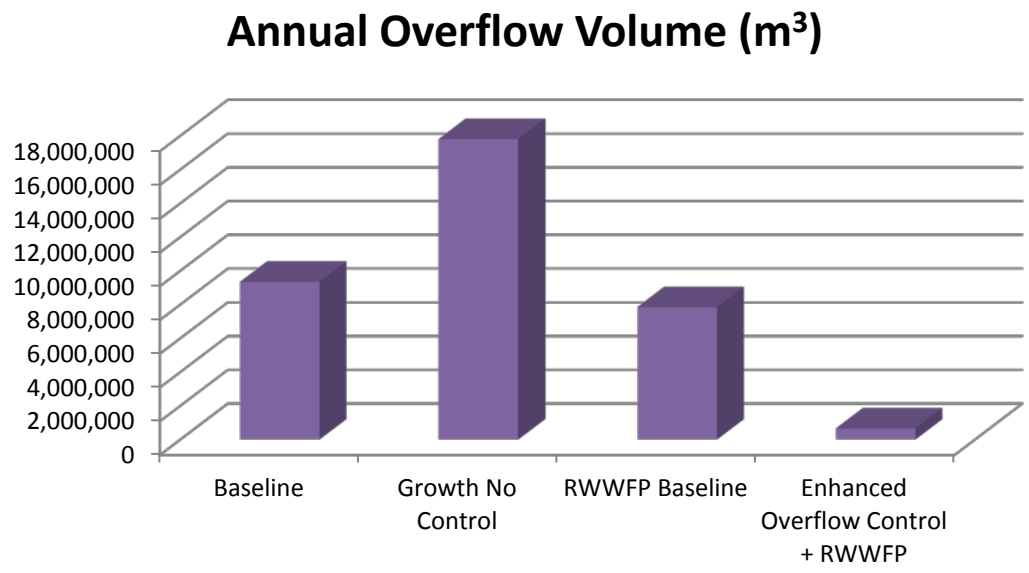


Figure 2.3 Enhanced Overflow Control Program Annual Volume

2.2.2 I/I Reduction Pilot Program

An important part of Halifax Water's long-term approach to reducing wastewater system demand is a comprehensive I/I program. The first step in that program is developing Halifax based information regarding the sources of I/I, possible measures to reduce I/I and the effectiveness and costs of these measures. This is the primary purpose of the I/I pilot program.

Table 2.11 outlines the proposed program tasks and estimated duration. These tasks are intended to proceed in parallel to the extent possible.

Table 2.11 I/I Pilot Program Outline

Task Description/Activities	Component Duration
Baseline/Existing Study Review • Review recommendations from previous I/I related studies • Review existing CCTV inspection reports • Confirmation of recommendations that are still valid and required for implementation • Review existing flow monitoring and rain gauging locations (overall network) • Identify additional monitoring locations • Review hydraulic model and confirm pilot area is covered by skeletonized collection system model • Identification of data gaps	3 months
Sewershed Prioritization/Data Collection and Model Development • Prioritization of prospective pilot program sewersheds (consideration of both public and private side flow reduction opportunities; focus on sewersheds expected to see WWTF expansions or significant PS upgrade requirements) • Select pilot program sewersheds • Build out model to serve pilot area(s) as needed • Identify flow monitoring location(s) for the pilot sewersheds and outline the flow monitoring program is to be undertaken • Assess need and feasibility of remote data access (using PI system) and impacts on timing for the pilot • Identify data coordination requirements with the hydraulic model • Install and calibrate flow meter(s) • Identify and assess range of I/I reduction techniques suitable for implementation in each pilot sewershed (storage, operational repairs (manhole, main line spot repairs), manhole cover plugs, sewer separation (combined systems), deep storm installation program (sanitary systems – no existing storm system), collection system relining program, lateral relining program, pressure grouting of manholes, flood grouting, sump pump disconnection program, foundation drain and roof leader disconnection program) • Identify capital projects that may be incorporated into the pilot evaluation process (i.e. pre-/post-construction monitoring of relevant capital projects) • Identify work plan, schedule, and measurement requirements for each sewershed	36 -60 months

Table 2.11 I/I Pilot Program Outline

Task Description/Activities	Component Duration
Implement I/I Solutions • Begin baseline monitoring • Implement simple operations solutions first (plug manhole covers, replace covers with lock-tight covers, minor spot repairs, etc.) • Implement specific solutions from previous studies • Implement private side solutions • Measure changes in flow after each solution is implemented • Track implementation costs	24 months
Evaluate Effectiveness of Pilot • Identify all variables for each pilot area (slopes, soils, existing conditions, known illegal connections, etc.) • Identify criteria to be used to evaluate effectiveness of the potential solutions • Incrementally implement and measure the impact of the agreed I/I techniques for each pilot sewershed • Assess how each successful I/I solution may be relevant to other sewersheds in the service area • Using the hydraulic model, plug in observed I/I reductions for the relevant sewersheds and predict the savings system-wide • Evaluate the impact of each solution in terms of m^3/reduced and cost to achieve the reduction	18 to 24 months
Reporting • Report on findings/results of the pilot program with regular updates • Use performance data to support future implementations of specific I/I techniques in other sewersheds (dollars spent, reduction in flows realized, recommendations for future implementations)	12 months

The success of the pilot program will require appropriate operational and capital funding for the pilot including the necessary flow monitoring, calibration and data management needs. As well, dedicated resources should be provided for this effort including the public side program, the private side program and operational resources for implementing operations-related repair work.

A total of $1.7 million has been budgeted for I/I pilot program development. Additional funding will be needed for solutions implementation.

2.3 TRANSMISSION MAIN CAPACITY AND SECURITY

Halifax Water is currently developing a long-term plan to expand and upgrade the trunk water transmission main system across the urban core to meet the demands of a growing population, to enhance overall system security, and to strengthen the capacity of the system to provide water under emergency conditions between the J.D. Kline system and the Lake Major system.

An integrated water system network model (Integrated Network Model) was used to:

- Assess current network capacity;
- Identify and size required transmission main projects for future growth; and
- Identify and size required transmission main projects for security of water supply.

The Integrated Network Model incorporates three pre-existing network models which cover the West, East and Central operating regions of the utility serviced by the J.D. Kline WSP and the Lake Major WSP.

In recognition of the potential future requirements for meeting limited demands across HRM under emergency conditions resulting from a prolonged outage at either the J.D. Kline or Lake Major WSPs, the Integrated Network Model has also been used to study the transmission main sizes required to deliver limited amounts of water from the J.D. Kline WSP to the Dartmouth distribution system or from the Lake Major WSP to the communities of Bedford and Sackville. The results of this analysis has shown that the existing and proposed water transmission mains incorporated into an integrated regional water transmission system will have the capacity to meet future average day demands through most of the urban core when one of the major water supply facilities is out of service. In fact, the only part of the system that cannot be provided with average day demand from the Lake Major WSP is the Halifax Peninsula and the west part of the system serviced from the Geizer Hill Storage Reservoirs (i.e. Spryfield, Herring Cove, Cowie Hill and BLT) due to the supply limit of the Lake Major WSP. During a protracted loss of service from the J.D. Kline WSP, these areas of the system would receive unfiltered, disinfected water from the Chain Lakes backup source.

The transmission main projects are presented in Table 2.12. The Transmission Main program totals $141.8 million ($2012). It includes 8 projects that are related to growth (regional level infrastructure) as well as 16 other projects associated with asset renewal and system security.

Infrastructure necessary to provide local servicing is paid for by the developer at the time of development. As well, area master infrastructure (oversized infrastructure that is required to directly support the designated master planning areas both inside and outside the development boundary and that is not considered Regional), is paid for by the developer and may be facilitated through the capital cost contribution (CCC) process. Neither local nor area master infrastructure is shown in the projected growth costs in the IRP.

Table 2.12 Proposed Transmission Main Projects

Project	Length (m)	Diameter (mm)	Description	Project Cost $ million (2012 $)	In-Service Date
East Region					
E1	1,390	400	Windmill Road Transmission Main Replacement - Phase 1	$2.27	2022
E2	1,540	400	Windmill Road Transmission Main Replacement - Phase 2	$2.52	2022
E3	3,610	900	Port Wallace Transmission Main - Phase 1	$10.05	2016
E4	820	600	Gaston Road Transmission Main Replacement - Phase 2	$1.56	2027
E5	1,280	400	Eastern Passage Transmission Main Replacement	$2.09	2027
E6	2,605	900	Port Wallace Transmission Main - Phase 2	$7.25	2027
E7	1		Burnside - Bedford Booster Pumping Station	$1.00	2042
E8	5,740	750	Burnside - Bedford Connector Transmission Main	$14.51	2037
E9	1,350	600	Burnside - Bedford Connector Transmission Main Extension of 600 mm Main on Glendale Dr. to HWY 102	$2.57	2017
			Sub-Total East Region	**$43.83**	
Central Region					
C1	980	750	Bedford Connector 30" Replacement - Phase 3	$2.48	2017
C2	1,515	600	Windgate Drive Transmission Main	$2.89	2027
C3	620	600	Stokil Tank Connection to Windgate Drive	$1.18	2032
C4	5,470	750	Lucasville Road Transmission Main - Phase 1 (includes Beaverbank Reinforcement)	$13.83	2017
C5	5,515	750	Lucasville Road Transmission Main - Phase 2	$13.94	2022
C6	1,000	600	Nordic Crescent Upgrading	$1.91	2032
			Sub-Total Central Region	**$36.22**	
West Region					
W1	1,485	1200	Pockwock Transmission Main Replacement Kearney Lake Road (Twin Culverts to Bluewater Road)	$5.60	2014
W2	1,620	1200	Pockwock Transmission Main Replacement Kearney Lake Road (Bluewater Road to Ham-Kearney Connector)	$6.11	2017

Table 2.12 Proposed Transmission Main Projects

Project	Length (m)	Diameter (mm)	Description	Project Cost $ million (2012 $)	In-Service Date
W3	1,050	900	North End Feeder Tunnel 36" Transmission Main Rehab	$2.92	2017
W4	4,035	600	Peninsula Low 24" Transmission Main Sliplining	$7.69	2027
W5	4,035	375	Peninsula Intermediate 15" Transmission Main Sliplining	$6.60	2022
W6	6,120	675	Peninsula Low 27" Transmission Main Sliplining	$14.63	2032
W7	2,610	400	Herring Cove Transmission Main Replacement	$4.27	2022
W8	1		Mainland North Booster Pumping Station to Fill Geizer 158	$1.00	2037
W9	5,100	750	Susie Lake Transmission Main	$12.89	2027
			Sub-Total West Region	**$61.71**	
			Total Capital	**$141.76**	

APPENDIX G

Halifax Water Integrated Resource Plan

Terms of Reference Compliance

Table of Contents

1. OBJECTIVE

	TOR Requirement	IRP Reference	
1.	IRP will identify the long-term servicing needs for Halifax Water's water, wastewater, and stormwater infrastructure in a cost-effective and reliable manner.	Sections 1, 4, 5, 6 and 7	Halifax Water embarked on the preparation of an Integrated Resource Plan (IRP) in order to define its overall program and resource needs for the next thirty years (2013 - 2043). The IRP responds to the combined requirements of regional growth, present and expected regulatory compliance and asset renewal. These three IRP drivers are presented in Sections 4.2, 4.3, and 4.4 respectively. Fourteen specific objectives were elaborated for the three drivers. The objectives reflect the current and anticipated compliance requirements (seven objectives) for the infrastructure systems; optimal asset renewal requirements as well as a number of related issues addressing water and wastewater system reliability, adequate stormwater capacity, adaptability to climate change and energy efficiency (five objectives); and two growth related objectives addressing the need to extend regional level servicing requirements and the requirement to manage flow capacity allocations. Specific projects and programs were allocated to each objective in the financial plan from existing Halifax Water initiatives and new program initiatives (Section 5.4), identifying the long-term servicing needs of Halifax Water's infrastructure. Sections 6 and 7 identify how the IRP was developed and analysed in a cost-effective and reliable manner.
2.	IRP will identify upgrade needs to address system reliability and safety, current and future capacity, and regulatory compliance.	Section 5.3 Volume 1 Appendix H	Fourteen specific objectives were elaborated for the three IRP drivers (Regulatory Compliance, Asset Renewal, and Growth). The objectives reflect the current and anticipated regulatory compliance requirements for the three Halifax Water infrastructure systems (Objectives 1 through 7, Table 5.1, Regulatory Compliance and Asset Renewal Related Objectives) and upgrade needs to address system reliability (Objective 9, Table 5.1), as well as current and future capacity (Objective 10, 13 and 14, Table 5.1). The IRP financial plan, presented in Volume 1 Appendix H lists recommended projects and upgrade needs under each of the specific IRP objectives.
3.	IRP will consider the interrelationship of the water, wastewater, and stormwater systems.	Sections 5.4, 6.3.1, and 7.6 Volume 1 Appendix F	Part of the IRP development was consideration of sustainable practices such as demand reduction programs (Section 6.3.1). For example water efficiency programs designed to reduce drinking water system demands also have demand reduction benefits for the wastewater system and should be considered under both a water and wastewater. The Five-Year Capital Plan and the RWWFP and thus the IRP contain a significant number of projects aimed at I/I reduction (Current Halifax Water Programs and Projects 2013 -2043, Table 5.2). This includes the SIR program for stormwater removal from the sanitary system and the I/I pilot program presented in Volume 1 Appendix F. The I/I program and the water demand reduction program both demonstrates the linkages among the three systems. The recommended planning programs in Section 7.6 will provide the needed data and insights to firmly incorporate integrated water management in the IRP update.

	TOR Requirement	IRP Reference	
4.	IRP will consider supply-side and demand-side management.	Sections 3.4, 3.5, and 7.0 Volume 1 Appendix F and H Volume 3 Appendices A, B and E RWWFP	The above (No. 3) discussed the IRP approach to demand-side management. The supply-side management assessment involved the review of water and wastewater facility needs in Volume 3 Appendices A and B and in the RWWFP as well as the development of the Enhanced Asset Renewal Program in Volume 3 Appendix E. Specifics of supply-side projects and programs are presented in Sections 3.4, 3.5, 7.0 and in Volume 1 Appendices F and H.
5.	IRP will consider economic constraints of the long term servicing needs.	Section 7	The economic constraints of the long term servicing needs for Halifax Water's water, wastewater, and stormwater infrastructure are outlined in Section 7. Under the recommended IRP proposed expenditures would more than double over the three-year timeframe, would be approximately $989 million in the 2016-2022 timeframe, approximately $1,427 million in the 2023-2032 timeframe, and would be about $1,143 million in the 2033 to 2042 timeframe. These constraints will be further considered in the subsequent Halifax water debt study and rate analysis, which will follow the preparation of the IRP.
6.	IRP will consider environmental constraints of the long term servicing needs.	Section 4.3	This section outlines the long term environmental needs and regulatory compliance constraints of the water, wastewater, and stormwater systems.
7.	IRP will use a minimum 30-year planning horizon, recognizing that a longer planning horizon may be required to address some service and funding requirements.	Sections 1 and 7.2, 7.3, 7.4 and 7.8 Volume 1 Appendix H Volume 3 Appendix E	Halifax Water prepared this IRP in order to define its overall program and resource needs for the next thirty years, 2013 -2043 (Section 1). Sections 7.2, 7.3 and 7.4 present the specific program/project expenditures for the 30-year period. Volume 1 Appendix H presents the 30-year financial plan. Volume 3 Appendix E discusses the need for long-term planning in relation to asset renewal. IRP recommendations included finalizing the overall integrated planning approach and future schedule (i.e. Regional Plan, master plans and asset renewal, and financial planning) within the IRP framework and to periodically update the IRP, assuming the initial update in 3 years and every 5 years afterwards (Section 7.8).

2. INTEGRATED RESOURCE PLAN – APPROACH

	TOR Requirement	IRP Reference	
1.	Halifax Water will work collaboratively with the Nova Scotia Utility and Review Board (UARB) staff and consultants led by James Goldstein (Tellus Institute) and the consultant team hired by Halifax Water to assist with the IRP development.	Section 1	The IRP was developed collaboratively with Halifax Water and its consultants and the NSUARB and its consultants led by the Tellus Institute. The collaboration involved: four Technical Conferences, numerous teleconferences, a number of workshops as well as review of documents.
2.	Halifax Water will use the IRP framework described in Section 3.0 below (Scope) to develop the plan.	Sections 1, 3, 4, 5, 6, and 7	The overall approach to the IRP is presented in Section 1 and in Section 5 of Volume 1.
3.	Halifax Water will coordinate the work for the IRP with other ongoing initiatives including the Regional Wastewater Functional Plan, the Asset Management Assessment, and the proposed Debt Study.	Section 5.4 Volume 1 Appendix H	Halifax Water programs and projects incorporated into the IRP are detailed in Section 5.4. Recommended outputs from the RWWFP were incorporated into the IRP and incorporated into the Recommended Plan financial model presented in Volume 1 Appendix H. The Asset Management Assessment was also incorporated in the IRP programs and into the Recommended Plan financial model presented in Volume 1 Appendix H. The IRP Recommended Plan financial model is one of the key inputs being presently used in the Debt Study.
4.	Halifax Water will identify assumptions necessary to plan for uncertainties related to environmental compliance (e.g. changes in wastewater effluent and biosolids management regulations resulting from the Canadian Council of Ministers of the Environment (CCME) efforts, change, increasing power cost, etc.).	Sections 4.3.2, 4.3.3 and 4.5.1	Additional improvements will be needed to meet the recently promulgated federal Wastewater Systems Effluent Regulations (WSER). The proposed regulations are intended to phase out the release of untreated and undertreated wastewater. The regulations will apply to wastewater systems that treat, or are designed to treat, an average daily volume of at least 100 cubic metres per day (m^3/d). The most significant projects will be the upgrade to full secondary treatment of the three Halifax Harbour Solutions WWTFs - Halifax, Dartmouth and Herring Cove by 2032. O&M costs were calculated for the WSER projects including increases in energy costs. The Province of Nova Scotia has indicated that it will implement WSER requirements under its jurisdiction through conditions attached to approvals issued by Nova Scotia Environment (NSE). Future versions of the WSER or emerging NSE regulations may well require additional controls beyond the offset of growth impacts. Accordingly, Halifax Water reconizes the need to plan for this possible if not probable future. The IRP includes an enhanced overflow control program, beyond that proposed by the RWWFP, based on the identification of high-risk CSO sites requiring more immediate attention (Volume 1 Appendix F). Section 4.5.1 presents the assessment of challenges, opportunities and risks associated with wastewater compliance.

	TOR Requirement	IRP Reference	
5.	Halifax Water will consult with Stakeholders (including, but not limited to, the formal interveners in Halifax Water's 2010 rate hearing, Halifax Regional Municipality, Nova Scotia Environment, and Urban Development Institute).	Section 2 Volume 2	Stakeholders were consulted and have provided input on the IRP analysis framework, assumptions, conclusion, action plan and content for this final report since the commencement of the IRP in 2011. The stakeholders included knowledgeable participants with significant interest in Halifax Water planning process. Members of the various groups and individuals include representatives from the public, non-governmental organizations, municipal and provincial government. A complete list of stakeholders is provided in Volume 2, Stakeholder Consultation Record.
6.	Halifax Water will share information with the UARB and stakeholders (and their respective advisors) to support the planning process subject to confidentiality agreements as appropriate.	Section 2	Stakeholder consultations were carried out in two phases. During the first phase, a short list of stakeholders were consulted who have acted as interveners during Halifax Water's rate hearing before NSUARB. - The second phase of the stakeholder consultation involved implementations of five technical conferences, which are outlined in Table 2.2, Purpose of Stakeholder Technical Conferences. Briefing packages were assembled for the technical conferences and made available to stakeholders. Summary minutes of the technical conferences, presentation materials, and conference agendas were posted on the Halifax Water IRP website. Access was provided to the IRP Study SharePoint site for viewing IRP related documents.
7.	Halifax Water will maintain compliance with the UARB regulatory framework.	Volume 1, Appendices A and G	The IRP was prepared at the direction of the Nova Scotia Utility and Review Board (NSUARB). This detailed Terms of Reference for the IRP (Volume 1 Appendix A) presents a quick reference to specific sections of the report, maintaining compliance with the UARB regulatory framework (Volume 1 Appendix G).
8.	Halifax Water will maintain compliance with the environmental regulatory framework.	Sections 5.3 and 6.2	IRP Objectives 1 through 7 comprises of projects and programs to ensure compliance with the environmental regulatory framework for the water, wastewater, and stormwater infrastructure (Section 5.3). Under the compliance driver, Objective 1 comprises of projects and programs to meet current NSE WWTF Permits to Operate compliance. As noted in Table 6.1, Recommended IRP Components and Timing, the timeframe to implement current compliance is 5 years. Objective 2 comprises of projects and programs to meet current NSE WSP Permits to Operate compliance. The water system is currently in full compliance. Objective 3 comprises of projects and programs to meet current overflow compliance. The timeframe to implement current compliance is 10 years. Objective 4 comprises of projects and programs to meet future WWTF compliance. As noted in Table 6.1 the timeframe to implement future WSER compliance for the HHSP WWTFs is 20 years. The timeframe to implement nutrient compliance for WWTFs discharging to sensitive receiving waters is 10 years. The nutrient reduction strategy will occur as per the timing period implemented in the RWWFP. Objective 5 comprises of projects and programs to meet future Drinking Water compliance. The implementation for the projects and programs was within 5 years as per the Halifax Water Five Year

	TOR Requirement	IRP Reference	
			Business Plan. Objective 6 comprises of projects and programs to meet future Overflow compliance. The enhanced program, above projects designated by the RWWFP, will have a 30-year implementation period. Objective 7 comprises of projects and programs to meet future stormwater quality compliance. The implementation timing of 10 years is for stormwater quality program development.
9.	Halifax Water will develop and enhance in-house capabilities related to strategic infrastructure planning that will be invaluable in future planning and operations.	Sections 5.4 and 7.6	The development and analysis of the alternative resource plans was a multi-step iterative process involving the Halifax Water technical team comprised of staff and consultants collaborating with the Tellus team. One of the central tasks of the IRP was to build a working framework for future integrated resource planning. This in turn required that the IRP process itself be defined as well as linking the IRP to other Halifax Water and HRM planning and financial processes. The concept is illustrated in Section 7.6, Figure 7.2, and Halifax Water IRP Planning Overview. As noted in the future IRP recommendations, it is recommended Halifax Water evaluate the adequacy of Halifax Water's existing institutional capacity and staffing to implement the programs and projects identified in the IRP.

3. SCOPE

	TOR Requirement	IRP Reference	
1.	IRP process will characterize current condition of the infrastructure assets and identify information gaps.	Sections 3.4 and 4.4.2 Volume 3 Appendix D and Volume 3 Appendix E	Section 3.4 describes the current water, wastewater, and stormwater infrastructure assets. A review of the available asset information was carried out as part of IRP preparation. The data gaps identified are presented in Volume 3, Appendix D and E and are summarized in Table 4.5, Asset Data Gaps.
2.	IRP process will document existing capacity of infrastructure components.	Section 3.4 Volume 3 Appendix A and B and RWWFP	Section 3.4 summarizes the existing capacity of the water and wastewater, infrastructure components, A review of the water system is presented in Volume 3 Appendix A, the WWTFs in Volume 3 Appendix B, the collection system in the RWWFP The storm system information regarding capacity was very limited. Portions of the drainage system (combined areas) were analysed under the RWWFP
3.	IRP process will develop demand forecasts for future water supply, and future wastewater and stormwater flows and capacity requirements.	Section 4.2.1 Volume 1 Appendix D RWWFP	The impact of growth was examined for both the water and wastewater systems. Most of the new growth is planned to occur in the urban core or adjacent areas. Very little growth other than infill is expected in the satellite communities. Hence the impacts were primarily on the large water and wastewater facilities and associated distribution or collection systems. The details of growth impacts on both water and wastewater systems are provided in Volume 3 Appendices A and B respectively. Volume 1 Appendix D and the RWWFP provide additional details of growth locations and distribution. Growth is not likely to have a significant impact on the overall stormwater system, as there are very few existing regional facilities. However, with growth, the length of the stormwater network (both piped and ditches) will be expended and therefore impact the ongoing asset management and operational programs over time. Sewer separartion is an option for asset renewal projects, leading to increased stormwater infrastructure over time.
4.	IRP process will identify jurisdictional responsibilities and policies related to overall water resources management (including water supply and extraction rates, source protection, groundwater resources, groundwater recharge practices, flood and stormwater management, flood protection, etc.).	Section 3.2	Halifax Water presently operates and manages all elements of the water and wastewater system but only specific portions of the stormwater system. Figure 3.1, in Section 3.2 presents the stormwater responsibilities graphically. The HRM Regional Plan presently requires the preparation of a Regional Stormwater Functional Plan (RSWFP) by HRM. The preparation of the RSWFP should be used to provide the “road map” that will resolve the jurisdictional and other issues surrounding stormwater management.

	TOR Requirement	IRP Reference	
5.	IRP process will identify risks and uncertainties that may influence Halifax Water's delivery of water, wastewater, and stormwater services.	Section 4.5	The three IRP drivers impact each of Halifax Water's infrastructure systems to varying degrees. The principal risks to Halifax Water associated with these impacts are connected to the uncertainty of future requirements. A second and equally important risk results from the limitations of available data supporting the IRP decision process. Specific drivers Uncertainties and Risk are discussed further in Sections 4.5.1, Compliance Challenges, Opportunities and Risks; 4.5.2, Asset Renewal Challenges, Opportunities and Risks; and 4.5.3, Growth Challenges, Opportunities and Risks.
6.	IRP process will develop a set of performance requirements (including social and environmental constraints) and criteria for prioritizing needs and evaluating the various plans.	Sections 5.3	Fourteen specific objectives were elaborated for the three IRP drivers (Regulatory Compliance, Asset Renewal, and Growth). The objectives reflect the current and anticipated regulatory compliance requirements for the three Halifax Water infrastructure systems (Objectives 1 through 7, Table 5.1, Regulatory Compliance and Asset Renewal Related Objectives) and upgrade needs to address system reliability (Objective 9, Table 5.1), as well as current and future capacity (Objective 10, 13 and 14, Table 5.1). The IRP financial plan lists recommended projects and upgrade needs under each of the specific IRP objectives.
7.	IRP process will develop realistic supply-side and demand-side options to meet current supply and capacity constraints and needs, future growth, and current and projected environmental requirements.	Section 6.2	Table 6.1, presents the Recommended IRP Components and Timing Objective 1 comprises of projects and programs to meet current NSE WWTF Permit to Operate compliance, the timeframe to implement current compliance is 5 years. Objective 2 comprises of projects and programs to meet current NSE WSP Permit to Operate compliance. The water system is currently in full compliance. Objective 3 comprises of projects and programs to meet current Overflow compliance. The timeframe to implement current compliance is 10 years. Objective 10 comprises of projects and programs to ensure existing stormwater system is adequately sized for minor storm conveyance. The timeframe to implement is 10 years for program development. Objective 13 and 14 comprises of projects and programs to provide regional water, wastewater, and stormwater infrastructure needed to support planned growth and manage flow capacity allocations, respectively. The implementation timing to support planned growth is as per the RWWFP. Additional future projected environmental requirements are outlined in ToR#65, below.

	TOR Requirement	IRP Reference	
8.	IRP process will perform and document a screening analysis to determine which options are to be evaluated further in the IRP process and which can be removed from further consideration.	Section 5	The development and analysis of the Integrated Resource Plans was a multi-step iterative process involving the Halifax Water technical team comprised of staff and consultants collaborating with the Tellus team. Results of plan development and analysis were presented to the Stakeholders Group at key points in the process. Figure 5.1 presented an overview of the IRP alternative resource plan development and evaluation process. Section 5.5 details the IRP variations and Sections 5.7 to 5.10 details the initial, intermediate, refined, and short-list plans, documenting which options were to be evaluated further in the IRP process (i.e. enhanced overflow control) and which were removed from further consideration (A, B, and C asset renewal changed to a composite asset renewal program).
9.	IRP process will identify all assumptions used for the IRP process including planning, forecast, and financial assumptions.	Detailed throughout Volumes 1 and 3 of the IRP report	Assumptions are detailed throughout the IRP report including those for asset service life estimates which were based on best industry practice, enhanced overflow control, demand reduction, end-of-period analysis, and financial modelling. Asset life data and fractional values are contained in the costing procedures technical memorandum, which is presented in Volume 3 Appendix C.
10.	IRP process will develop the resource plans.	Sections 5 and 6	See ToR #24 above. Figure 5.1 presents an overview of the IRP alternative resource plan development and evaluation process. Through the synthesis of key inputs, twenty-eight initial resource plans were developed. These were evolved through into 18 intermediate plans and then 10 refined plans. A short list of four plans was selected from the 10 refined plans. The final recommended plan was selected from the short list, which is presented in Section 6, IRP Recommended Plan.
11.	IRP process will evaluate the resource plans to determine the preferred alternative based on the least cost plan that meets the defined performance requirements and criteria. Least cost is defined as the lowest cumulative present worth of the annual revenue requirements.	Section 5.10	The rationale for the selection of the Recommended Plan is presented in Section 5.10.
12.	IRP process will perform sensitivity analysis to determine the impacts of realistic variations to the input assumptions.	Section 6.3	The Recommended Plan analysis is presented in Section 6.3. The Recommended Plan was analysed to assess the impact of three factors: • The potential benefits of water demand reduction and I/I reduction on the Recommended Plan. • The level of asset renewal (A, B, C and composite) on end-of-period asset value. • The population growth rate (high, baseline and low) on plan requirements.

	TOR Requirement	IRP Reference	
13.	IRP process will identify an implementation and financing schedule for actions required over the next 3 years (through 2015) to meet demand projections as well as reliability, safety, capacity, regulatory, and environmental requirements.	Section 7.2	The 3-year expenditures from 2013 to 2015 associated with the Recommended Plan are presented in Table 7.2, IRP Recommended Expenditures 2013-2015 ($million*).*
14.	IRP process will identify the longer-term implementation activities and estimated financing needs as currently known through the end of the planning horizon.	Sections 7.3 and 7.4	Table 7.3 presents the IRP expenditure plan for 2016-2022 while Section 7.3 describes the longer term recommendations for 2016 to 2022. Table 7.4 presents the IRP expenditure plan for 2023 to 2032 and 2033 to 2042 while Section 7.4 describes the longer term recommendations of these expenditure plans.
15.	IRP process will file the final IRP with the UARB.		Halifax Water is intending to file the IRP with the NSUARB.

4. INTEGRATED RESOURCE PLAN FRAMEWORK - PROCESS

	TOR Requirement	IRP Reference	
1.	IRP process will develop a plan for delivering water, wastewater, and stormwater services that minimizes the cumulative present worth of annual revenue requirements, while meeting various performance requirements and regulatory constraints.	Sections 4 and 5	Halifax Water embarked on the preparation of an Integrated Resource Plan (IRP) for its water, wastewater, and stormwater services in order to define its overall program and resource needs for the next thirty years (2013 - 2043). Specific projects and programs were allocated to each objective in the financial plan from existing Halifax Water initiatives and new program initiatives (Section 5.4), identifying the long-term servicing needs of Halifax Water's water, wastewater, and stormwater infrastructure. Section 5 identifies how the IRP was developed and analysed in a cost-effective and reliable manner.
2.	IRP process will use current models, where available, to evaluate the developed resource plans against the IRP objective and constraints (Modeling may include financial assumptions, regulatory constraints, water demand and wastewater/ stormwater flow and capacity forecast, supply-side and demand-side options).	Section 5 Volume 1 Appendices F and H Volume 3 Appendix E RWWFP	The IRP financial analysis was carried out with a financial modeling tool specifically developed for the IRP. Details of financial modelling are presented in Section 5 and in Volume 1 Appendix H. The Enhanced Asset Renewal program was formulated using a proprietary model described in Volume 3 Appendix E. The Enhanced Overflow Control program was developed based on wastewater system modeling conducted under the RWWFP. Details of the program development are presented in Volume 1 Appendix F.
3.	IRP process will identify future programs needed for management of stormwater (infrastructure, flows, capacity, flood protection, stormwater quality issues, retention/storage needs, etc.)	Section 5.4	In parallel with the Regional Stormwater Functional Plan (to be prepared by HRM), it is recommended that Halifax Water consider a new climate change assessment program intended to examine the impacts of climate change on Halifax Water current infrastructure, operations and future design requirements as well as a new Stormwater Quality Assessment program designed to assess likely future stormwater quality management requirements.
4.	IRP process, where feasible and appropriate, will use sensitivity analysis to address a range of reasonable assumptions.	Sections 5.0 and 6.3	In Section 5 the various levels of the alternative resource plans were subjected to their sensitivity to various plan elements such as the level of asset renewal. In Section 6, the Recommended Plan was analysed to assess the impact of three factors: • The potential benefits of water demand reduction and I/I reduction on the Recommended Plan. • The level of asset renewal (A, B, C and composite) on end-of-period asset value. • The population growth rate (high, baseline and low) on plan requirements.
5.	IRP process will consider technically, economically, and environmentally viable supply-side technologies including operating practices (optimizations), capital and operating costs, and operating assumptions.	Sections 3.3 and 5.4	As noted in ToR # 23 there is a broad range of supply-side alternatives considered. They were derived from the following sources: • Five-Year Capital Plan • Program/project extensions beyond the Five-Year Capital Plan refined in the IRP • RWWFP • Programs and projects developed through the IRP

	TOR Requirement	IRP Reference	
6.	IRP process will critically assess the potential role of demand-side management (DSM) practices and review the estimated impacts on costs, demand, and capacity.	Section 6.3 RWWFP	A full business case analysis of demand reduction was not feasible for this IRP due to considerable limitations in available data and time needed to assess and analyse results. The approach that was taken examined the benefit value gained from demand reduction for the wastewater system and compared these values with literature-based information on flow reduction costs. The focus of the analysis was a case study of the combined benefits of water efficiency and I/I reduction on the expansion requirements identified under the RWWFP for the Dartmouth facility.
7.	Initial IRP process will be completed consistent with the data that will be available to Halifax Water within the time line of this project. Future enhancements to the IRP will improve the accuracy and detail of the outcomes.	Sections 4.4.2 and 7.8	The foundation of an efficient asset renewal program is a solid understanding of the asset inventory coupled with an understanding of current asset condition. This information along with cost data provides the ingredients to develop a well-founded program. A review of available asset information was carried out as part of IRP preparation. The data gaps identified are presented in Volume 3, Appendix D and summarized in Table 4.5. Based on the review, it was clear that there were significant limitations on asset condition data with water system linear assets having the most recorded information and wastewater and stormwater linear assets having little or no recorded condition data. It was recommended to ensure adequate data collection and analysis components in all functional and asset renewal planning for future IRP preparation.

4.1 INTEGRATED RESOURCE PLAN FRAMEWORK – IRP DELIVERABLES

4.1.1 Demand and Capacity Forecasts

	TOR Requirement	IRP Reference	
1.	IRP process will review and confirm existing water supply demand forecasts (e.g. average and peak) over the proposed planning horizon relative to identified alternative growth scenarios and system enhancements or constraints.	Volume 3 Appendix A	Volume 3 Appendix A documents the existing water supply demand forecasts for the J.D. Kline WSP, Lake Major WSP, Bennery Lake WSP, Small WSP Systems as well as growth impacts on the water transmission system.
2.	IRP process will document effects from Halifax Water's ongoing water loss control program.	Section 3.3	Halifax Water has achieved a considerable measure of success since adopting the AWWA/IWA Water Loss Control Methodology in 2000. Halifax Water currently specifies a LOS for water loss. Section 3.3 presents the details of the Halifax water Corporate Balanced Scorecard which is presented in Volume 1 Appendix C.

	TOR Requirement	IRP Reference	
3.	IRP process will review, if necessary, the requirement for augmenting the current water supply to meet growth projections.	Section 4.2.1	As noted in Section 4.2.1, major facilities that will require expansion due to growth include: The Lake Major WSP will be well within the WSP capacity but reaching the maximum water withdrawal permit limit at the end of 2046. There will be a need for exploring additional water supplies beyond the 2046 horizon. The potential demand at the Bennery Lake WSP is predicted to surpass the water source safe yield and the maximum water withdrawal permit limit by 2016. The forecast demand is projected to exceed the WSP's capacity between 2021-2026. Therefore, during the timeframe of the IRP there is a need to expand the Bennery Lake WSP, increase safe yield of lake (e.g. using a dam or pumping from Grand Lake), and submit an application to NSE to request an increase in the Water Withdrawal Permit.
4.	IRP process will integrate outputs from the ongoing Regional Wastewater Functional Plan (RWWFP) for the wastewater system, as it will provide a solid baseline concerning existing conditions and available wastewater system capacity (Different flow scenarios will be examined as outlined in the RWWFP including dry weather flows and a range of wet weather events as well as a range of antecedent conditions). The RWWFP will evaluate impacts on the existing collection system, using growth projections provided by Halifax Regional Municipality (HRM).	Section 5.4.1	Specific projects recommended by the RWWFP were integrated into Objectives 6, 13 and 14 of IRP financial plan. The total capital cost of the RWWFP is estimated as $645 million ($2012). The full details of the RWWFP expenditures are presented in Volume 1 Appendix E.
5.	IRP process will document the existing responsibilities for stormwater and seek clarity around organizational jurisdiction for these elements on a go-forward basis.	Sections 3.3.2 and 7.8	Halifax Water is responsible for operating and maintaining existing stormwater infrastructure located within the street right-of-way (ROW) or easements owned by Halifax Water. New stormwater infrastructure designed according to Halifax Water standards and developed as a result of growth, becomes part of the stormwater asset base of Halifax Water. However, overall stormwater planning and management remain the joint responsibility of the province (through NSE), HRM, and Halifax Water. In detail, Halifax Water is responsible for the pipes and ditches in the street right-of-way (ROW), and public easements. HRM is responsible for the overland flows (during major storms), lot grading, and private property drainage. Watercourses, wetlands, and lakes are the jurisdiction of Nova Scotia Environment. Halifax Water comments on any of the proposed infrastructure that will become Halifax Water's responsibility. Halifax Water, as a stakeholder, provides input into stormwater decisions and infrastructure owned by others that may impact the stormwater infrastructure owned by Halifax Water. Halifax Water also participates in revising stormwater specifications. Figure 3.1 graphically illustrates the areas of stormwater responsibility.

	TOR Requirement	IRP Reference	
			The proposed review of existing policies and regulations that affect the planning, design and approval of stormwater management system elements is an opportune time to examine the existing jurisdiction and roles of Halifax Water, HRM, Nova Scotia Environment, and other regulators as they relate to stormwater management and systems overall. Such a review would serve to clarify roles and responsibilities, and identify where better integration of activities may be warranted, including opportunities for enhancing effectiveness and efficiencies. Section 7.8 recommends clarifying role and mandate of Halifax Water in stormwater planning and management.
6.	IRP process, along with the current Asset Management Assessment, and ongoing Halifax Water asset and data management activities, will identify what activities need to be undertaken to improve overall stormwater system knowledge, policy, and practices (e.g. developing asset inventory, conducting condition assessments, ensuring data is available in GIS and any future work management system that Halifax Water may implement, and analysis related to overall storm system operations and optimization).	Sections 4.2.2, 4.3.4, 5.4.2, and 7.8	New separated stormwater systems would be developed at the same time as the new growth areas. The impact on existing stormwater infrastructure would likely be small. However, with growth, the length of the stormwater network (both piped and ditches) will be expanded and therefore impact the ongoing asset management and operational programs over time. The main regulatory compliance concerns related to stormwater runoff are the impacts on receiving water quality and the impacts related to flow volumes and velocity (i.e. flooding and erosion). A report commissioned by HRM noted that stormwater runoff could negatively affect both the quality and quantity of area water resources. The Regional Municipal Planning Strategy commits HRM to preparing a Regional Stormwater Functional Plan (RSWFP). Based on a risk analysis a composite asset renewal program was developed. The composite program specifies and individual level of renewal (i.e. A, B or C) for each individual asset class rather than using an "across the board" level for all assets (e.g. all asset classes treated at level B). The estimated cost of the composite program corresponds to expenditures between the A and B levels for the stormwater system. Based on the above information the IRP recommends in Section 7.8: • Assess stormwater quality compliance requirements. • Clarify role and mandate of Halifax Water in stormwater planning and management.
7.	Halifax Water will provide approximate information on length of stormwater piped systems, length of ditched infrastructure, number of driveway culverts, a high level estimate of the number of cross-culverts owned by Halifax water, and general assumptions on condition and capacity constraints.	Section 3.4.3	There are over 790 km of stormwater pipe and an estimated 8 km of culverts in Halifax Water's stormwater system. In addition, there are approximately 37,000 manholes and 17,000 catch basins throughout the HRM. Halifax Water is responsible for the operation, repair, maintenance, and cleaning of all stormwater pipes (culverts and open ditches), manholes and catch basins. The locations of the stormwater system features are presented in Volume 1 Appendix D. The stormwater system data gaps identified are presented in Volume 3 Appendix D and are summarized in Table 4.5, Asset Data Gaps. Condition and capacity data was unavailable for the stormwater network. The expected Regional Stormwater Functional Plan (to be prepared by HRM), should address these issues.

4.1.2 Supply-Side Options

	TOR Requirement	IRP Reference	
1.	IRP process will identify appropriate and practical supply-side options that may include methods and technologies to reduce water production volumes, wastewater overflows, manage flood levels, strengthen standards for system expansion, and manage power consumption.	Sections 5.4	Tables 5.2 and 5.3 describe existing and new programs developed by Halifax Water. See also ToR # 23, ToR # 36 and ToR # 42.
2.	IRP process will identify regulatory constraints, environmental impacts, and both capital and operating costs associated with each set of supply-side options.	Sections 3 and 5 Volume 1 Appendices F and H Volume 3 Appendices A, B and C RWWFP	Sections 3 and 5 as well as Volume 1 Appendix F, Volume 3 Appendices A, B and C and the RWWFP present the analysis of supply-side options and costs. The financial model for the Recommended Plan is presented in Volume 1 Appendix H. It provides both capital and new O&M costs for the supply-side options. See above also.

The supply-side assessment may include but not be limited to the following technologies and methods:

• Enhanced redundancy and optimization routing • Leak detection surveys • Leak reduction program • Master meter calibration • Water Treatment Plant operational uses • Additional treatment capacity or upgrades • Transmission main upgrades • Source protection • Strategic land management	• CSO/SSO management • Optimize number and configuration of pumping stations • Over-sizing pipes / storage • System optimization and flow routing • Optimize power requirements • Additional treatment capacity or upgrades • Regulatory upgrades • Receiving water quality • Strategic land management	• On-site reduction of run-off • Optimization of drainage paths / corridors • Retention / storage • System optimization and flow routing • Deep storm sewer installation receiving water quality • Strategic land management

4.1.3 Demand-Side Options

	TOR Requirement	IRP Reference	
1.	IRP process will investigate demand-side management options to reduce finish water requirements and wastewater flows.	Section 6.3	A full business case analysis of demand reduction was not feasible for this IRP due to considerable limitations in available data and time needed to assess and analyse results. The approach that was taken examined the benefit value gained from demand reduction for the wastewater system and compared these values with literature-based information on flow reduction costs. The focus of the analysis was a case study of the combined benefits of water efficiency and I/I reduction on the expansion requirements identified under the RWWFP for the Dartmouth facility.
2.	IRP process will include demand-side assessments of cost, supply and capacity needs, and usage impacts.	Section 6.3	See above.

The demand-side assessment may include but not be limited to the following technologies and methods:

• Customer leak reduction • Service meter calibration • Non-revenue water • Water conservation (outdoor water use reductions, xeriscaping, plumbing code modifications, water audits, etc.) • Rate incentives	• I/I reduction (illegal connections, cross-connections, storage, retention, water movement optimization, etc.) • Water recycling • Rate incentives • Lateral repairs • Source control • Construction standards	• Grading requirements • Comprehensive controlled drainage management • Source control • Sediment / erosion management • Stormwater rate structure • Construction standards

4.1.4 Screening of Supply & Demand-Side Options

	TOR Requirement	IRP Reference	
1.	Halifax Water will establish performance metrics for the supply-side and demand-side options.	Section 5.4	Fourteen specific objectives were elaborated for the three IRP drivers (Regulatory Compliance, Asset Renewal, and Growth). The objectives reflect the current and anticipated regulatory compliance requirements for the three Halifax Water infrastructure systems (Objectives 1 through 7, Table 5.1, Regulatory Compliance and Asset Renewal Related Objectives) and upgrade needs to address system reliability (Objective 9, Table 5.1), as well as current and future capacity (Objective 10, 13 and 14, Table 5.1). The IRP financial plan lists recommended projects and upgrade needs under each of the specific IRP objectives.
2.	IRP supply-side and demand-side options will undergo a screening test to determine whether they will advance to a more detailed analysis as part of the resource plans. The screening will focus on: system optimization, system reliability, redundancy and flexibility, feasibility, regulatory compliance, need and ability to obtain regulatory approval, and total cost.	Section 5.0	Through the synthesis of existing, refined and new programs with IRP drivers, 28 initial resource plans were developed. These were evolved through into 18 intermediate plans, and 10 refined plans. A short list of four plans was selected from the 10 refined plans. The Recommended Plan was selected from the short list.

4.1.5 Financial Considerations

	TOR Requirement	IRP Reference	
1.	IRP process will consider the financial impacts of declining water usage on rates and the revenue stream.	This will be completed in subsequent analysis in the Debt Study/ rate submission	
2.	IRP process will consider the availability of funding assistance through federal and provincial programs.	This will be completed in subsequent analysis in the Debt Study/ rate submission	

	TOR Requirement	IRP Reference	
3.	IRP process will consider timing impact of capital plan implementation (effect on budgets).	Section 5.5	A number of programs /projects did consider variations in timing implementation. These programs/projects were in all cases associated with wastewater compliance issues. The variations reflected the uncertainties in desired regulatory implementation timing. The exception is a number of current WWTF compliance related upgrades that were incorporated with timing fixed by the Five-Year Capital Plan sometimes adjusted by discussions with Halifax Water staff. This was due to the advanced state of these projects.
4.	IRP process will appropriate debt policy, in coordination with the UARB-approved Debt Study (underway with completion date of October 2012).	This will be completed in subsequent analysis in the Debt Study/ rate submission	
5.	IRP process will consider costs associated with additional staff, information needs, tools, and technology to support capital program growth.	Section 7.2	A significant number of new planning initiatives all have activity within the first 3 years of the Recommended IRP. While the absolute program is not particularly large these planning activities will require significant participation on the part of Halifax Water staff and will likely require either additional resources or some prioritization of the activities. Considering the linked nature of the planning culminating in the next IRP update and the need for considerable additional detail supporting the IRP update, the planning activities will require additional resources. A number of enterprise projects are included in the IRP financial plan including a computerized maintenance management system, a data collection project, fleet upgrade, GIS data program implementation, miscellaneous equipment upgrades, SCADA enhancements and master planning, etc.

4.1.6 Basic Assumptions and Plan Considerations

	TOR Requirement	IRP Reference	
1.	IRP process will identify basic assumptions used for supply-side and demand-side options and system impacts related to aging infrastructure, capacity issues, regulatory compliance, and growth. These will be documented together with the proposed resource plans.	Sections 4 and 5.6 Volume 1 Appendix F Volume 3 Appendices C and D	Basic assumptions regarding future requirements are presented in Section 4 for all three drivers. The assumptions surrounding asset renewal are provided in Volume 1 Appendix F and Volume 3 Appendix E. Costing assumptions are presented in Volume 3 Appendix C. Financial modeling assumptions are provided in Section 5.6.
2.	IRP process will develop and document appropriate level of reinvestment by each asset class (options may include conventional dig and replace as well as in-situ repairs and lining and other trenchless techniques).	Volume 1 Appendix F Volume 3 Appendix D	The Enhanced Asset Renewal program is presented in Volume 1 Appendix F and in Volume 3 Appendix E.
3.	IRP process will document opportunities to rationalize operational practices.	Sections 7.6 and 7.7	As a result of the IRP, Halifax Water is considering consolidating its system planning into comprehensive master plans, which along with other planning activities feed into the IRP. The concept is illustrated in Figure 7.3, Halifax Water IRP Planning Overview. Table 7.5, Halifax Water Master Planning summarizes the proposed master planning initiatives and gives their relationship to other existing and proposed planning programs and projects. One of the IRP outcomes was the presentation of the 14 IRP planning objectives. Some of these objectives are linked to current Halifax Water LOS. Table 7.7, Recommended LOS Updates or Additions presents a series of recommendations for updating/expanding the current LOS to allow a full evaluation of program implementation. The updated/expanded LOS once developed will require support for LOS monitoring, data analysis and reporting. Halifax Water will need to consider the impact on operating staff for this additional data collection, analysis, and reporting.
4.	IRP process will identify system and facility upgrades needed to comply with the CCME Wastewater Regulations, anticipated sometime in 2012.	Section 4.3.2	The three HHSP facilities will require upgrades to meet the recently promulgated federal Wastewater Systems Effluent Regulations (WSER). Halifax Water has recently completed a risk assessment indicating that under the WSER, all three facilities will be required to upgrade to full secondary treatment. Halifax and Dartmouth WSER upgrades were deemed to require upgrade within 20 years and Herring Cove with 30 years; however, with the RWWFP redirecting flows to the Herring Cove WWTF, it will require upgrade to a medium facility, thus requiring an upgrade to secondary within the 20 year IRP planning horizon.

	TOR Requirement	IRP Reference	
5.	IRP process will use growth projections and system information and forecasts to plan for future growth related assets.	Section 4.2 Volume 1 Appendix D	Growth is one of the key IRP drivers. All three infrastructures will need to meet future growth demands. Specific growth related projects are listed in Objectives 13 and 14 of the IRP financial plan. Growth requirements for the water and wastewater system are detailed in Section 4.2.1 and the stormwater system is detailed in Section 4.2.2. HRM provided a range of growth projections for use by the IRP project team. Based on the mid-range those projections the following growth estimates were developed and applied to the IRP and the RWWFP: Residential growth to 2046 – 159,240 persons. Employment area growth to 2046 – 698.1 ha. The locations of planned growth are provided in Volume 1 Appendix D in the IRP maps.

4.1.7 Resource Plans Development and Integration

	TOR Requirement	IRP Reference	
1.	IRP resource plans will be evaluated based on system safety and reliability requirements.	Section 5.5 Volume 1 Appendix F	IRP Objective 9 addresses the need to enhance reliability of critical water and wastewater assets. Timeframe to implement the water and wastewater system security program is based on Halifax Water's Five Year Capital Plan. An asset component-by-component risk analysis was conducted to determine the optimal levels of asset renewal for each component. This was the second stage of the asset renewal program analysis and was undertaken for the intermediate plans creating a single optimized component asset renewal strategy. Volume 1 Appendix F presents the results of the water, wastewater and stormwater asset risk analysis.
2.	IRP resource plans will be evaluated based on robustness of the plan (i.e. sensitivity of the plan to possible variations in the key assumptions).	Sections 5.0 and 6.3	See ToR # 54, 51, 42 and 35.
3.	IRP resource plans will be evaluated based on plan resilience (i.e. degree to which the selection of the preferred plan constrains Halifax Water's future planning options).	Sections 5.0 and 6.3	See above.

	TOR Requirement	IRP Reference	
4.	IRP resource plans will be evaluated based on future regulatory compliance outlook.	Section 6.2	Under the compliance driver, Objective 4 comprises of projects and programs to meet future WWTF compliance. As noted in Table 5.4 the timeframe to implement future WSER compliance for the HHSP WWTFs is 20 years. The timeframe to implement nutrient compliance for WWTFs discharging to sensitive receiving waters is 10 years. The nutrient reduction strategy will occur as per the timing period implemented in the RWWFP. Objective 5 comprises of projects and programs to meet future Drinking Water compliance. The implementation for the projects and programs was within 5 years as per the Halifax Water Five Year Capital Plan. Objective 6 comprises of projects and programs to meet future wastewater overflow compliance. The enhanced program, above projects designated by the RWWFP, will have a 30-year implementation period. Objective 7 comprises of projects and programs to meet future stormwater quality compliance. The implementation timing of 10 years is for stormwater quality program development.
5.	IRP resource plans will be evaluated based on financial capability.	This will be done in subsequent analysis in the Debt Study/rate submission.	
6.	IRP process will model planning and financial scenarios resulting in a range of resource plans that meet regulatory and other requirements (ranked based on the net present worth of the revenue requirements).	Sections 4 and 5	Halifax Water embarked on the preparation of an Integrated Resource Plan (IRP) for its water, wastewater, and stormwater services in order to define its overall program and resource needs for the next thirty years (2013 -2043). Specific projects and programs were allocated to each objective in the financial plan from existing Halifax Water initiatives and new program initiatives (Section 5.4), identifying the long-term servicing needs of Halifax Water's water, wastewater, and stormwater infrastructure. Section 5 identifies how the IRP was developed and analysed in a cost-effective and reliable manner.

4.1.8 Sensitivity Analysis

	TOR Requirement	IRP Reference	
1.	IRP process will make a variety of assumptions, some of which may have significant uncertainty.	Sections 4.5.1, 4.5.2, and 4.5.3	Sections 4.5.1, 4.5.2, and 4.5.3 address the uncertainty for challenges, opportunities, and risk of the three IRP drivers (Compliance, Asset Renewal and Growth).
2.	IRP process will include a sensitivity analysis.	Section 6.3	The Recommended Plan was analysed to assess the impact of three factors: • The potential benefits of water demand reduction and I/I reduction on the Recommended Plan. • The level of asset renewal (A, B, C and composite) on end-of-period asset value. • The population growth rate (high, baseline and low) on plan requirements.
3.	IRP process will evaluate least cost resource plans for robustness by varying key assumptions across a reasonable range.	Sections 4 and 5.6 Volume 1 Appendix F Volume 3 Appendices C and D	Basic assumptions regarding future requirements are presented in Section 4 for all three drivers. The assumptions surrounding asset renewal are provided in Volume 1 Appendix F and Volume 3 Appendix E. Costing assumptions are presented in Volume 3 Appendix C. Financial modelling assumptions are provided in Section 5.6.

4.1.9 Final Integrated Resource Plan Report

	TOR Requirement	IRP Reference	
1.	IRP final report will include background information and an overview of the IRP process.	Sections 1, 2, and 3 Volume 1 Appendix D Volume 3 Appendices A and B RWWFP	Figure 1.1 presents an overview of the IRP development process linked to the contents of the Section 2 presents an overview of the stakeholder consultation during development of the IRP. Section 3 presents the IRP Planning Context, including an overview of all three infrastructure systems, existing projects and programs. Volume 1 Appendix D provides maps for the study area. Volume 3 Appendices A and B provide details of the water system and WWTFs respectively. The RWWFP provides details of the wastewater collection systems.
2.	IRP final report will include forecast summaries.	Volume 3 Appendices A and B RWWFP	Volume 3 Appendices A and B provide details of growth impacts upon the water system and WWTFs respectively. The RWWFP provides details of growth impacts upon the collection system.
3.	IRP final report will include a description of the supply-side and demand side options evaluated in the IRP.	Section 5.0 Volume 1 Appendices B, E and F	Section 5 presents an overview of the components of each of the alternative resource plans. Volume Appendices B, E and F provides of the Five-Year Capital Plan, RWWFP and the existing and new programs/projects.
4.	IRP final report will include a description of the screening analysis employed to determine which options would precede to more detailed analysis.	Sections 5.7 to 5.10	This section presents a summary of the IRP Plan development including Initial Plan Analysis and development of the Intermediate Plans, Refined Plans, and Short List Plans.
5.	IRP final report will include identification of the plan assumptions.	Detailed throughout Volumes 1 and 3 of the IRP report	Assumptions are detailed throughout the IRP report including those for asset service life estimates which were based on best industry practice, enhanced overflow control, demand reduction, end-of-period analysis, and financial modelling. Asset life data and fractional values are contained in the costing procedures technical memorandum, which is presented in Volume 3 Appendix C.
6.	IRP final report will include a description of the resource plans and the associated components.	Sections 5 and 6	Figure 5.1 presents an overview of the IRP alternative resource plan development and evaluation process. A flow chart is provided as Figure 5.6 illustrating the initial, intermediate, refined, and short-list alternative resource plans selection process. Through the synthesis of key inputs, twenty-eight initial resource plans were developed. These were evolved through into 18 intermediate plans and then 10 refined plans. A short list of four plans was selected from the 10 refined plans. The final recommended plan was selected from the short list, which is presented in Section 6, Recommended Resource Plan.

	TOR Requirement	IRP Reference	
7.	IRP final report will include results of the model analysis for the various resource plans demonstrating the least cost plan.	Section 5 Volume 1 Appendix H	See ToR#76 above. Volume 1 Appendix H presents the financial model for the Recommended Plan.
8.	IRP final report will include results of the sensitivity analysis.	Section 6.3	The Recommended Plan was analysed to assess the impact of three factors: • The potential benefits of water demand reduction and I/I reduction on the Recommended Plan. • The level of asset renewal (A, B, C and composite) on end-of-period asset value. • The population growth rate (high, baseline and low) on plan requirements.
9.	IRP final report will include selection of the recommended resource plan.	Section 6.3	The recommended IRP plan and implementation is presented in Table 6.1, Recommended IRP Components and Timing. The timing of expenditures is shown in Figure 6.1, Recommended IRP Expenditures by Year. The expenditures by driver are shown in Figure 6.2, Recommended IRP Expenditures by Driver.
10.	IRP final report will include a recommended action plan for the next 3 fiscal years, including capital and operating costs to address supply and capacity projections, regulatory requirements, and environmental requirements.	Section 7.2	The 3-year expenditures from 2013 to 2015 associated with the recommended IRP are presented in Table 7.2, IRP Recommended Expenditures 2013-2015 ($million). Any significant increase in expenditure levels for the 3-year period is likely unrealistic from the viewpoint of the increased revenue required and the impact on rates as well as Halifax Water's institutional capacity. Even with accelerated implementation it will require at least 2 to 3 years to have adequate data and systems in place to obtain string return from scaled-up asset renewal expenditures. The 2013-2015 expenditures should be reviewed and reprogrammed with adequate ramp-up tie particularly for the asset management program. Other considerations with the first three years of the recommended IRP are listed in Section 7.2.
11.	IRP final report will include longer term recommendations over the planning horizon, including capital and operating costs.	Sections 7.3 and 7.4	Table 7.3 presents the IRP expenditure plan for 2016-2022 while Section 7.3 describes the longer-term recommendations for 2016 to 2022. Table 7.4 presents the IRP expenditure plan for 2023 to 2032 and 2033 to 2042 while Section 7.4 describes the longer-term recommendations of these expenditure plans.
12.	IRP final report will include recommended data acquisition, modeling, and analysis required for future enhancements to the IRP.	Section 7.8	Based on the analysis carried out through the course of the IRP, Section 7.8 details the IRP recommendations including ensuring adequate data collection and analysis components in all functional and asset renewal planning.

APPENDIX H

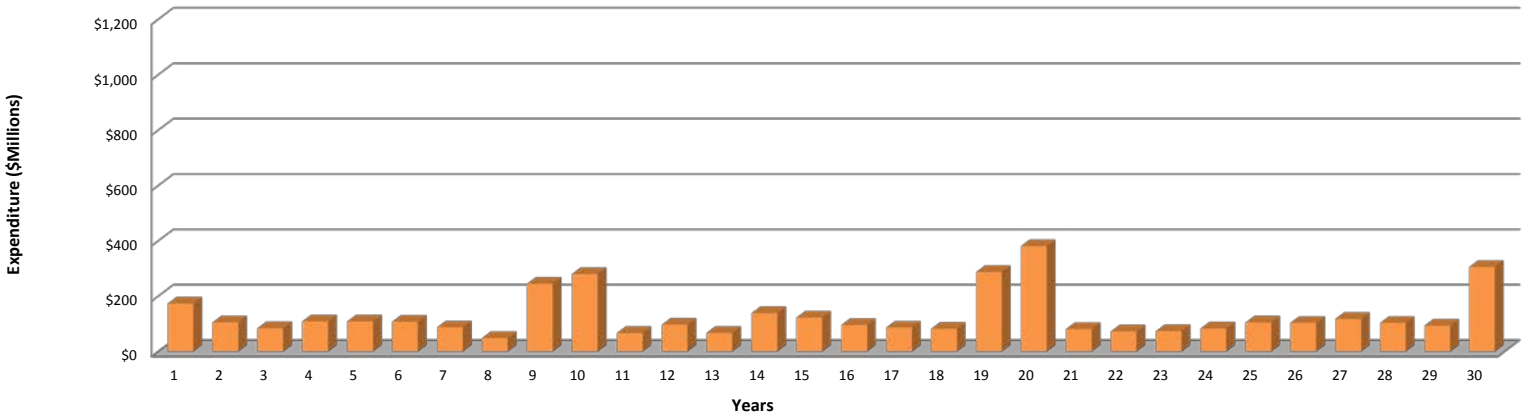
Halifax Water Integrated Resource Plan
Recommended IRP Financial Model

APPENDIX H-1

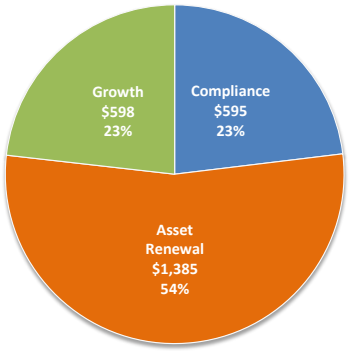
Summary

Recommended Integrated Resource Plan 40-4

Annual Plan Expenditures (All W, WW, SW)



Expediture by Driver (30 Years)



Water, Wastewater & Stormwater Cost Breakdown (NPV)

Driver	Obj	Water		Wastewater		Stormwater		Total	
		3-yr	30-yr	3-yr	30-yr	3-yr	30-yr	3-yr	30-yr
Compliance	1	$0.00	$0.00	$49,038.82	$85,929.16	$0.00	$0.00	$49,038.82	$85,929.16
	2	$2,870.48	$4,978.33	$0.00	$0.00	$0.00	$0.00	$2,870.48	$4,978.33
	3	$0.00	$0.00	$2,166.90	$31,878.55	$414.52	$1,207.38	$2,581.42	$33,085.93
	4	$0.00	$0.00	$329.45	$332,523.62	$0.00	$0.00	$329.45	$332,523.62
	5	$5,136.12	$10,226.68	$0.00	$0.00	$0.00	$0.00	$5,136.12	$10,226.68
	6	$0.00	$0.00	$22,679.01	$117,475.10	$276.35	$10,355.44	$22,955.36	$127,830.55
	7	$0.00	$0.00	$0.00	$0.00	$247.23	$574.69	$247.23	$574.69
Asset Renewal	8	$80,034.69	$404,443.35	$110,616.76	$740,827.16	$4,880.87	$85,736.18	$195,532.32	$1,231,006.69
	9	$4,315.13	$70,510.78	$6,027.81	$9,170.97	$0.00	$0.00	$10,342.93	$79,681.76
	10	$0.00	$0.00	$92.89	$7,943.53	$1,350.56	$7,375.96	$1,443.45	$15,319.49
	11	$0.00	$0.00	$0.00	$0.00	$658.61	$658.61	$658.61	$658.61
	12	$1,330.44	$43,012.36	$8,660.38	$15,403.80	$0.00	$0.00	$9,990.82	$58,416.16
Growth	13	$1,463.82	$79,521.07	$40,331.88	$495,839.96	$0.00	$0.00	$41,795.70	$575,361.03
	14	$278.66	$2,794.44	$576.71	$17,886.42	$1,402.22	$2,380.96	$2,257.59	$23,061.82
Total		**$95,429**	**$615,487**	**$240,521**	**$1,854,878**	**$9,230**	**$108,289**	**$345,180**	**$2,578,655**

TOTAL 3YR NPV : $345 M **TOTAL 30Yr NPV : $2,579 M**

Recommended Alternative
Resource Plan 40-4

The total 3-year and 30-year NPV for the recommended plan inclusive of capital and O&M costs are $345 million and $2,579 million, respectively.

Annual Plan Expenditures

The timing of expenditures (in $2012) for the recommended Alternative Resource Plan 40-4 is shown in the top figure presented on the previous page, which indicates significant expenditures around years 10, 20 and 30. This corresponds to the following projects:

- Year 10 – WWTF Nutrient Upgrades.
- Year 20 – WSER HHSP WWTF Upgrades.
- Year 30 – Enhanced Overflow Control Program.

Over the 30-year period the average expenditure under the Recommended Alternative Resource Plan is $131 million/yr.

Expenditure by Driver

The IRP responds to the combined requirements of regional growth, present and expected regulatory compliance and asset renewal.

The expenditures by driver for the recommended Alternative Resource Plan 40-4 are shown in the bottom left Figure presented on the previous page. Approximately 54% or $1,385.1 of the expenditures including O&M costs are associated with asset renewal and the remainder split between growth (23% or $598.4) and compliance (23% or $595.2) for the water, wastewater and stormwater systems.

Water, Wastewater, and Stormwater Cost Breakdown (NPV)

The expenditures for the individual water, wastewater, and stormwater systems, as per the recommended Alternative Resource Plan 40-4, are shown in the bottom right Table presented on the previous page. The expenditures are divided into the objectives described below and are inclusive of O&M costs.

Fourteen specific objectives were elaborated for the three drivers. The objectives reflect the current and anticipated compliance requirements (seven objectives) for the infrastructure systems (Objectives 1 through 7); optimal asset renewal requirements as well as a number of related issues addressing water and wastewater system reliability, adequate stormwater capacity, adaptability to climate change and energy efficiency (Objectives 8 through 12); and two growth related objectives addressing the need to extend regional level servicing requirements and the requirement to manage flow capacity allocations (Objectives 13 and 14). Specific projects and programs were allocated to each objective in the financial plan from existing Halifax Water initiatives and new program initiatives identifying the long-term servicing needs of Halifax Water's infrastructure.

APPENDIX H-2

Financial Model by Objective

Financial Model 40-4

Halifax Water Integrated Resource Plan - Short List Plan 40-4

LEGEND

- HRWC Capital Budget - Water Projects
- HRWC Capital Budget - Wastewater Projects
- HRWC Capital Budget - Stormwater Projects
- HRWC Programs
- RWWFP Projects
- XCG WWTF Projects
- GENIVAR - Water Projects
- Halcrow Asset Renewal
- HRWC Capital Budget - Airport/Aerotech Projects
- XCG WWTF - Airport/Aerotech Projects
- RWWFP Projects - Airport/Aerotech
- O&M Yearly Costs

Driver: **Regulatory Compliance**

Objective:1 **Meet current Nova Scotia Environment (NSE) WWTF permit to operate requirements**

	Project Name / Description	Asset Group	Opex Group	Year Zero (2012/2013)	Capital Expenditure profile in $k 2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	Type of Program/Project	Objective Allocation (%)	Objectives
2.066	Grit Management Facility	Wastewater - Collection Combined	Wastewater Collection	$12																														HW Capital Budget	20-20-60	1-7-8
4.009	Integrated Resource Plan (split W-WW-SW)	Wastewater - Collection Combined	Wastewater Collection	$40			$60	$60				$60	$60				$60	$60				$60	$60				$60	$60				$60	$60		HW Capital Budget	40-20-25-15	1-3-8-13
2.209	Dartmouth WWTF - UV Disinfection System Upgrades	Wastewater - Energy	Wastewater Treatment						$15																										HW Capital Budget	20-80	1-12
2.215	Halifax WWTF - UV Disinfection System Upgrades	Wastewater - Energy	Wastewater Treatment						$15																										HW Capital Budget	20-80	1-12
2.219	Herring Cove WWTF - UV Disinfection System Upgrades	Wastewater - Energy	Wastewater Treatment		$20																														HW Capital Budget	20-80	1-12
2.020	Lockview-MacPherson WWTF - Tertiary Upgrade	Wastewater - Treatment Facilities	Wastewater Treatment	$150	$650																														HW Capital Budget	100	1
2.020 (O&M)	Lockview-MacPherson WWTF Tertiary Upgrade - New O&M costs associated with energy costs, media replacement, chemical costs, replacement parts allowance, additional labour	Wastewater - Treatment Facilities (O&M)	Wastewater Treatment			$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	O&M (yearly costs) from XCG	100	1
2.039	Belmont WWTF Decommissioning	Wastewater - Treatment Facilities	Wastewater Treatment				$240	$900	$600																										HW Capital Budget	60-30-10	1-12-14
2.040	Beechville, Lakeside, Timberlea WWTF Upgrade	Wastewater - Treatment Facilities	Wastewater Treatment	$3,000	$10,500	$7,500																													HW Capital Budget	60-10-30	1-12-13
2.040 (O&M)	Beechville, Lakeside, Timberlea WWTF Upgrade - New O&M costs associated with upgrade to secondary treatment - energy for aeration, chemical costs for TP removal, Increase in labour, UV upgrade costs (energy, bulb replacement, cleaning chemicals), and filtration costs (energy, media replacement, chemical costs, replacement parts allowance and additional labour)	Wastewater - Treatment Facilities (O&M)	Wastewater Treatment				$358	$358	$358	$358	$358	$358	$358	$358	$358	$358																			O&M (yearly costs) from XCG	100	1
2.044 (O&M)	Blackup Power Program: Increase in labour and inspections at all facilities	Wastewater - Treatment Facilities (O&M)	Wastewater Treatment									$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	O&M (yearly costs) from XCG	100	1
2.095 (O&M)	Wellington WWTF - New O&M costs associated with new mechanical treatment facility - energy for aeration, chemical costs for TP removal, Increase in labour, and UV upgrade costs (energy, bulb replacement, cleaning chemicals)	Wastewater - Treatment Facilities (O&M)	Wastewater Treatment	$4	$4	$4	$4	$4	$4	$4	$4	$4	$4	$4	$4	$4	$4	$4	$4	$4	$4	$4	$4	$4	$4	$4	$4	$4	$4	$4	$4	$4	$4	$4	O&M (yearly costs) from XCG	100	1
2.097	Eastern Passage WWTF Design Build Upgrade	Wastewater - Treatment Facilities	Wastewater Treatment	$12,000	$19,380																														HW Capital Budget	60-10-10-20	1-9-12-13
2.097 (O&M)	Eastern Passage WWTF Design Build Upgrade - New O&M costs associated with upgrade to secondary treatment - energy for aeration, chemical costs for TP removal, Increase in labour, and UV upgrade costs (energy, bulb replacement, cleaning chemicals)	Wastewater - Treatment Facilities (O&M)	Wastewater Treatment			$788	$788	$788	$788	$788	$788	$788	$788	$788	$788	$788	$788	$788	$788	$788	$788	$788	$788	$788	$788	$788	$788	$788	$788	$788	$788	$788	$788	O&M (yearly costs) from XCG	100	1
2.124	Mill Cove WWTF UV Upgrade	Wastewater - Treatment Facilities	Wastewater Treatment					$968																											HW Capital Budget	90-10	1-12
2.126	Bio-Solids Facility - Upgrade Program	Wastewater - Treatment Facilities	Wastewater Treatment	$359	$63	$77	$29																												HW Capital Budget	100	1
2.222	HHSP Deficiency Management	Wastewater - Treatment Facilities	Wastewater Treatment	$250																															HW Capital Budget	50-25-25	1-9-12
2.500	Halifax WWTF - Conduct treatability study, optimize coagulant dosages, polymer dosages, and sludge pumping to improve performance of DensaDeg during high flows.	Wastewater - Treatment Facilities	Wastewater Treatment						$98																										XCG WWTF Project	100	1
2.503	Dartmouth WWTF - Conduct treatability study, optimize coagulant dosages, polymer dosages, and sludge pumping to improve performance of DensaDeg during high flows.	Wastewater - Treatment Facilities	Wastewater Treatment						$98																										XCG WWTF Project	100	1
2.504	Dartmouth WWTF - Characterize effluent UVT and assess capacity of the existing disinfection system. Upgrade UV disinfection system.	Wastewater - Treatment Facilities	Wastewater Treatment						$4,480																										XCG WWTF Project	100	1
2.504 (O&M)	Dartmouth WWTF - New O&M costs due to bulb replacement, cleaning chemicals, annual electricity costs increase	Wastewater - Treatment Facilities (O&M)	Wastewater Treatment							$66	$66	$66	$66	$66	$66	$66	$66	$66	$66	$66	$66	$66	$66	$66	$66	$66	$66	$66	$66	$66	$66	$66	$66	O&M (yearly costs) from XCG	100	1
2.507	Herring Cove WWTF - Optimize coagulant dosages, polymer dosages, and sludge pumping to improve performance of DensaDeg process during high flows.	Wastewater - Treatment Facilities	Wastewater Treatment						$46																										XCG WWTF Project	100	1
2.509	Lockview-MacPherson WWTF - Modifications to equalization tank pumping and/or increase equalization tank volume to reduce magnitude of peak flows to downstream treatment processes.	Wastewater - Treatment Facilities	Wastewater Treatment						$102																										XCG WWTF Project	100	1
2.510	Lockview-MacPherson WWTF - Modifications to secondary clarifiers, such as installing baffles and replacing the sludge / scum collection equipment, to improve performance.	Wastewater - Treatment Facilities	Wastewater Treatment						$240																										XCG WWTF Project	100	1
2.511	Lockview-MacPherson WWTF - UV system upgrade.	Wastewater - Treatment Facilities	Wastewater Treatment						$112																										XCG WWTF Project	100	1
2.511 (O&M)	Lockview-MacPherson WWTF - New O&M costs for bulb replacement, cleaning chemicals, and annual electricity costs for additional UV capacity	Wastewater - Treatment Facilities (O&M)	Wastewater Treatment							$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	O&M (yearly costs) from XCG	100	1
2.513	Middle Musquodoboit WWTF - Provide additional equalization storage volume to attenuate peak flows to the downstream treatment process and/or provide a bypass line around the mechanical plant discharging to the polishing pond to protect the treatment process and ensure continued compliance with treatment requirements.	Wastewater - Treatment Facilities	Wastewater Treatment						$120																										XCG WWTF Project	100	1
2.515	North Preston WWTF - Provide additional alkalinity addition to supplement the existing caustic soda addition system and/or utilize a different chemical for alkalinity addition (Project underway).	Wastewater - Treatment Facilities	Wastewater Treatment						$29																										XCG WWTF Project	100	1
2.516	North Preston WWTF - Conduct a detailed biological treatment capacity assessment to evaluate the ability of the current process to provide consistent nitrification (to be completed after upgrades to the alkalinity addition system).	Wastewater - Treatment Facilities	Wastewater Treatment						$33																										XCG WWTF Project	100	1
2.517	North Preston WWTF - Install an autosampler to collect samples of engineered wetland effluent to determine actual effluent loadings applied to the receiver, Whynder Lake.	Wastewater - Treatment Facilities	Wastewater Treatment						$37																										XCG WWTF Project	100	1
2.519	Uplands Park WWTF - To ensure continued compliance with treatment requirements: - Construct flow splitter boxes and reconfigure trickling filter and clarifier influent piping to improve flow splits; and - Replace mechanical equipment associated with the existing trickling filters (distribution arms, effluent collection system).	Wastewater - Treatment Facilities	Wastewater Treatment						$293																										XCG WWTF Project	100	1
2.016	Aerotech WWTF Upgrade - Design/Construction	Wastewater - Airport Aerotech System	Wastewater Treatment	$125	$4,875	$5,000																													HW Capital Budget	50-20-30	1-8-13
2.016 (O&M)	New O&M costs associated with additional treatment at Aerotech WWTF - energy for aeration, chemical costs for TP removal, Increase in labour, allowance for sludge handling (energy), energy and labour costs associated with additional EQ volume, and filtration costs (energy, media replacement, chemical costs, replacement parts allowance and additional labour)	Wastewater - Airport Aerotech System (O&M)	Wastewater Treatment				$162	$162	$162	$162	$162	$162	$162	$162	$162	$162	$162	$162	$162	$162	$162	$162	$162	$162	$162	$162	$162	$162	$162	$162	$162	$162	$162	$162	O&M (yearly costs) from XCG	25-75	1-13
2.236	Aerotech WW Servicing Options Assessment	Wastewater - Airport Aerotech System	Wastewater Treatment		$100																														HW Capital Budget	40-30-30	1-4-13
2.528	Implement an operational control strategy to slowly add the Aerotech lagoon effluent to the mechanical treatment plant to avoid slug loads of high TKN/TAN influent during wet weather events.	Wastewater - Airport Aerotech System	Wastewater Treatment						$152																										XCG WWTF Project	100	1
2.538	Aerotech WWTF Upgrade Program	Wastewater - Airport Aerotech System	Wastewater Treatment	$12	$245	$7	$13	$245	$245			$245				$245			$245			$245			$245			$245			$245				HW Capital Budget	35-35-30	1-4-8
Sub-Total Objective 1 (Capital Projects and Programs)				**$15,948**	**$35,833**	**$12,584**	**$342**	**$2,173**	**$6,713**	**$0**	**$245**	**$60**	**$305**	**$0**	**$245**	**$0**	**$305**	**$60**	**$245**	**$0**	**$245**	**$60**	**$305**	**$0**	**$245**	**$0**	**$305**	**$60**	**$245**	**$0**	**$245**	**$60**	**$305**	**$0**			
Sub-Total Objective 1 (O&M)				**$4**	**$4**	**$802**	**$1,323**	**$1,323**	**$1,323**	**$1,389**	**$1,389**	**$1,438**	**$1,438**	**$1,438**	**$1,438**	**$1,081**	**$1,081**	**$1,081**	**$1,081**	**$1,081**	**$1,081**	**$1,081**	**$1,081**	**$1,081**	**$1,081**	**$1,081**	**$1,081**	**$1,081**	**$1,081**	**$1,081**	**$1,081**	**$1,081**	**$1,081**	**$1,081**			

Financial Model 40-4

Objective:2 **Meet current NSE WSP permit to operate requirements**

Capital Expenditure profile in $k

	Project Name / Description	Asset Group	Opex Group	Year Zero (2012/2013)	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	Type of Program/Project	Objective Allocation	Objectives
3.276	J D Kline - Flow Splitting Improvements in the Pre-Mix	Water - Treatment Facilities	Water Treatment						$150	$500																									HW Capital Budget	50-50	2-5
3.280	J D Kline - Removal of Aluminium in the Pprocess Wastewater	Water - Treatment Facilities	Water Treatment				$1,350		$575																										HW Capital Budget	50-50	2-5
3.297	Miller Lake Small System - Extension of Well Supply Line	Water - Treatment Facilities	Water Treatment	$250																															HW Capital Budget	100	2
3.601 (PR)	Water Quality Master Plan (WQMP) Periodic Updates	Water - Treatment Facilities	Water Treatment					$100																											Program	100	2
3.602 (PR)	Ongoing Water Quality Research Program	Water - Treatment Facilities	Water Treatment		$140	$140	$140	$140	$140																										Program	100	2
3.603 (PR)	Lead Services Replacement Program	Water - Treatment Facilities	Water Treatment		$75	$75	$75	$75	$75																										Program	100	2
3.261	CSE Retrofit - Arkerley Reservoir Chamber	Water - Structures	Water Transmission & Distribution	$11																															HW Capital Budget	30-70	2-8
3.257	Confined Space Retrofit - Orchard Central Chamber	Water - Structures	Water Transmission & Distribution		$8																														HW Capital Budget	20-80	2-8
4.009	Integrated Resource Plan (split W-WW-SW)	Water - Transmission	Water Transmission & Distribution	$40			$60	$60				$60	$60				$60	$60				$60	$60				$60	$60				$60	$60		HW Capital Budget	40-40-20	2-8-13
4.016	SCADA Master Plan Implementation (50/50 split W/WW)	Water - IT	Water Treatment	$297	$665	$339																													HW Capital Budget	50-50	2-5
4.016	SCADA Master Plan Update (50/50 split W/WW)	Water - IT	Water Treatment					$50					$50					$50					$50					$50					$50		HW Capital Budget	50-50	2-5
Sub-Total Objective 2 (Capital Projects and Programs)				$598	$888	$554	$1,625	$425	$940	$500	$0	$60	$110	$0	$0	$0	$60	$110	$0	$0	$0	$60	$110	$0	$0	$0	$60	$110	$0	$0	$0	$60	$110	$0			

Objective: 3 **Meet current overflow compliance requirements**

Capital Expenditure profile in $k

	Project Name / Description	Asset Group	Opex Group	Year Zero (2012/2013)	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	Type of Program/Project	Objective Allocation	Objectives
1.003	Ivylea Crescent - New Storm Sewer	Stormwater - Pipes	StormWater Collection					$194																											HW Capital Budget	30-20-30-20	3-6-10-14
1.014	Perth Street, Wardour Street, Fort Sackville Road - Deep Storm Sewer Installation	Stormwater - Pipes	StormWater Collection											$362																					HW Capital Budget	30-20-30-20	3-6-10-14
1.021	Crestfield Avenue (Uplands Phase 3) - Deep Storm Sewer Installation	Stormwater - Pipes	StormWater Collection			$216																													HW Capital Budget	30-20-30-20	3-6-10-14
1.030	Glengary Drive - New Storm Sewer	Stormwater - Pipes	StormWater Collection											$90																					HW Capital Budget	30-20-30-20	3-6-10-14
1.041	Ellerslie Crescent - Storm Sewer Upgrade	Stormwater - Pipes	StormWater Collection											$90																					HW Capital Budget	30-20-30-20	3-6-10-14
1.042	Deep Storm Sewer Installation Program	Stormwater - Pipes	StormWater Collection	$240	$90		$135	$150																											HW Capital Budget	30-20-30-20	3-6-10-14
1.053	Barrington Street Storm Sewer Separation	Stormwater - Pipes	StormWater Collection											$90																					HW Capital Budget	30-20-30-20	3-6-10-14
1.006	Clement Street Berm - Removal and Inlet Structure Reconfiguration	Stormwater - Structures	StormWater Collection					$20																											HW Capital Budget	20-20-20-20-20	3-6-8-10-14
2.009	North Preston Sewershed - Wastewater Collection System Replacement Program	Wastewater - Collection Sanitary	Wastewater Collection											$96	$432	$432																			HW Capital Budget	30-10-20-20-20	3-6-8-10-14
2.011	Eastern Passage Sewage Collection System Upgrades	Wastewater - Collection Sanitary	Wastewater Collection											$150	$300	$1,800	$2,100	$2,400	$3,000	$3,600															HW Capital Budget	30-10-20-20-20	3-6-8-10-14
2.075	Beaver Crescent Collection System Replacement	Wastewater - Collection Sanitary	Wastewater Collection											$150	$540	$540																			HW Capital Budget	30-10-20-20-20	3-6-8-10-14
2.232	Springfield Lake Collection Upgrade	Wastewater - Collection Sanitary	Wastewater Collection	$45		$75	$75																												HW Capital Budget	30-10-20-20-20	3-6-8-10-14
2.043	Overflow Monitoring Program	Wastewater - Collection Combined	Wastewater Collection		$100	$125	$125	$125																											HW Capital Budget	50-20-30	3-6-13
2.052	Integrated Wastewater Projects - Program	Wastewater - Collection Combined	Wastewater Collection	$250	$200	$210	$220	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	HW Capital Budget	20-80	3-8
2.086	Ellenvale Holding Tank Sewershed	Wastewater - Collection Combined	Wastewater Collection											$300	$300	$300	$300	$300	$300	$300															HW Capital Budget	30-10-20-20-20	3-6-8-10-14
2.231	SIR Program Flow Meters	Wastewater - Equipment	Wastewater Collection	$31																															HW Capital Budget	70-30	3-6
2.006	Valleyford Holding Tank	Wastewater - Structures	Wastewater Collection											$440																					HW Capital Budget	40-30-30	3-6-14
2.089	Fairfield Holding Tank	Wastewater - Structures	Wastewater Collection											$1,700																					HW Capital Budget	40-30-30	3-6-14
2.090	Bedford Sackville Trunk Sewer - Holding Tanks	Wastewater - Structures	Wastewater Collection											$800	$2,400	$2,400																			HW Capital Budget	40-30-30	3-6-14
2.111	Armdale Roundabout CSO screening	Wastewater - Structures	Wastewater Collection											$1,500																					HW Capital Budget	50-50	3-6
2.112	Quinpool Road CSO screening	Wastewater - Structures	Wastewater Collection												$1,500																				HW Capital Budget	50-50	3-6
2.113	Coburg Road CSO screening	Wastewater - Structures	Wastewater Collection													$1,500																			HW Capital Budget	50-50	3-6
2.114	South Street CSO screening	Wastewater - Structures	Wastewater Collection														$1,500																		HW Capital Budget	50-50	3-6
2.115	Beaufort Avenue CSO screening	Wastewater - Structures	Wastewater Collection															$1,500																	HW Capital Budget	50-50	3-6
2.118	AST PS - Automated Bar Screen	Wastewater - Structures	Wastewater Collection												$540																				HW Capital Budget	60-40	3-8
2.120	Herring Cove - Automated Bar Screen	Wastewater - Structures	Wastewater Collection													$540																			HW Capital Budget	60-40	3-8
2.121	Melva PS - Automated Bar Screen	Wastewater - Structures	Wastewater Collection														$540																		HW Capital Budget	60-40	3-8
2.122	Jamieson PS - Automated Bar Screen	Wastewater - Structures	Wastewater Collection															$540																	HW Capital Budget	60-40	3-8
2.228	Outfall Elimination Program	Wastewater - Outfalls	Wastewater Collection	$40	$40	$40	$40	$40																											HW Capital Budget	40-30-30	3-6-14
4.009	Integrated Resource Plan (split W-WW-SW)	Wastewater - Collection Combined	Wastewater Collection	$20			$30	$30				$30	$30				$30	$30				$30	$30				$30	$30				$30	$30		HW Capital Budget	40-20-25-15	1-3-8-13
4.016	SCADA Master Plan Implementation (50/50 split W/WW)	Wastewater - IT	Wastewater Collection	$297	$665	$339																													HW Capital Budget	50-50	3-6
4.016	SCADA Master Plan Update (50/50 split W/WW)	Wastewater - IT	Wastewater Collection					$50					$50					$50					$50					$50					$50		HW Capital Budget	50-50	3-6
Sub-Total Objective 3 (Capital Projects and Programs)				$923	$1,095	$1,005	$625	$909	$300	$300	$300	$330	$380	$6,068	$6,312	$7,812	$4,770	$5,120	$3,600	$4,200	$300	$330	$380	$300	$300	$300	$330	$380	$300	$300	$300	$330	$380	$300			

Objective: 4 **Meet future WWTF effluent requirements**

Capital Expenditure profile in $k

	Project Name / Description	Asset Group	Opex Group	Year Zero (2012/2013)	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	Type of Program/Project	Objective Allocation	Objectives
2.065	Frame WWTF Replacement	Wastewater - Treatment Facilities	Wastewater Treatment	$10				$30	$300																										HW Capital Budget	10-90	4-8
2.065 (O&M)	Frame WWTF Replacement - New O&M costs associated with new mechanical treatment facility - energy for aeration, chemical costs for TP removal, Increase in labour, and UV upgrade costs (energy, bulb replacement, cleaning chemicals)	Wastewater - Treatment Facilities (O&M)	Wastewater Treatment							$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	O&M (yearly costs)	10-90	4-8
2.502	Halifax WWTF - Construct a secondary treatment system such as a BAF to treat the influent flow: -CCME component: to produce a secondary effluent that meets CCME requirements	Wastewater - Treatment Facilities	Wastewater Treatment																					$156,000											XCG WWTF Project	100	4
2.502 (O&M)	Halifax WWTF - Construct a secondary treatment system such as a BAF to treat the influent flow: -CCME component: to produce a secondary effluent that meets CCME requirements	Wastewater - Treatment Facilities (O&M)	Wastewater Treatment																						$667	$667	$667	$667	$667	$667	$667	$667	$667	$667	O&M (yearly costs)	100	4
2.506	Dartmouth WWTF - Construct a secondary treatment system such as a BAF to treat the influent flow: -CCME component: to produce a secondary effluent that meets CCME requirements	Wastewater - Treatment Facilities	Wastewater Treatment																					$97,600											XCG WWTF Project	100	4
2.506 (O&M)	Dartmouth WWTF - Construct a secondary treatment system such as a BAF to treat the influent flow: -CCME component: to produce a secondary effluent that meets CCME requirements	Wastewater - Treatment Facilities (O&M)	Wastewater Treatment																						$332	$332	$332	$332	$332	$332	$332	$332	$332	$332	O&M (yearly costs)	100	4
2.508	Herring Cove WWTF - Construct a secondary treatment system such as a BAF to treat the influent flow: -CCME component: to produce a secondary effluent that meets CCME requirements	Wastewater - Treatment Facilities	Wastewater Treatment																					$33,280											XCG WWTF Project	100	4
2.508 (O&M)	Herring Cove WWTF - Construct a secondary treatment system such as a BAF to treat the influent flow: -CCME component: to produce a secondary effluent that meets CCME requirements	Wastewater - Treatment Facilities (O&M)	Wastewater Treatment																						$124	$124	$124	$124	$124	$124	$124	$124	$124	$124	O&M (yearly costs)	100	4
2.512	Lockview-MacPherson WWTF - Construct a new treatment facility to meet Limit of Technology for phosphorus and nitrogen (nitrification/dentirification, membrane bioreactor) for existing design ADF capacity. Decommission existing treatment facility.	Wastewater - Treatment Facilities	Wastewater Treatment											$9,072																					XCG WWTF Project	100	4

Financial Model 40-4

2.512 (O&M)	Lockview-Macpherson WWTF - New O&M due to increase in energy with membranes and nitrification, chemical costs (cleaning chemicals and Alum), membrane replacement costs, increase in labour, UV disinfection system (energy, bulb replacement and cleaning chemicals)	Wastewater - Treatment Facilities (O&M)	Wastewater Treatment												$72	$72	$72	$72	$72	$72	$72	$72	$72	$72	$72	$72	$72	$72	$72	$72	$72	$72	$72	$72	O&M (yearly costs)	100	4
2.514	Middle Musquodoboit WWTF - Construct a new treatment facility to meet Limit of Technology for phosphorus and nitrogen (nitrification/dentirification, membrane bioreactor) for existing design ADF capacity. Decommission existing treatment facility.	Wastewater - Treatment Facilities	Wastewater Treatment											$4,576																					XCG WWTF Project	100	4
2.514 (O&M)	Middle Musquodoboit WWTF - New O&M due to increase in energy with membranes and nitrification, chemical costs (cleaning chemicals and Alum), membrane replacement costs, increase in labour, UV disinfection system (energy, bulb replacement and cleaning chemicals)	Wastewater - Treatment Facilities (O&M)	Wastewater Treatment												$36	$36	$36	$36	$36	$36	$36	$36	$36	$36	$36	$36	$36	$36	$36	$36	$36	$36	$36	$36	O&M (yearly costs)	100	4
2.518	North Preston WWTF - Upgrade existing treatment facility to meet Limit of Technology for phosphorus and nitrogen (nitrification / denitrification, membrane bioreactor) for existing design ADF capacity. Assumes upgrades have been made to existing treatment facility to meet NSE requirements.	Wastewater - Treatment Facilities	Wastewater Treatment											$7,712																					XCG WWTF Project	100	4
2.518 (O&M)	North Preston WWTF - New O&M due to increase in energy with membranes and nitrification, chemical costs (cleaning chemicals and Alum), membrane replacement costs, increase in labour	Wastewater - Treatment Facilities (O&M)	Wastewater Treatment												$92	$92	$92	$92	$92	$92	$92	$92	$92	$92	$92	$92	$92	$92	$92	$92	$92	$92	$92	$92	O&M (yearly costs)	100	4
2.520	Uplands Park WWTF - Construct a new treatment facility to meet Limit of Technology for phosphorus and nitrogen (nitrification/dentirification, membrane bioreactor) for existing design ADF capacity. Decommission existing treatment facility.	Wastewater - Treatment Facilities	Wastewater Treatment											$4,400																					XCG WWTF Project	100	4
2.520 (O&M)	Uplands Park WWTF - New O&M due to increase in energy with membranes and nitrification, chemical costs (cleaning chemicals and Alum), membrane replacement costs, increase in labour, UV disinfection system (energy, bulb replacement and cleaning chemicals)	Wastewater - Treatment Facilities (O&M)	Wastewater Treatment												$35	$35	$35	$35	$35	$35	$35	$35	$35	$35	$35	$35	$35	$35	$35	$35	$35	$35	$35	$35	O&M (yearly costs)	100	4
2.521	Wellington WWTF - Upgrade treatment facility to meet Limit of Technology for phosphorus and nitrogen (nitrification / denitrification, membrane bioreactor) for existing design ADF capacity. (Assumes new facility to meet NSE requirements has been constructed and will be upgraded to meet LoT).	Wastewater - Treatment Facilities	Wastewater Treatment											$2,480																					XCG WWTF Project	100	4
2.521 (O&M)	Wellington WWTF - New O&M due to increase in energy with membranes and nitrification, chemical costs for TP removal, membrane replacement costs, increase in labour	Wastewater - Treatment Facilities (O&M)	Wastewater Treatment												$32	$32	$32	$32	$32	$32	$32	$32	$32	$32	$32	$32	$32	$32	$32	$32	$32	$32	$32	$32	O&M (yearly costs)	100	4
2.522	Frame WWTF - Upgrade treatment facility to meet Limit of Technology for phosphorus and nitrogen (nitrification / denitrification, membrane bioreactor) for existing design ADF capacity. (Assumes new facility to meet NSE requirements has been constructed and will be upgraded to meet LoT).	Wastewater - Treatment Facilities	Wastewater Treatment											$2,624																					XCG WWTF Project	100	4
2.522 (O&M)	Frame WWTF - New O&M due to increase in energy with membranes and nitrification, chemical costs for TP removal, membrane replacement costs, increase in labour	Wastewater - Treatment Facilities (O&M)	Wastewater Treatment												$33	$33	$33	$33	$33	$33	$33	$33	$33	$33	$33	$33	$33	$33	$33	$33	$33	$33	$33	$33	O&M (yearly costs)	100	4
2.527	Mill Cove WWTF - Upgrade existing treatment facility to meet Limit of Technology for phosphorus and nitrogen (nitrification / denitrification, membrane bioreactor) for existing design ADF capacity.	Wastewater - Treatment Facilities	Wastewater Treatment											$115,504																					XCG WWTF Project	100	4
2.527 (O&M)	Mill Cove WWTF - New O&M due to increase in energy with membranes and nitrification, chemical costs (cleaning chemicals and Alum), membrane replacement costs, increase in labour	Wastewater - Treatment Facilities	Wastewater Treatment												$1,320	$1,320	$1,320	$1,320	$1,320	$1,320	$1,320	$1,320	$1,320	$1,320	$1,320	$1,320	$1,320	$1,320	$1,320	$1,320	$1,320	$1,320	$1,320	$1,320	O&M (yearly costs)	100	4
2.236	Aerotech WW Servicing Options Assessment	Wastewater - Airport Aerotech System	Wastewater Treatment		$75																														HW Capital Budget	40-30-30	1-4-13
2.529	Aerotech WWTF - Upgrade existing treatment facility to meet Limit of Technology for phosphorus and nitrogen (nitrification / denitrification, membrane bioreactor) for existing 2041 design capacity of 7.65 ML/d.	Wastewater - Airport Aerotech System	Wastewater Treatment											$36,640																					XCG WWTF Project	100	4
2.529 (O&M)	Aerotech WWTF - New O&M due to increase in energy with membranes and nitrification, chemical costs (cleaning chemicals and Alum), membrane replacement costs, increase in labour	Wastewater - Treatment Facilities (O&M)	Wastewater Treatment												$394	$394	$394	$394	$394	$394	$394	$394	$394	$394	$394	$394	$394	$394	$394	$394	$394	$394	$394	$394	O&M (yearly costs)	100	4
2.538	Aerotech WWTF Upgrade Program	Wastewater - Airport Aerotech System	Wastewater Treatment	$12	$245	$7	$13	$245	$245		$245		$245		$245		$245		$245		$245		$245		$245		$245		$245		$245		$245		HW Capital Budget	35-35-30	1-4-8
Sub-Total Objective 4 (Capital Projects and Programs)				$22	$320	$7	$13	$275	$545	$0	$245	$0	$245	$183,008	$245	$0	$245	$0	$245	$0	$245	$0	$245	$286,880	$245	$0	$245	$0	$245	$0	$245	$0	$245	$0			
Sub-Total Objective 4 (O&M)				$0	$0	$0	$0	$0	$0	$1	$1	$1	$1	$1	$2,016	$2,016	$2,016	$2,016	$2,016	$2,016	$2,016	$2,016	$2,016	$2,016	$3,139	$3,139	$3,139	$3,139	$3,139	$3,139	$3,139	$3,139	$3,139	$3,139			

Objective: 5

Meet future NSE/Health Canada drinking water quality requirements

Select from drop-down

Capital Expenditure profile in $k

	Project Name / Description	Asset Group	Opex Group	Year Zero (2012/2013)	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	**Type of Program/Project**	**Objective Allocation**	**Objectives**
3.033	Watershed Land Acquisition	Water - Land	Water Transmission & Distribution			$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	HW Capital Budget	10-90	5-9
3.276	J D Kline - Flow Splitting Improvements in the Pre-Mix	Water - Treatment Facilities	Water Treatment						$150	$500																									HW Capital Budget	50-50	2-5
3.278	J D Kline - Mechanical Mixers in the Mixing Tanks	Water - Treatment Facilities	Water Treatment			$1,550	$1,000																												HW Capital Budget	100	5
3.280	J D Kline - Removal of Aluminium in the process wastewater	Water - Treatment Facilities	Water Treatment				$1,350		$575																										HW Capital Budget	50-50	2-5
3.604 (PR)	Water Quality Master Plan (WQMP) Periodic Updates	Water - Treatment Facilities	Water Treatment										$100					$100					$100					$100					$100		Program	100	5
3.605 (PR)	Ongoing Water Quality Research Program	Water - Treatment Facilities	Water Treatment							$140	$140	$140	$140	$140	$140	$140	$140	$140	$140	$140	$140	$140	$140	$140	$140	$140	$140	$140	$140	$140	$140	$140	$140	$140	Program	100	5
3.606 (PR)	Lead Services Replacement Program	Water - Treatment Facilities	Water Treatment							$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	Program	100	5
3.522	Bennery Lake WSP - Future Process Improvements (from 2008 Aerotech Servicing Study)	Water - Airport Aerotech System	Water Treatment			$555																													HW Capital Budget	30-70	5-8
4.016	SCADA Master Plan Implementation (50/50 split W/WW)	Water - IT	Water Treatment	$297	$665	$339																													HW Capital Budget	50-50	2-5
4.016	SCADA Master Plan Update (50/50 split W/WW)	Water - IT	Wastewater Collection					$50					$50					$50					$50					$50					$50		HW Capital Budget	50-50	2-5
Sub-Total Objective 5 (Capital Projects and Programs)				$297	$665	$2,464	$2,370	$70	$745	$735	$235	$235	$385	$235	$235	$235	$235	$385	$235	$235	$235	$235	$385	$235	$235	$235	$235	$385	$235	$235	$235	$235	$385	$235			

Objective: 6

Meet future regulations for overflow volume and frequency

Capital Expenditure profile in $k

	Project Name / Description	Asset Group	Opex Group	Year Zero (2012/2013)	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	**Type of Program/Project**	**Objective Allocation**	**Objectives**
1.003	Ivylea Crescent - New Storm Sewer	Stormwater - Pipes	StormWater Collection					$129																											HW Capital Budget	30-20-30-20	3-6-10-14
1.014	Perth Street, Wardour Street, Fort Sackville Road - Deep Storm Sewer Installation	Stormwater - Pipes	StormWater Collection											$241																					HW Capital Budget	30-20-30-20	3-6-10-14
1.021	Crestfield Avenue (Uplands Phase 3) - Deep Storm Sewer Installation	Stormwater - Pipes	StormWater Collection			$144																													HW Capital Budget	30-20-30-20	3-6-10-14
1.030	Glengary Drive - New Storm Sewer	Stormwater - Pipes	StormWater Collection											$60																					HW Capital Budget	30-20-30-20	3-6-10-14
1.041	Ellerslie Crescent - Storm Sewer Upgrade	Stormwater - Pipes	StormWater Collection											$60																					HW Capital Budget	30-20-30-20	3-6-10-14
1.042	Deep Storm Sewer Installation Program	Stormwater - Pipes	StormWater Collection	$160	$60		$90	$100																											HW Capital Budget	30-20-30-20	3-6-10-14
1.053	Barrington Street Storm Sewer Separation	Stormwater - Pipes	StormWater Collection											$60																					HW Capital Budget	30-20-30-20	3-6-10-14
1.006	Clement Street Berm - Removal and Inlet Structure Reconfiguration	Stormwater - Structures	StormWater Collection					$20																											HW Capital Budget	20-20-20-20-20	3-6-8-10-14
2.600 (PR)	Wet Weather Management Planning Program	Wastewater - Collection Sanitary	StormWater Collection		$250	$250	$250	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	Program	100	6
2.601 (PR)	Future Overflow Compliance Program (Enhanced Overflow Program - 10 overflows per year at B&C receiving waters)	Wastewater - Collection Combined	Wastewater Collection																															$173,145	Enhanced Overflow Control Program	100	6
2.530 (O&M)	Enhanced Overflow Program (after 2043)	Wastewater - Collection Combined	Wastewater Collection																																O&M (yearly costs)	100	6
2.009	North Preston Sewershed - Wastewater Collection System Replacement Program	Wastewater - Collection Sanitary	Wastewater Collection											$32	$144	$144																			HW Capital Budget	30-10-20-20-20	3-6-8-10-14
2.011	Eastern Passage Sewage Collection System Upgrades	Wastewater - Collection Sanitary	Wastewater Collection											$50	$100	$600	$700	$800	$1,000	$1,200															HW Capital Budget	30-10-20-20-20	3-6-8-10-14
2.075	Beaver Crescent Collection System Replacement	Wastewater - Collection Sanitary	Wastewater Collection											$50	$180	$180																			HW Capital Budget	30-10-20-20-20	3-6-8-10-14
2.232	Springfield Lake Collection Upgrade	Wastewater - Collection Sanitary	Wastewater Collection	$15		$25	$25																												HW Capital Budget	30-10-20-20-20	3-6-8-10-14
2.043	Overflow Monitoring Program	Wastewater - Collection Combined	Wastewater Collection		$40	$50	$50	$50																											HW Capital Budget	50-20-30	3-6-13

Financial Model 40-4

2.086	Ellenvale Holding Tank Sewershed	Wastewater - Collection Combined	Wastewater Collection											$100	$100	$100	$100	$100	$100	$100															HW Capital Budget	30-10-20-20-20	3-6-8-10-14
2.231	SIR Program Flow Meters	Wastewater - Equipment	Wastewater Collection	$13																															HW Capital Budget	70-30	3-6
2.228	Outfall Elimination Program	Wastewater - Outfalls	Wastewater Collection	$30	$30	$30	$30	$30																											HW Capital Budget	40-30-30	3-6-14
2.006	Valleyford Holding Tank	Wastewater - Structures	Wastewater Collection											$330																					HW Capital Budget	40-30-30	3-6-14
2.089	Fairfield Holding Tank	Wastewater - Structures	Wastewater Collection											$1,275																					HW Capital Budget	40-30-30	3-6-14
2.090	Bedford Sackville Trunk Sewer - Holding Tanks	Wastewater - Structures	Wastewater Collection											$600	$1,800	$1,800																			HW Capital Budget	40-30-30	3-6-14
2.111	Armdale Roundabout CSO screening	Wastewater - Structures	Wastewater Collection											$1,500																					HW Capital Budget	50-50	3-6
2.112	Quinpool Road CSO screening	Wastewater - Structures	Wastewater Collection												$1,500																				HW Capital Budget	50-50	3-6
2.113	Coburg Road CSO screening	Wastewater - Structures	Wastewater Collection													$1,500																			HW Capital Budget	50-50	3-6
2.114	South Street CSO screening	Wastewater - Structures	Wastewater Collection														$1,500																		HW Capital Budget	50-50	3-6
2.115	Beaufort Avenue CSO screening	Wastewater - Structures	Wastewater Collection															$1,500																	HW Capital Budget	50-50	3-6
2.815	Gravity sewer from Little Albro Lake to Jamieson St PS (DA1)	Wastewater - Collection Combined	Wastewater Collection		$3,763																														RWWFP Project	100	6
2.816	450mm surface water sewer from Fenwick St to Old Ferry Rd PS with the addition of Maynard St (DA2)	Wastewater - Collection Combined	Wastewater Collection			$3,010																													RWWFP Project	100	6
2.823	I/I Reduction Program (DA9)	Wastewater - Collection Sanitary	Wastewater Collection				$3,200																												RWWFP Project	100	6
2.824	I/I Reduction within Eastern Passage Drainage Area (EP1)	Wastewater - Collection Sanitary	Wastewater Collection			$2,080																													RWWFP Project	100	6
2.839	I/I Reduction Program (HA8)	Wastewater - Collection Sanitary	Wastewater Collection		$6,400																														RWWFP Project	100	6
2.845	I/I Reduction Program (HC6)	Wastewater - Collection Sanitary	Wastewater Collection		$3,200																														RWWFP Project	100	6
2.846	I/I Reduction Program - manhole sealing (MC1)	Wastewater - Collection Sanitary	Wastewater Collection				$48																												RWWFP Project	100	6
2.853	General I/I reduction program allowance (MC8)	Wastewater - Collection Sanitary	Wastewater Collection					$1,600																											RWWFP Project	100	6
2.858	Separation/resewerage - New storm sewers for Springfield Lake Stormwater Collection System (SP5)	Stormwater - Pipes	StormWater Collection					$10,743																											RWWFP Project	100	6
4.016	SCADA Master Plan Implementation (50/50 split W/WW)	Wastewater - IT	Wastewater Collection	$297	$665	$339																													HW Capital Budget	50-50	3-6
4.016	SCADA Master Plan Update (50/50 split W/WW)	Wastewater - IT	Wastewater Collection					$50					$50					$50					$50					$50					$50		HW Capital Budget	50-50	3-6
Sub-Total Objective 6 (Capital Projects and Programs)				**$515**	**$14,408**	**$5,928**	**$3,693**	**$13,222**	**$500**	**$500**	**$500**	**$500**	**$550**	**$4,858**	**$4,324**	**$4,824**	**$2,800**	**$2,950**	**$1,600**	**$1,800**	**$500**	**$500**	**$550**	**$500**	**$500**	**$500**	**$500**	**$550**	**$500**	**$500**	**$500**	**$500**	**$550**	**$173,645**			
Sub-Total Objective 6 (O&M)				**$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**			

Objective: 7

Meet future stormwater quality compliance requirements

Capital Expenditure profile in $k

	Project Name / Description	Asset Group	Opex Group	Year Zero (2012/2013)	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	Type of Program/Project	Objective Allocation	Objectives
1.601 (PR)	Stormwater Quality Compliance Needs Assessment	Stormwater - Pipes	StormWater Collection		$75	$75	$75	$75																											Program	100	7
4.009	Integrated Resource Plan (split W-WW-SW)	Stormwater - Pipes	StormWater Collection	$33			$38	$38				$38	$38				$38	$38				$38	$38				$38	$38				$38	$38		HW Capital Budget	33-33-33	7-8-10
2.066	Grit Management Facility	Wastewater - Collection Combined	Wastewater Collection	$12																															HW Capital Budget	20-20-60	1-7-8
Sub-Total Objective 7 (Capital Projects and Programs)				**$45**	**$75**	**$75**	**$113**	**$113**	**$0**	**$0**	**$0**	**$38**	**$38**	**$0**	**$0**	**$0**	**$38**	**$38**	**$0**	**$0**	**$0**	**$38**	**$38**	**$0**	**$0**	**$0**	**$38**	**$38**	**$0**	**$0**	**$0**	**$38**	**$38**	**$0**			

Driver: **Asset Renewal**

Objective: 8

Implement optimal level of asset reinvestment (all asset classes)

Capital Expenditure profile in $k

	Project Name / Description	Asset Group	Opex Group	Year Zero (2012/2013)	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	Type of Program/Project	Objective Allocation	Objectives
1.004	Tobin Drive Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection			$400																													HW Capital Budget	100	8
1.009	183 Lakeview Avenue - Twin Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection				$130																												HW Capital Budget	100	8
1.010	Kipawa Crescent - Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection						$121																										HW Capital Budget	100	8
1.011	Sackville Drive (West of Hamilton) - Culvert Replacement (no civic provided)	Stormwater - Culverts/Ditches	StormWater Collection		$137																														HW Capital Budget	100	8
1.012	1419 Lucasville Road - Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection							$107																									HW Capital Budget	100	8
1.015	Hammonds Plains Road & Bluewater Road Intersection - Drainage Improvements	Stormwater - Culverts/Ditches	StormWater Collection				$15	$80																											HW Capital Budget	20-80	8-10
1.016	Holly Court - Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection							$116																									HW Capital Budget	100	8
1.017	Wilson Drive & Highway 2 - Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection		$149																														HW Capital Budget	100	8
1.018	Waverley Fire Department #41 - Dual Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection					$189																											HW Capital Budget	100	8
1.022	Parker's Brook - Culvert Condition Assessment (Dartmouth Rd)	Stormwater - Culverts/Ditches	StormWater Collection				$30																												HW Capital Budget	100	8
1.023	Cobequid Road @ Sucker Brook - Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection					$160																											HW Capital Budget	100	8
1.024	Mason's Mill Pond Culvert - Condition Assessment	Stormwater - Culverts/Ditches	StormWater Collection				$30																												HW Capital Budget	100	8
1.027	Lucasville Road Culverts Replacements	Stormwater - Culverts/Ditches	StormWater Collection	$180																															HW Capital Budget	100	8
1.049	258 Yankeetown Road Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection		$75																														HW Capital Budget	100	8
1.051	Between 24&28 Seawood Avenue - Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection						$30																										HW Capital Budget	100	8
1.055	Leeward Avenue - Ditch Regrading and Rock Breaking	Stormwater - Culverts/Ditches	StormWater Collection	$70																															HW Capital Budget	100	8
1.057	Diana Drive Stormwater Modifications	Stormwater - Culverts/Ditches	StormWater Collection	$10																															HW Capital Budget	20-80	8-10
1.058	Spruce Grove Court to Daisy Drive - Drainage Swale	Stormwater - Culverts/Ditches	StormWater Collection	$10																															HW Capital Budget	20-80	8-10
1.059	561 Herring Cove Road, Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection	$105																															HW Capital Budget	100	8
1.060	Civic #150 Kaye Street, Lower Sackville - Cross Culvert replacement	Stormwater - Culverts/Ditches	StormWater Collection							$100																									HW Capital Budget	100	8
1.061	Civic #1250 Sackville Drive - Cross Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection							$100																									HW Capital Budget	100	8
1.062	Oceanview Drive Retention Pond Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection																													$98			Genivar AR Project	100	8
1.063	Meadowbrook Retention Pond Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection																			$81													Genivar AR Project	100	8
1.064	Glenbourne Estates Retention Pond Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection																													$106			Genivar AR Project	100	8
1.065	Parkland Avenue Retention Pond Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection																													$76			Genivar AR Project	100	8
1.066	Glen Forest Weir / Retention Pond Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection				$97																												Genivar AR Project	100	8
1.067	Lacewood Retention Pond Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection									$142																							Genivar AR Project	100	8
1.068	Old Sambro Road Retention Pond Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection																			$26													Genivar AR Project	100	8
1.069	Tamarack Drive Retention Pond Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection																													$71			Genivar AR Project	100	8
1.070	Forest Hills Retention Pond Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection																			$62													Genivar AR Project	100	8
1.071	Guysborough Retention Pond Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection																		$106														Genivar AR Project	100	8
1.072	Stewart Harris Drive Retention Pond Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection																	$117															Genivar AR Project	100	8
1.073	Cranberry Lake Retention Pond Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection																			$41													Genivar AR Project	100	8
1.074	Main Street Retention Pond Culvert Replacement	Stormwater - Culverts/Ditches	StormWater Collection																			$23													Genivar AR Project	100	8
	Total Stormwater Culverts/Ditches (not included in objective sub-totals)			$375	$361	$400	$302	$429	$151	$423	$0	$142	$0	$0	$0	$0	$0	$0	$0	$117	$106	$232	$0	$0	$0	$0	$0	$0	$0	$0	$0	$351	$0	$0			
1.602 (AR)	Stormwater Culverts/Ditches	Asset Renewal	StormWater Collection	$0	$6	$0	$65	$0	$216	$0	$367	$225	$367	$367	$367	$367	$367	$367	$367	$250	$261	$135	$367	$367	$367	$367	$367	$367	$367	$367	$367	$16	$367	$367	Asset Renewal	100	8
4.005	Data Collection Project (WW/SW)	Stormwater - IT	StormWater Collection		$40																														HW Capital Budget	100	8
4.008	GIS Data Program Implementation (W/WW/SW)	Stormwater - IT	StormWater Collection		$150	$200	$200	$200	$200	$200	$200																								HW Capital Budget	100	8
4.011	Lateral Card Database Conversion Project (WW/SW)	Stormwater - IT	StormWater Collection		$125	$125	$125																												HW Capital Budget	100	8
	Total Stormwater IT (not included in objective sub-totals)			$0	$315	$325	$325	$200	$200	$200	$200	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0			
1.019	Drainage Remediation Program Surveys/Studies	Stormwater - Pipes	StormWater Collection	$10	$10	$40	$50	$60	$70	$80	$90	$100	$110																						HW Capital Budget	20-80	8-10
1.025	Pinehill Drive Embankment Protection	Stormwater - Pipes	StormWater Collection			$166																													HW Capital Budget	100	8

Financial Model 40-4

1.028	Cavalier Drive Storm Sewer Outfall - Erosion Remediation	Stormwater - Pipes	StormWater Collection																		$200													HW Capital Budget	100	8
1.034	Raymond Street, Phase 2 - Storm Sewer Rehabilitation	Stormwater - Pipes	StormWater Collection					$300																										HW Capital Budget	100	8
1.038	Integrated Stormwater Projects - Program	Stormwater - Pipes	StormWater Collection	$350	$368	$403	$403	$420	$420	$420	$420	$420	$420	$420	$420	$420	$420	$420	$420	$420	$420	$420	$420	$420	$420	$420	$420	$420	$420	$420	$420	$420	$420	HW Capital Budget	70-30	8-10
1.043	Sullivan's Pond Storm Sewer System Replacement	Stormwater - Pipes	StormWater Collection						$2,000																									HW Capital Budget	100	8
1.602 (PR)	Asset Management Implementation Program (SW)	Stormwater - Pipes	StormWater Collection	$88	$300	$300	$300	$200	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	Program	100	8
4.009	Integrated Resource Plan (split W-WW-SW)	Stormwater - Pipes	StormWater Collection	$33			$38	$38				$38	$38				$38	$38				$38	$38				$38	$38				$38	$38		HW Capital Budget	33-33-33	7-8-10
	Total Stormwater Pipes (not included in objective sub-totals)			$481	$678	$909	$791	$1,018	$2,657	$667	$677	$725	$735	$587	$587	$587	$625	$625	$587	$587	$787	$625	$625	$587	$587	$587	$625	$625	$587	$587	$587	$625	$625	$587			
1.602 (AR)	Stormwater Pipes	Asset Renewal	StormWater Collection	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$6,400	$6,400	$6,200	$6,362	$6,362	$0	$0	$0	$0	$0	$15,716	$15,716	$15,716	$15,678	$15,678	$15,716	Asset Renewal	100	8
1.006	Clement Street Berm - Removal and Inlet Structure Reconfiguration	Stormwater - Structures	StormWater Collection					$20																										HW Capital Budget	20-20-20-20-20	3-6-8-10-14
1.047	Stormwater Structure Replacement Program	Stormwater - Structures	StormWater Collection		$150	$150	$200	$200																										HW Capital Budget	100	8
1.052	Idlewylde Road Storm Sewer Outlet/Embankment Stabilization	Stormwater - Structures	StormWater Collection		$200																													HW Capital Budget	100	8
	Total Stormwater Structures (not included in objective sub-totals)			$0	$350	$150	$200	$220	$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			
1.602 (AR)	Stormwater Structure	Asset Renewal	StormWater Collection	$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	Asset Renewal	100	8
2.009	North Preston Sewershed - Wastewater Collection System Replacement Program	Wastewater - Collection Sanitary	Wastewater Collection											$64	$288	$288																			HW Capital Budget	30-10-20-20-20	3-6-8-10-14
2.011	Eastern Passage Sewage Collection System Upgrades	Wastewater - Collection Sanitary	Wastewater Collection											$100	$200	$1,200	$1,400	$1,600	$2,000	$2,400															HW Capital Budget	30-10-20-20-20	3-6-8-10-14
2.075	Beaver Crescent Collection System Replacement	Wastewater - Collection Sanitary	Wastewater Collection											$100	$360	$360																			HW Capital Budget	30-10-20-20-20	3-6-8-10-14
2.145	Dorothea Drive Sanitary Sewer Upgrade	Wastewater - Collection Sanitary	Wastewater Collection						$300																									HW Capital Budget	100	8
2.013	Wanda Lane Sanitary Sewer Replacement	Wastewater - Collection Sanitary	Wastewater Collection			$1,000	$1,200																											HW Capital Budget	100	8
2.200	Alder Crescent Collection System - reverse graded pipe, 300m plus watermain	Wastewater - Collection Sanitary	Wastewater Collection		$500																													HW Capital Budget	100	8
2.232	Springfield Lake Collection Upgrade	Wastewater - Collection Sanitary	Wastewater Collection	$30		$50	$50																											HW Capital Budget	30-10-20-20-20	3-6-8-10-14
2.602 (PR)	Asset Management Implementation Program (WW)	Wastewater - Collection Combined	Wastewater Collection	$88	$300	$300	$300	$200	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	Program	100	8
2.052	Integrated Wastewater Projects - Program	Wastewater - Collection Combined	Wastewater Collection	$1,000	$800	$840	$880	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	HW Capital Budget	20-80	3-8
2.066	Grit Management Facility	Wastewater - Collection Combined	Wastewater Collection	$36																														HW Capital Budget	20-20-60	1-7-8
2.072	Russell Lake West Collection System (CCC)	Wastewater - Collection Combined	Wastewater Collection					$165	$1,600																									HW Capital Budget	100	8
2.073	Portland Hills Collection System (CCC)	Wastewater - Collection Combined	Wastewater Collection		$18	$70																												HW Capital Budget	100	8
2.074	Bedford West Collection System (CCC)	Wastewater - Collection Combined	Wastewater Collection	$15	$75		$140	$25	$153																									HW Capital Budget	100	8
2.076	Kempt Road Sewer Replacement	Wastewater - Collection Combined	Wastewater Collection					$475																										HW Capital Budget	100	8
2.086	Ellenvale Holding Tank Sewershed	Wastewater - Collection Combined	Wastewater Collection											$200	$200	$200	$200	$200	$200	$200															HW Capital Budget	30-10-20-20-20	3-6-8-10-14
2.117	Deacon Street, Gateway Avenue, Green Street, Leeds Street and Pembrooke St- Sewer Lining	Wastewater - Collection Combined	Wastewater Collection			$750																												HW Capital Budget	100	8
2.001	Barrington Street Extension - Access Manhole Replacement	Wastewater - Trunk Sewers	Wastewater Collection		$100																													HW Capital Budget	100	8
2.035	CN Quinpool Bridge Structure - Replacement of 450mm Combined Sewer	Wastewater - Trunk Sewers	Wastewater Collection	$100																														HW Capital Budget	100	8
2.063	Freshwater Brooke Phase 4	Wastewater - Trunk Sewers	Wastewater Collection						$6,250																									HW Capital Budget	100	8
2.067	Northwest Arm Sewer Rehabilitation	Wastewater - Trunk Sewers	Wastewater Collection			$250	$1,800	$1,800		$5,000			$6,000																					HW Capital Budget	100	8
2.069	Jamieson Street Trunk Sewer Outfall Replacement - Phase 2 - Construction	Wastewater - Trunk Sewers	Wastewater Collection				$1,100																											HW Capital Budget	100	8
2.070	Bedford Sackville Trunk Sewer - Maintenance Access Routes	Wastewater - Trunk Sewers	Wastewater Collection								$600	$600																						HW Capital Budget	80-20	8-9
2.203	Bedford West (CCC)	Wastewater - Trunk Sewers	Wastewater Collection	$1,250	$750																													HW Capital Budget	100	8
4.009	Integrated Resource Plan (split W-WW-SW)	Wastewater - Collection Combined	Wastewater Collection	$25			$38	$38				$38	$38				$38	$38				$38	$38				$38	$38				$38	$38		HW Capital Budget	40-20-25-15	1-3-8-13
	Total Wastewater Sewers & Trunk Sewers (not included in objective sub-totals)			$2,544	$2,543	$3,260	$5,508	$3,903	$9,670	$6,367	$1,967	$2,004	$7,404	$1,831	$2,415	$3,415	$3,004	$3,204	$3,567	$3,967	$1,367	$1,404	$1,404	$1,367	$1,367	$1,367	$1,404	$1,404	$1,367	$1,367	$1,367	$1,404	$1,404	$1,367			
2.602 (AR)	Wastewater Sewers & Trunk Sewers	Asset Renewal	Wastewater Collection	$0	$2,727	$2,010	$0	$1,367	$0	$0	$1,396	$1,359	$0	$3,439	$2,855	$1,855	$2,265	$2,065	$0	$0	$2,146	$2,109	$2,109	$3,903	$3,903	$3,903	$3,865	$3,865	$2,146	$2,146	$2,146	$2,109	$2,109	$2,146	Asset Renewal	100	8
2.004	Bayers Lake Forcemain Upgrade & Twinning	Wastewater - Forcemains	Wastewater Collection	$1,080	$500																													HW Capital Budget	50-50	8-9
2.022	Fish Hatchery Park - Forcemain Replacement	Wastewater - Forcemains	Wastewater Collection									$4,581																						HW Capital Budget	100	8
2.032	Shore Drive Golf Links - Forcemain Replacement and Twinning	Wastewater - Forcemains	Wastewater Collection				$118																											HW Capital Budget	50-50	8-9
2.033	MacPherson Forcemain Replacement and twinning	Wastewater - Forcemains	Wastewater Collection			$194																												HW Capital Budget	50-50	8-9
2.051	Cathodic Protection Program (Various Locations)	Wastewater - Forcemains	Wastewater Collection	$75	$75	$75	$75	$75																										HW Capital Budget	50-50	8-9
2.080	Forcemain Replacement Program	Wastewater - Forcemains	Wastewater Collection					$600																										HW Capital Budget	100	8
2.144	Bedford West - FM Design to redirect WW (Hollyhock PS) from Mill Cove to Halifax	Wastewater - Forcemains	Wastewater Collection	$5																														HW Capital Budget	50-50	8-14
	Total Wastewater Forcemains (not included in objective sub-totals)			$1,160	$575	$269	$193	$675	$0	$0	$0	$4,581	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0			
2.602 (AR)	Wastewater Forcemains	Asset Renewal	Wastewater Collection	$0	$0	$0	$0	$0	$2,951	$2,951	$2,951	$0	$2,951	$2,746	$2,746	$2,746	$2,746	$2,746	$832	$832	$832	$832	$832	$2,582	$2,582	$2,582	$2,582	$2,582	$9,260	$9,260	$9,260	$9,260	$9,260	$9,260	Asset Renewal	100	8
2.005	Autoport Pleasant Street PS Replacement	Wastewater - Structures	Wastewater Collection						$100	$100	$1,000																							HW Capital Budget	100	8
2.008	Gaston Rd PS Upgrade	Wastewater - Structures	Wastewater Collection						$900																									HW Capital Budget	100	8
2.038	Roach's Pond Grit Building rehab	Wastewater - Structures	Wastewater Collection					$250	$1,250																									HW Capital Budget	100	8
2.046	Wastewater Pumping Station Upgrade Program - Various Locations	Wastewater - Structures	Wastewater Collection			$550	$400	$550																										HW Capital Budget	100	8
2.046	Wastewater Pumping Station Upgrade Program - West Region	Wastewater - Structures	Wastewater Collection	$133	$23																													HW Capital Budget	100	8
2.046	Wastewater Pumping Station Upgrade Program - East Region	Wastewater - Structures	Wastewater Collection	$125	$125																													HW Capital Budget	100	8
2.046	Wastewater Pumping Station Upgrade Program - Central Region	Wastewater - Structures	Wastewater Collection	$100	$145																													HW Capital Budget	100	8
2.062	Leiblin Drive PS Generator	Wastewater - Structures	Wastewater Collection						$35	$315																								HW Capital Budget	70-30	8-9
2.081	Main Street, Memorial Drive, O'Dell Drive, Humber Park PS Upgrades	Wastewater - Structures	Wastewater Collection						$5,000																									HW Capital Budget	100	8
2.085	Balcome Drive PS	Wastewater - Structures	Wastewater Collection	$750																														HW Capital Budget	100	8
2.087	Quigley's Corner Pump Replacement and PS Upgrade	Wastewater - Structures	Wastewater Collection	$300					$5,500																									HW Capital Budget	100	8
2.088	Russell Lake PS Upgrade	Wastewater - Structures	Wastewater Collection			$1,000	$1,000																											HW Capital Budget	100	8
2.091	Bedford PS Rehabilitation (at Mill Cove WWTF)	Wastewater - Structures	Wastewater Collection		$750		$1,375	$1,375																										HW Capital Budget	100	8
2.093	Windmill Road PS	Wastewater - Structures	Wastewater Collection						$1,500																									HW Capital Budget	100	8
2.118	AST PS - Automated Bar Screen	Wastewater - Structures	Wastewater Collection												$360																				HW Capital Budget	60-40	3-8
2.120	Herring Cove - Automated Bar Screen	Wastewater - Structures	Wastewater Collection													$360																			HW Capital Budget	60-40	3-8
2.121	Melva PS - Automated Bar Screen	Wastewater - Structures	Wastewater Collection														$360																		HW Capital Budget	60-40	3-8
2.122	Jamieson PS - Automated Bar Screen	Wastewater - Structures	Wastewater Collection															$360																	HW Capital Budget	60-40	3-8
	Total Wastewater Pumping Stations (not included in objective sub-totals)			$1,408	$1,043	$1,550	$2,775	$2,175	$14,285	$415	$1,000	$0	$0	$0	$360	$360	$360	$360	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0			
2.602 (AR)	Wastewater Pumping Stations	Asset Renewal	Wastewater Collection	$0	$10,142	$9,635	$8,410	$9,010	$0	$3,472	$3,022	$4,022	$4,022	$4,537	$4,177	$4,177	$4,177	$4,177	$10,164	$10,164	$10,164	$10,164	$10,164	$2,151	$2,151	$2,151	$2,151	$2,151	$6,347	$6,347	$6,347	$6,347	$6,347	$6,347	Asset Renewal	100	8
2.602 (NAR)	Wastewater Structures	New Asset Renewal	Wastewater Collection	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,489	$165	$318	$394	$1,430	$55	$1,385	$0	$5,600	$1,035	$10,947	$4,560	$1,825	$4,925	$6,114	$1,650	$5,964	$1,385	$24,704	New Asset Renewal	100	8
2.050	Wastewater Treatment Facilities Upgrades (Various Locations)	Wastewater - Treatment Facilities	Wastewater Treatment	$135		$250	$250	$250																										HW Capital Budget	100	8
2.050	Wastewater Treatment Facilities Upgrades - Mill Cove WWTF	Wastewater - Treatment Facilities	Wastewater Treatment	$50																														HW Capital Budget	100	8
2.050	Wastewater Treatment Facilities Upgrades - Uplands Park WWTF	Wastewater - Treatment Facilities	Wastewater Treatment	$50	$450																													HW Capital Budget	100	8
2.050	Wastewater Treatment Facilities Upgrades - Middle Musquodoboit WWTF	Wastewater - Treatment Facilities	Wastewater Treatment					$10																										HW Capital Budget	100	8
2.056	Plant Optimization Audit Program	Wastewater - Treatment Facilities	Wastewater Treatment		$25	$36			$75																									HW Capital Budget	20-50-10-20	8-9-12-14
2.057	HHSP Upgrade Program	Wastewater - Treatment Facilities	Wastewater Treatment			$250	$250	$250																										HW Capital Budget	100	8
2.057	HHSP Upgrade Program - Halifax WWTF	Wastewater - Treatment Facilities	Wastewater Treatment	$145																														HW Capital Budget	50-50	8-12
2.057	HHSP Upgrade Program - Dartmouth WWTF	Wastewater - Treatment Facilities	Wastewater Treatment	$90	$75																													HW Capital Budget	50-50	8-12
2.065	Frame WWTF Replacement	Wastewater - Treatment Facilities	Wastewater Treatment	$90				$270	$2,700																									HW Capital Budget	10-90	4-8

Financial Model 40-4

2.065 (O&M)	New O&M costs associated with new mechanical Frame WWTF - energy for aeration, chemical costs for TP removal, Increase in Labour, and UV upgrade costs (energy, bulb replacement, cleaning chemicals)	Wastewater - Treatment Facilities (O&M)	Wastewater Treatment							$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	O&M (yearly costs)	10-90	4-8
2.208	Dartmouth HHSP ARV's	Wastewater - Treatment Facilities	Wastewater Treatment	$6																															HW Capital Budget	30-70	8-12
	Total Wastewater Treatment Facilities (not included in objective sub-totals)			$566	$550	$536	$500	$780	$2,775	$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			
2.602 (AR)	Wastewater Treatment Facilities	Asset Renewal	Wastewater Treatment	$0	$14,535	$17,650	$18,054	$17,774	$9,375	$13,526	$12,826	$13,526	$13,526	$7,507	$7,507	$7,507	$7,507	$7,507	$35,462	$35,462	$35,462	$35,462	$35,462	$13,091	$13,091	$13,091	$13,091	$13,091	$14,931	$14,931	$14,931	$14,931	$14,931	$14,931	Asset Renewal	100	8
2.602 (NAR)	Wastewater Treatment Facilities	New Asset Renewal	Wastewater Treatment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$5,141	$1,354	$93	$2,515	$1,131	$0	$70	$0	$3,920	$14,861	$136	$5,277	$1,489	$229	$2,650	$1,267	$136	$206	$14,040	New Asset Renewal	100	8
2.201	Asphalt Roller	Wastewater - Equipment	Wastewater Treatment	$15																															HW Capital Budget	100	8
2.233	Tri-axel Trailer	Wastewater - Equipment	Wastewater Treatment	$30																															HW Capital Budget	100	8
4.012	Miscellaneous Equipment Replacement	Wastewater - Equipment	Wastewater Treatment		$60	$60	$60	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	HW Capital Budget	100	8
4.018	Survey Equipment (50/50 split W/WW)	Wastewater - Equipment	Wastewater Treatment	$15																															HW Capital Budget	100	8
	Total Wastewater Equipment (not included in objective sub-totals)			$60	$60	$60	$60	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70			
4.007	Fleet Upgrade Program	Wastewater - Fleet	Wastewater Treatment	$1,000	$1,250	$1,000	$1,200	$1,100	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	HW Capital Budget	100	8
	Total Wastewater Fleet (not included in objective sub-totals)			$1,000	$1,250	$1,000	$1,200	$1,100	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000			
4.006	Desktop Computer Replacement Program (W/WW)	Wastewater - IT	Wastewater Treatment	$130	$130	$130	$130	$130	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	HW Capital Budget	100	8
4.008	GIS Data Program Implementation (W/WW/SW)	Wastewater - IT	Wastewater Collection		$150	$200	$200	$200	$200	$200	$200																								HW Capital Budget	100	8
4.013	Network Infrastructure Upgrades (50/50 split W/WW)	Wastewater - IT	Wastewater Treatment	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	HW Capital Budget	100	8
4.015	SCADA Control System Enhancements	Wastewater - IT	Wastewater Treatment	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	HW Capital Budget	100	8
	Total Wastewater IT (not included in objective sub-totals)			$330	$480	$530	$530	$530	$550	$550	$550	$350	$350	$350	$350	$350	$350	$350	$350	$350	$350	$350	$350	$350	$350	$350	$350	$350	$350	$350	$350	$350	$350	$350			
4.017	Security Upgrade Program	Wastewater - Security	Wastewater Treatment	$150	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	HW Capital Budget	100	8
	Total Wastewater Security (not included in objective sub-totals)			$150	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200			
2.213	East Region Operation Facility - Design	Wastewater - Structures	Wastewater Collection				$300																												HW Capital Budget	100	8
4.002	Cowie Hill Facility - Furniture	Wastewater - Structures	Wastewater Collection	$125																															HW Capital Budget	100	8
4.003	Cowie Hill Operations Facility	Wastewater - Structures	Wastewater Collection	$4,000	$3,700																														HW Capital Budget	100	8
4.004	Cowie Hill Road Extension	Wastewater - Structures	Wastewater Collection	$250																															HW Capital Budget	100	8
	Total Wastewater Structures (not included in objective sub-totals)			$4,375	$3,700	$0	$300	$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			
3.607 (PR)	Asset Management Implementation Program (W)	Water - Transmission	Water Transmission & Distribution	$88	$300	$300	$300	$200	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	$167	Program	100	8
3.008	Pockwock Transmission Main Replacement Kearney Lake Road (Twin Culverts to Bluewater Road) (W1)	Water - Transmission	Water Transmission & Distribution			$1,681																													GENIVAR	30-70	8-9
3.010	Peninsula Intermediate 15" Transmission Main Sliplining (W5)	Water - Transmission	Water Transmission & Distribution											$1,979																					GENIVAR	30-70	8-9
3.011	Peninsula Low 27" Transmission Main Sliplining (W6)	Water - Transmission	Water Transmission & Distribution																					$4,388											GENIVAR	30-70	8-9
3.013	Windmill Road Transmission Main Replacement - Phase 1 (E1)	Water - Transmission	Water Transmission & Distribution											$2,077																					GENIVAR	100	8
3.014	Windmill Road Transmission Main Replacement - Phase 2 (E2)	Water - Transmission	Water Transmission & Distribution											$2,301																					GENIVAR	100	8
3.017	Herring Cove Transmission Main Replacement (W7)	Water - Transmission	Water Transmission & Distribution											$1,280																					GENIVAR	30-70	8-9
3.042	Critical Trans Main Valve Replacement Program	Water - Transmission	Water Transmission & Distribution		$250	$250	$500																												HW Capital Budget	100	8
3.043	Bedford South CCC - Nine Mile Drive Extension	Water - Transmission	Water Transmission & Distribution	$35																															HW Capital Budget	100	8
3.045	Bedford West CCC - Various Phases	Water - Transmission	Water Transmission & Distribution	$10	$20	$30	$25	$25	$150																										HW Capital Budget	100	8
3.102	Pockwock Transmission Main Replacement Kearney Lake Road (Bluewater Road to Ham-Kearney Connector) (W2)	Water - Transmission	Water Transmission & Distribution						$1,834																										GENIVAR	30-70	8-9
3.251	Bedford Connector 30" Replacement - Phase 3 (C1)	Water - Transmission	Water Transmission & Distribution						$743																										GENIVAR	30-70	8-9
3.252	Birch Cove North CCC	Water - Transmission	Water Transmission & Distribution					$330																											HW Capital Budget	100	8
3.265	Eastern Passage Transmission Main Replacement (E5)	Water - Transmission	Water Transmission & Distribution																$628																GENIVAR	30-70	8-9
3.266	Gaston Road Transmission Main Replacement Phase 2 (E4)	Water - Transmission	Water Transmission & Distribution																$469																GENIVAR	30-70	8-9
3.299	Morris Lake Estates CCC	Water - Transmission	Water Transmission & Distribution					$15																											HW Capital Budget	100	8
3.527	Peninsula Low 24" Transmission Main Sliplining (W4)	Water - Transmission	Water Transmission & Distribution																$2,306																GENIVAR	30-70	8-9
3.532	North End Feeder Tunnel 36" Transmission Main Rehab (W3)	Water - Transmission	Water Transmission & Distribution						$877																										GENIVAR	30-70	8-9
4.009	Integrated Resource Plan (split W-WW-SW)	Water - Transmission	Water Transmission & Distribution	$40			$60	$60				$60	$60				$60	$60				$60	$60				$60	$60				$60	$60		HW Capital Budget	40-40-20	2-8-13
	Total Water Transmission Mains (not included in objective sub-totals)			$173	$570	$2,261	$885	$630	$3,771	$167	$167	$227	$227	$7,803	$167	$167	$227	$227	$3,569	$167	$167	$227	$227	$4,555	$167	$167	$227	$227	$167	$167	$167	$227	$227	$167			
3.607 (AR)	Water Transmission Mains	Asset Renewal	Water Transmission & Distribution	$0	$4,852	$0	$4,537	$4,792	$0	$3,410	$3,410	$3,350	$3,350	$0	$2,615	$2,615	$2,555	$2,555	$0	$248	$248	$188	$188	$0	$1,283	$1,283	$1,223	$1,223	$0	$3,325	$3,325	$3,265	$3,265	$2,325	Asset Renewal	100	8
3.022	Water Distribution - Main Renewal Program	Water - Distribution	Water Transmission & Distribution		$3,200	$3,500	$3,600	$3,600																											HW Capital Budget	100	8
3.066	Cathodic Protection Program	Water - Distribution	Water Transmission & Distribution		$100	$100	$100	$100																											HW Capital Budget	50-50	8-9
3.250	Bayers Rd Water Main Renewal (Integrated)	Water - Distribution	Water Transmission & Distribution	$315																															HW Capital Budget	100	8
3.253	Carver St Service Lateral Relocation	Water - Distribution	Water Transmission & Distribution	$56																															HW Capital Budget	100	8
3.254	Chandler Drive	Water - Distribution	Water Transmission & Distribution	$284																															HW Capital Budget	100	8
3.255	CNR Bridge at Quinpool Road (integrated)	Water - Distribution	Water Transmission & Distribution	$81																															HW Capital Budget	100	8
3.287	Kingfisher Crescent Water Main Renewal (Integrated)	Water - Distribution	Water Transmission & Distribution	$222																															HW Capital Budget	100	8
3.295	Lawnsdale Drive Water Main Renewal (Integrated)	Water - Distribution	Water Transmission & Distribution	$373																															HW Capital Budget	100	8
3.301	Mountain Drive Water Main Renewal (Integrated)	Water - Distribution	Water Transmission & Distribution	$198																															HW Capital Budget	100	8
3.302	Pine Street Water Main Renewal (Integrated)	Water - Distribution	Water Transmission & Distribution	$433																															HW Capital Budget	100	8
3.303	Plateau Cr Water Main Renewal (Integrated)	Water - Distribution	Water Transmission & Distribution	$419																															HW Capital Budget	100	8
3.304	Pleasant Street	Water - Distribution	Water Transmission & Distribution	$167																															HW Capital Budget	100	8
3.314	Waverley Road Bridge Water Main Replacement	Water - Distribution	Water Transmission & Distribution	$75																															HW Capital Budget	100	8
3.315	Willow Street Water Main Renewal (Integrated)	Water - Distribution	Water Transmission & Distribution	$125																															HW Capital Budget	100	8
	Total Water Distribution (not included in objective sub-totals)			$2,748	$3,300	$3,600	$3,700	$3,700	$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			
3.607 (AR)	Water Distribution Mains	Asset Renewal	Water Transmission & Distribution	$0	$3,182	$2,882	$2,782	$2,782	$4,323	$4,323	$4,323	$4,323	$4,323	$6,967	$6,967	$6,967	$6,967	$6,967	$4,378	$4,378	$4,378	$4,378	$4,378	$6,567	$6,567	$6,567	$6,567	$6,567	$4,170	$4,170	$4,170	$4,170	$4,170	$4,170	Asset Renewal	100	8
3.035	~ Meter Program	Water - Meters	Water Transmission & Distribution	$1,050	$1,100	$1,150	$1,150	$1,150																											HW Capital Budget	100	8
	Total Water Meters (not included in objective sub-totals)			$1,050	$1,100	$1,150	$1,150	$1,150	$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			
3.607 (AR)	Water Meters	Asset Renewal	Water Transmission & Distribution	$0	$0	$0	$0	$0	$446	$450	$448	$448	$480	$480	$471	$456	$456	$481	$481	$481	$396	$427	$411	$407	$374	$467	$459	$459	$443	$443	$449	$485	$485	$483	Asset Renewal	100	8
3.607 (NAR)	Water Meters	New Asset Renewal	Water Transmission & Distribution	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,100	$1,150	$1,150	$1,150	$0	$0	$0	$0	$0	New Asset Renewal	100	8
3.068	~ Hydrants	Water - Hydrants	Water Transmission & Distribution	$75	$75	$75	$75	$75																											HW Capital Budget	100	8
	Total Water Hydrants (not included in objective sub-totals)			$75	$75	$75	$75	$75	$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			
3.069	~ Service Lines	Water - Services	Water Transmission & Distribution	$240	$240	$240	$240	$240																											HW Capital Budget	100	8
	Total Water Services (not included in objective sub-totals)			$240	$240	$240	$240	$240	$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			
3.067	~ Valves	Water - Distribution	Water Transmission & Distribution	$50	$50	$50	$50	$50																											HW Capital Budget	100	8
	Total Water Valves (not included in objective sub-totals)			$50	$50	$50	$50	$50	$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			
3.607 (AR)	Water Valves	Asset Renewal	Water Transmission & Distribution	$0	$0	$0	$0	$0	$39	$39	$39	$39	$39	$39	$39	$39	$39	$39	$39	$39	$39	$39	$39	$77	$77	$77	$77	$77	$75	$75	$75	$75	$75	$75	Asset Renewal	100	8
3.203 (O&M)	Grand Lake Pumping (O&M)	Water - Pumping (O&M)	Water Transmission & Distribution											$14	$14	$14	$14	$14	$14	$14	$14	$14	$14	$14	$14	$14	$14	$14	$14	$14	$14	$14	$14	$14	GENIVAR O&M Costs (yearly)	30-70	8-13
3.203	Chambers and Pumping Stations	Water - Structures	Water Transmission & Distribution			$250	$250	$250																											HW Capital Budget	100	8
	Total Water Pumping Stations (not included in objective sub-totals)			$0	$0	$250	$250	$250	$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			
3.607 (AR)	Water Pumping Stations	Asset Renewal	Water Transmission & Distribution	$0	$3,255	$3,005	$3,005	$3,005	$220	$220	$220	$220	$220	$966	$966	$966	$966	$966	$1,116	$1,116	$1,116	$1,116	$1,116	$34	$34	$34	$34	$34	$3,255	$3,255	$3,255	$3,255	$3,255	$3,255	Asset Renewal	100	8
3.500	Mount Edward 1 Replacement with Steel Tank	Water - Structures	Water Transmission & Distribution											$7,855																					HW Capital Budget	100	8
3.501	Cowie Hill Replacement with Steel Tank	Water - Structures	Water Transmission & Distribution																$4,163																GENIVAR Capital Project	100	8
3.502	Geizer 123 Replacement with Steel Tank	Water - Structures	Water Transmission & Distribution																					$10,829											GENIVAR Capital Project	100	8
3.503	Lakeside/Timberlea Replacement with Steel Tank	Water - Structures	Water Transmission & Distribution																										$2,202						GENIVAR Capital Project	100	8
3.504	Meadowbrook Replacement with Steel Tank	Water - Structures	Water Transmission & Distribution																															$3,411	GENIVAR Capital Project	100	8
3.505	Akerley Blvd. (large tank) Coating in 2021 and 2041	Water - Structures	Water Transmission & Distribution										$960																				$960		GENIVAR Capital Project	100	8
3.506	Beaver Bank (small tank) Coating in 2027	Water - Structures	Water Transmission & Distribution																$320																GENIVAR Capital Project	100	8
3.507	Geizer 158 (large tank) Coating in 20115 and 2035	Water - Structures	Water Transmission & Distribution				$960																				$960								GENIVAR Capital Project	100	8
3.508	Mount Edward 2 (large tank) Coating in 2018 and 2033	Water - Structures	Water Transmission & Distribution							$960																				$960					GENIVAR Capital Project	100	8
3.509	North Preston (small tank) Coating in 2013 and 2033	Water - Structures	Water Transmission & Distribution		$320																				$320										GENIVAR Capital Project	100	8
3.510	Sampson(large tank) Coating in 2029.	Water - Structures	Water Transmission & Distribution																		$960														GENIVAR Capital Project	100	8

Financial Model 40-4

3.511	Stokil (large tank) Coating in 2020 and 2040.	Water - Structures	Water Transmission & Distribution									$960																			$960			GENIVAR Capital Project	100	8
3.512	Waverley (small tank) Coating in 2019 and 2039	Water - Structures	Water Transmission & Distribution								$320																			$320				GENIVAR Capital Project	100	8
	Total Water Reservoirs (not included in objective sub-totals)			$0	$320	$0	$960	$0	$0	$960	$320	$960	$960	$7,855	$0	$0	$0	$0	$4,483	$0	$960	$0	$0	$10,829	$320	$0	$960	$0	$2,202	$960	$320	$960	$960	$3,411			
3.024	DMA Program	Water - Structures	Water Transmission & Distribution			$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	HW Capital Budget	50-50	8-14
3.257	Confined Space Retrofit - Orchard Central Chamber	Water - Structures	Water Transmission & Distribution		$32																														HW Capital Budget	20-80	2-8
4.002	Cowie Hill Facility - Furniture	Water - Structures	Water Transmission & Distribution	$125																															HW Capital Budget	100	8
4.003	Cowie Hill Operations Facility	Water - Structures	Water Transmission & Distribution	$4,000	$3,700																														HW Capital Budget	100	8
4.004	Cowie Hill Road Extension	Water - Structures	Water Transmission & Distribution	$250																															HW Capital Budget	100	8
	Total Water Facilities (not included in objective sub-totals)			$4,375	$3,732	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50			
3.261	CSE Retrofit - Arkerley Reservoir Chamber	Water - Structures	Water Transmission & Distribution	$25																															HW Capital Budget	30-70	2-8
3.513	Pockwock Lake Dam Concrete and Mechanical Restoration in 2025 (20% of Asset Value)	Water - Structures	Water Transmission & Distribution														$1,415																		GENIVAR Capital Project	100	8
3.514	East Lake Dam Concrete and Mechanical Restoration in 2020 and 2040 (20% of Asset Value)	Water - Structures	Water Transmission & Distribution									$722																			$722			GENIVAR Capital Project	100	8
3.515	Lake Major Dam Replacement in 2017	Water - Structures	Water Transmission & Distribution						$2,097																										Capital Project	100	8
3.516	Chain Lake Dam Replacement in 2040	Water - Structures	Water Transmission & Distribution																												$4,324			GENIVAR Capital Project	100	8
3.517	Lake Lamont Dam Civils/Mechanicals Repair and Replace in 2020 (20% of Asset Value)	Water - Structures	Water Transmission & Distribution									$262																							GENIVAR Capital Project	100	8
3.518	Bayer's Lake Diversion Civils/Mechanicals Repair and Replace in 2025 (20% of Asset Value)	Water - Structures	Water Transmission & Distribution														$722																		GENIVAR Capital Project	100	8
	Total Water Dams (not included in objective sub-totals)			$25	$0	$0	$0	$0	$2,097	$0	$0	$984	$0	$0	$0	$0	$2,137	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$5,046	$0	$0			
3.309	PRV Replacement - Prince Albert Road	Water - Structures	Water Transmission & Distribution			$310																													HW Capital Budget	100	8
	Total Water PRVs (not included in objective sub-totals)			$0	$0	$310	$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			
3.607 (NAR)	Water Structures	New Asset Renewal	Water Transmission & Distribution	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$406	$76	$141	$45	$655	$1,216	$52	$214	$116	$806	$2,050	$806	$1,015	$386	$4,027	$6,755	$1,592	$1,144	$814	New Asset Renewal	100	8
3.607 (AR)	Water PRVs	Asset Renewal	Water Transmission & Distribution	$0	$576	$266	$576	$576	$1,397	$1,397	$1,397	$1,397	$1,397	$1,118	$1,118	$1,118	$1,118	$1,118	$1,030	$1,030	$1,030	$1,030	$1,030	$732	$732	$732	$732	$732	$576	$576	$576	$576	$576	$576	Asset Renewal	100	8
3.272	J D Kline - Chemical Feed Pump Replacement Program	Water - Treatment Facilities	Water Treatment	$120	$120	$120	$120	$120																											HW Capital Budget	100	8
3.273	J D Kline - Chlorination System Replacement	Water - Treatment Facilities	Water Treatment			$2,400																													HW Capital Budget	100	8
3.274	J D Kline - Chlorination System Replacement Design	Water - Treatment Facilities	Water Treatment	$100																															HW Capital Budget	100	8
3.275	J D Kline - Entrance Road Paving Renewal	Water - Treatment Facilities	Water Treatment			$85																													HW Capital Budget	100	8
3.277	J D Kline - Lobby Upgrades	Water - Treatment Facilities	Water Treatment						$180																										HW Capital Budget	100	8
3.279	J D Kline - Parking Lot Resurfacing	Water - Treatment Facilities	Water Treatment				$120																												HW Capital Budget	100	8
3.281	J D Kline - Replace Pump Motors #1 and #3	Water - Treatment Facilities	Water Treatment						$140																										HW Capital Budget	50-50	8-12
3.282	J D Kline - Replace Valve Actuators at the Pumping Station	Water - Treatment Facilities	Water Treatment			$95																													HW Capital Budget	100	8
3.283	J D Kline - Replacement program for Filter Valve Actuators	Water - Treatment Facilities	Water Treatment		$45	$45	$45	$45																											HW Capital Budget	100	8
3.290	Lake Major WSP - Control Room Renovations	Water - Treatment Facilities	Water Treatment	$14																															HW Capital Budget	100	8
3.291	Lake Major WSP - Lime System Upgrade	Water - Treatment Facilities	Water Treatment	$38																															HW Capital Budget	100	8
3.292	Lake Major WSP - New Diesel Generator	Water - Treatment Facilities	Water Treatment						$158																										HW Capital Budget	70-30	8-9
3.293	Lake Major WSP - Ventilation in Motor Control Room	Water - Treatment Facilities	Water Treatment	$20																															HW Capital Budget	100	8
	Total Water Treatment Facilities (not included in objective sub-totals)			$292	$165	$2,745	$285	$165	$478	$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			
3.607 (AR)	Pockwock and Lake Major Treatment Facilities	Asset Renewal	Water Treatment	$0	$5,543	$2,963	$5,423	$5,543	$0	$0	$0	$0	$0	$5,914	$5,914	$5,914	$5,914	$5,914	$0	$0	$0	$0	$0	$7,557	$7,557	$7,557	$7,557	$7,557	$5,708	$5,708	$5,708	$5,708	$5,708	$5,708	Asset Renewal	100	8
3.607 (AR)	Small Water Treatment Facilities	Asset Renewal	Water Treatment	$0	$135	$135	$135	$135	$122	$122	$122	$122	$122	$135	$135	$135	$135	$135	$17	$17	$17	$17	$17	$400	$400	$400	$400	$400	$168	$168	$168	$168	$168	$168	Asset Renewal	100	8
3.607 (NAR)	Water Treatment Facilities	New Asset Renewal	Water Treatment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$38	$451	$420	$48	$235	$122	$22	$22	$32	$22	$22	$60	$473	$452	$70	$257	$143	$43	$53	New Asset Renewal	100	8
4.007	Fleet Upgrade Program	Water - Fleet	Water Treatment	$250	$200	$460	$450	$465	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	HW Capital Budget	100	8
	Total Water Fleet (not included in objective sub-totals)			$250	$200	$460	$450	$465	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500			
3.041	SCADA Control System Upgrades	Water - IT	Water Treatment	$50	$50																														HW Capital Budget	100	8
4.001	Computerized Maintenance Management System (50/50 split W/WW)	Water - IT	Water Treatment	$50	$50	$400	$400	$400																											HW Capital Budget	100	8
4.006	Desktop Computer Replacement Program (W/WW)	Water - IT	Water Treatment	$130	$130	$130	$130	$130	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	HW Capital Budget	100	8
4.008	GIS Data Program Implementation (W/WW/SW)	Water - IT	Water Treatment		$150	$200	$200	$200	$200	$200	$200																								HW Capital Budget	100	8
4.010	IT Program	Water - IT	Water Treatment	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	HW Capital Budget	100	8
4.013	Network Infrastructure Upgrades (50/50 split W/WW)	Water - IT	Water Treatment	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	HW Capital Budget	100	8
4.015	SCADA Control System Enhancements	Water - IT	Water Treatment	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	HW Capital Budget	100	8
	Total Water IT (not included in objective sub-totals)			$480	$630	$980	$980	$980	$600	$600	$600	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400			
4.017	Security Upgrade Program	Water - Security	Water Treatment	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	HW Capital Budget	100	8
	Total Water Security (not included in objective sub-totals)			$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50			
3.262	Diesel Plate Compactor	Water - Equipment	Water Treatment				$16																												HW Capital Budget	100	8
3.294	Large tapping machine c/w electric operator and 4" to 12" cutters	Water - Equipment	Water Treatment		$34																														HW Capital Budget	100	8
3.310	Scissor-Lift Equipment - Lake Major WSP	Water - Equipment	Water Treatment	$20																															HW Capital Budget	100	8
3.311	Small Hydro Vac for valve box maintenance	Water - Equipment	Water Treatment					$25																											HW Capital Budget	100	8
3.312	Trench Box	Water - Equipment	Water Treatment			$10																													HW Capital Budget	100	8
4.012	Miscellaneous Equipment Replacement	Water - Equipment	Water Treatment	$30	$55	$60	$60	$45																											HW Capital Budget	100	8
4.014	Power Meter/Data Logger (50/50 split W/WW)	Water - Equipment	Water Treatment	$5																															HW Capital Budget	100	8
4.018	Survey Equipment (50/50 split W/WW)	Water - Equipment	Water Treatment	$10																															HW Capital Budget	100	8
	Total Water Equipment (not included in objective sub-totals)			$65	$89	$70	$76	$70	$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			
2.016	Aerotech WWTF Upgrade - Design/Construction	Wastewater - Airport Aerotech System	Wastewater Treatment	$50	$1,950	$2,000																													HW Capital Budget	50-20-30	1-8-13
2.538	Aerotech WWTF Upgrade Program	Wastewater - Airport Aerotech System	Wastewater Treatment	$11	$210	$6	$11	$210	$210		$210		$210		$210		$210		$210		$210		$210		$210		$210		$210		$210		$210		HW Capital Budget	35-35-30	1-4-8
	Total Airport/Aerotech Wastewater Treatment Facilities (not included in objective sub-totals)			$61	$2,160	$2,006	$11	$210	$210	$0	$210	$0	$210	$0	$210	$0	$210	$0	$210	$0	$210	$0	$210	$0	$210	$0	$210	$0	$210	$0	$210	$0	$210	$0			
2.602 (AR)	Airport/Aerotech WW Treatment Facilities	Asset Renewal	Wastewater Treatment	$0	$0	$0	$389	$190	$0	$0	$0	$0	$0	$400	$190	$400	$190	$400	$2,190	$2,400	$2,190	$2,400	$2,190	$0	$0	$0	$0	$0	$190	$400	$190	$400	$190	$400	Asset Renewal	100	8
2.602 (AR)	Airport/Aerotech WW Pumping Stations	Asset Renewal	Wastewater Treatment	$0	$156	$156	$156	$156	$26	$26	$26	$26	$26	$0	$0	$0	$0	$0	$156	$156	$156	$156	$156	$0	$0	$0	$0	$0	$26	$26	$26	$26	$26	$26	Asset Renewal	100	8
2.602 (AR)	Airport/Aerotech WW Forcemains	Asset Renewal	Wastewater Treatment	$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	$101	$101	$101	$101	$101	$101	Asset Renewal	100	8
2.602 (AR)	Airport/Aerotech WW Collections System	Asset Renewal	Wastewater Treatment	$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	Asset Renewal	100	8
2.602 (NAR)	Wastewater Airport Aerotech System	New Asset Renewal	Wastewater Treatment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,070	$1,002	$4	$70	$85	$0	$70	$120	$70	$3,664	$70	$1,070	$1,072	$4	$140	$85	$70	$70	$190	New Asset Renewal	100	8
3.519	Bennery Distribution System Upgrades	Water - Airport Aerotech System	Water Transmission & Distribution	$88	$88	$88	$88	$88																											HW Capital Budget	80-20	8-13
3.520	Aerotech Steel Reservoir (small tank) Coating in 2014 and 2034	Water - Airport Aerotech System	Water Transmission & Distribution			$320																				$320									HW Capital Budget	100	8
3.521	Bennery Lake WSP - Raw Water Supply from Grand Lake	Water - Airport Aerotech System	Water Transmission & Distribution											$1,140																					HW Capital Budget	30-50-20	8-9-13
	Total Airport/Aerotech Distribution (not included in objective sub-totals)			$88	$88	$408	$88	$88	$0	$0	$0	$0	$0	$1,140	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$320	$0	$0	$0	$0	$0	$0	$0	$0			
3.607 (AR)	Airport/Aerotech Water Distribution	Asset Renewal	Water Transmission & Distribution	$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	Asset Renewal	100	8
3.522	Bennery Lake WSP - Future Process Improvements (from 2008 Aerotech Servicing Study)	Water - Airport Aerotech System	Water Treatment			$1,295																													HW Capital Budget	30-70	5-8
3.523	Bennery WSP Upgrades	Water - Airport Aerotech System	Water Treatment	$140	$140	$140	$140	$140																											HW Capital Budget	100	8
	Total Airport/Aerotech WSP (not included in objective sub-totals)			$140	$140	$1,435	$140	$140	$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			
3.607 (AR)	Airport/Aerotech Water Treatment Facilities	Asset Renewal	Water Treatment	$0	$2,061	$766	$2,061	$2,061	$367	$367	$367	$367	$367	$0	$0	$0	$0	$0	$367	$367	$367	$367	$367	$0	$0	$0	$0	$0	$2,201	$2,201	$2,201	$2,201	$2,201	$2,201	Asset Renewal	100	8
3.607 (AR)	Water Pumping Stations - Airport	Asset Renewal	Water Treatment	$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	Asset Renewal	100	8
3.607 (AR)	Water Pumping Stations - Aerotech	Asset Renewal	Water Treatment	$0	$785	$785	$785	$785	$0	$0	$0	$0	$0	$131	$131	$131	$131	$131	$0	$0	$0	$0	$0	$785	$785	$785	$785	$785	$0	$0	$0	$0	$0	$0	Asset Renewal	100	8
3.607 (NAR)	Water Airport Aerotech System	New Asset Renewal	Water Treatment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$25	$242	$25	$25	$0	$0	$0	$0	$0	$380	$0	$25	$242	$25	$25	$0	$0	$0	$0	New Asset Renewal	100	8
Sub-Total Objective 8 (Capital Projects and Programs)				**$22,610**	**$25,014**	**$25,329**	**$22,323**	**$19,613**	**$39,313**	**$12,218**	**$7,560**	**$12,242**	**$12,156**	**$21,836**	**$6,358**	**$7,148**	**$9,183**	**$7,036**	**$15,035**	**$7,457**	**$6,216**	**$5,108**	**$5,086**	**$19,957**	**$5,270**	**$5,060**	**$6,046**	**$4,876**	**$7,152**	**$5,700**	**$5,270**	**$11,232**	**$6,046**	**$8,151**			
Sub-Total Objective 8 (Asset Renewal)				**$0**	**$47,955**	**$40,253**	**$46,378**	**$48,176**	**$19,482**	**$30,304**	**$30,915**	**$29,425**	**$31,191**	**$34,746**	**$36,198**	**$35,393**	**$35,534**	**$35,568**	**$62,999**	**$63,340**	**$65,003**	**$65,182**	**$65,188**	**$38,654**	**$39,903**	**$39,996**	**$39,891**	**$39,891**	**$65,683**	**$69,217**	**$69,013**	**$68,772**	**$68,913**	**$68,257**			
Sub-Total Objective 8 (New Asset Renewal)				**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$9,170**	**$3,289**	**$1,000**	**$3,096**	**$3,536**	**$1,393**	**$1,599**	**$356**	**$9,738**	**$20,767**	**$14,325**	**$12,948**	**$7,265**	**$7,170**	**$13,025**	**$10,014**	**$7,905**	**$2,848**	**$39,801**			
Sub-Total Objective 8 (Programs, Projects and Asset Renewal)				**$22,610**	**$72,969**	**$65,582**	**$68,701**	**$67,789**	**$58,795**	**$42,522**	**$38,475**	**$41,667**	**$43,347**	**$56,582**	**$42,556**	**$51,710**	**$48,005**	**$43,604**	**$81,131**	**$74,333**	**$72,611**	**$71,889**	**$70,629**	**$68,349**	**$65,940**	**$59,381**	**$58,884**	**$52,032**	**$80,004**	**$87,942**	**$84,296**	**$87,909**	**$77,807**	**$116,209**			
Sub-Total Objective 8 (O&M)				**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$5**	**$5**	**$5**	**$5**	**$19**	**$19**	**$19**	**$19**	**$19**	**$19**	**$19**	**$19**	**$19**	**$19**	**$19**	**$19**	**$19**	**$19**	**$19**	**$19**	**$19**	**$19**	**$19**	**$19**	**$19**			

Financial Model 40-4

	Objective: 9	Enhance reliability of critical assets			Capital Expenditure profile in $k																												Type of Program/Project	Objective Allocation	Objectives
	Project Name / Description	Asset Group	Opex Group	Year Zero (2012/2013)	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43			
2.004	Bayers Lake Forcemain Upgrade & Twinning	Wastewater - Forcemains	Wastewater Collection	$1,080	$500																													HW Capital Budget	50-50	8-9
2.032	Shore Drive Golf Links - Forcemain Replacement and Twinning	Wastewater - Forcemains	Wastewater Collection				$118																											HW Capital Budget	50-50	8-9
2.033	MacPherson Forcemain Replacement and twinning	Wastewater - Forcemains	Wastewater Collection			$194																												HW Capital Budget	50-50	8-9
2.051	Cathodic Protection Program (Various Locations)	Wastewater - Forcemains	Wastewater Collection	$75	$75	$75	$75	$75																										HW Capital Budget	80-20	8-9
	Total Wastewater Forcemains (not included in objective sub-totals)			$1,155	$575	$269	$193	$75	$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			
2.070	Bedford Sackville Trunk Sewer - Maintenance Access Routes	Wastewater - Trunk Sewer	Wastewater Collection								$150	$150																						HW Capital Budget	80-20	8-9
	Total Wastewater Sewers (not included in objective sub-totals)			$0	$0	$0	$0	$0	$0	$0	$150	$150	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0			
2.108	GIS Migration & Development	Wastewater - IT	Wastewater Collection	$250																														HW Capital Budget	100	9
2.214	EMS Software	Wastewater - IT	Wastewater Collection	$70																														HW Capital Budget	100	9
4.001	Computerized Maintenance Management System (50/50 split W/WW)	Wastewater - IT	Wastewater Collection	$50	$50	$400	$400	$400																										HW Capital Budget	100	9
4.005	Data Collection Project (WW/SW)	Wastewater - IT	Wastewater Collection		$40																													HW Capital Budget	100	9
4.010	IT Program	Wastewater - IT	Wastewater Collection	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	HW Capital Budget	100	9
4.011	Lateral Card Database Conversion Project (WW/SW)	Wastewater - IT	Wastewater Collection		$125	$125	$125																											HW Capital Budget	100	9
	Total Wastewater IT (not included in objective sub-totals)			$420	$265	$575	$575	$450	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50			
2.062	Leiblin Drive PS Generator	Wastewater - Structures	Wastewater Collection						$15	$135																								HW Capital Budget	70-30	8-9
	Total Wastewater Pumping Stations (not included in objective sub-totals)			$0	$0	$0	$0	$0	$15	$135	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0			
2.044	Wastewater Treatment Facilities - Backup Power Program (Various Locations)	Wastewater - Treatment Facilities	Wastewater Treatment		$176	$278			$1,189		$700																							HW Capital Budget	100	9
2.056	Plant Optimization Audit Program	Wastewater - Treatment Facilities	Wastewater Treatment		$63	$90			$188																									HW Capital Budget	20-50-10-20	8-9-12-14
2.097	Eastern Passage WWTF Design Build Upgrade	Wastewater - Treatment Facilities	Wastewater Treatment	$2,000	$3,230																													HW Capital Budget	60-10-10-20	1-9-12-13
2.222	HHSP Deficiency Management	Wastewater - Treatment Facilities	Wastewater Treatment	$125																														HW Capital Budget	50-25-25	1-9-12
	Total Wastewater Treatment Facilities (not included in objective sub-totals)			$2,125	$3,469	$368	$0	$0	$1,377	$0	$700	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0			
3.264	Eastern Passage Reservoir	Water - Structures	Water Transmission & Distribution																$2,400															HW Capital Budget	100	9
3.269	Herring Cove Reservoir Twinning	Water - Structures	Water Transmission & Distribution						$4,250																									HW Capital Budget	100	9
3.270	Bedford South Reservoir Twinning	Water - Structures	Water Transmission & Distribution							$11,000																								HW Capital Budget	100	9
3.033	Watershed Land Acquisition	Water - Land	Water Transmission & Distribution			$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	HW Capital Budget	10-90	5-9
	Total Water Land, and Structures (not included in objective sub-totals)			$0	$0	$180	$180	$180	$4,430	$11,180	$180	$180	$180	$180	$180	$180	$180	$180	$2,580	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180			
3.066	Cathodic Protection Program	Water - Distribution	Water Transmission & Distribution		$100	$100	$100	$100																										HW Capital Budget	50-50	8-9
	Total Water Distribution			$0	$100	$100	$100	$100	$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			
3.292	Lake Major WSP - New Diesel Generator	Water - Treatment Facilities	Water Treatment						$68																									HW Capital Budget	70-30	8-9
	Total Water Treatment Facilicties			$0	$0	$0	$0	$0	$68	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0			
3.008	Pockwock Transmission Main Replacement Kearney Lake Road (Twin Culverts to Bluewater Road) (W1)	Water - Transmission	Water Transmission & Distribution			$3,923																												GENIVAR	30-70	8-9
3.010	Peninsula Intermediate 15" Transmission Main Sliplining (W5)	Water - Transmission	Water Transmission & Distribution											$4,618																				GENIVAR	30-70	8-9
3.011	Peninsula Low 27" Transmission Main Sliplining (W6)	Water - Transmission	Water Transmission & Distribution																					$10,239										GENIVAR	30-70	8-9
3.015	Susie Lake Transmission Main (W9)	Water - Transmission	Water Transmission & Distribution																$5,837															GENIVAR	70-30	9-13
3.017	Herring Cove Transmission Main Replacement (W7)	Water - Transmission	Water Transmission & Distribution											$2,987																				GENIVAR	30-70	8-9
3.018	Port Wallace Transmission Main - Phase 1 (E3)	Water - Transmission	Water Transmission & Distribution						$4,545																									GENIVAR	68-32	9-13
3.019	Stokil Tank Connection to Windgate Drive (C3)	Water - Transmission	Water Transmission & Distribution																					$827										GENIVAR	30-70	9-13
3.020	Lucasville Road Transmission Main - Phase 1 (includes beaverbank Reinforcement) (C4)	Water - Transmission	Water Transmission & Distribution						$2,683																									GENIVAR	30-70	9-13
3.021	Burnside - Bedford Booster Pumping Station (E7)	Water - Transmission	Water Transmission & Distribution																														$1,000	GENIVAR	100	9
3.102	Pockwock Transmission Main Replacement-Bluewater Rd to Hammonds-Kearney Contector (W2)	Water - Transmission	Water Transmission & Distribution						$4,280																									GENIVAR	30-70	8-9
3.251	Bedford Connector 30" Replacement - Phase 3 (C1)	Water - Transmission	Water Transmission & Distribution						$1,734																									GENIVAR	30-70	8-9
3.265	Eastern Passage Transmission Main Replacement (E5)	Water - Transmission	Water Transmission & Distribution																$1,465															GENIVAR	30-70	8-9
3.266	Gaston Road Transmission Main Replacement Phase 2 (E4)	Water - Transmission	Water Transmission & Distribution																$1,093															GENIVAR	30-70	8-9
3.306	Port Wallace Transmission Main - Phase 2 (E6)	Water - Transmission	Water Transmission & Distribution																$3,280															GENIVAR	77-23	9-13
3.527	Peninsula Low 24" Transmission Main Sliplining (W4)	Water - Transmission	Water Transmission & Distribution																$5,381															GENIVAR	30-70	8-9
3.528	Windgate Drive Transmission Main (C2)	Water - Transmission	Water Transmission & Distribution																					$1,494										GENIVAR	66-34	9-13
3.531	Lucasville Road Transmission Main - Phase 2 (C5)	Water - Transmission	Water Transmission & Distribution											$6,312																				GENIVAR	70-30	9-13
3.532	North End Feeder Tunnel 36" Transmission Main Rehab (W3)	Water - Transmission	Water Transmission & Distribution						$2,046																									GENIVAR	30-70	8-9
3.540	Nordic Crescent Upgrading (C6)	Water - Transmission	Water Transmission & Distribution																					$1,905										GENIVAR	100	9
3.541	Burnside - Bedford Connector Transmission Main (E8)	Water - Transmission	Water Transmission & Distribution																										$6,569					GENIVAR	100	9-13
3.542	Burnside - Bedford Connector Transmission Main Extension of 600mm Main on Glendale Dr. to HWY 102 (E9)	Water - Transmission	Water Transmission & Distribution						$1,331																									GENIVAR	100	9-13
	Total Water Transmission (not included in objective sub-totals)			$0	$0	$3,923	$0	$0	$16,619	$0	$0	$0	$0	$13,917	$0	$0	$0	$0	$17,056	$0	$0	$0	$0	$14,464	$0	$0	$0	$0	$6,569	$0	$0	$0	$1,000			
3.521	Bennery Lake WSP - Raw Water Supply from Grand Lake	Water - Airport Aerotech System	Water Transmission & Distribution											$1,900																				HW Capital Budget	30-50-20	8-9-13
Sub-Total Objective 9 (Capital Projects and Programs)				**$3,700**	**$4,409**	**$5,415**	**$1,048**	**$805**	**$22,558**	**$11,365**	**$1,080**	**$380**	**$230**	**$16,047**	**$230**	**$230**	**$230**	**$230**	**$19,686**	**$230**	**$230**	**$230**	**$230**	**$14,694**	**$230**	**$230**	**$230**	**$230**	**$6,799**	**$230**	**$230**	**$230**	**$230**	**$1,230**			

	Objective: 10	Ensure exisitina storm system is adequately sized for minor storm convevance			Capital Expenditure profile in $k																												Type of Program/Project	Objective Allocation	Objectives
	Project Name / Description	Asset Group	Opex Group	Year Zero (2012/2013)	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43			
1.015	Hammonds Plains Road & Bluewater Road Intersection - Drainage Improvements	Stormwater - Culverts/Ditches	StormWater Collection				$60	$320																										HW Capital Budget	20-80	8-10
1.057	Diana Drive Stormwater Modifications	Stormwater - Culverts/Ditches	StormWater Collection	$40																														HW Capital Budget	20-80	8-10
1.058	Spruce Grove Court to Daisy Drive - Drainage Swale	Stormwater - Culverts/Ditches	StormWater Collection	$40																														HW Capital Budget	20-80	8-10
1.003	Ivylea Crescent - New Storm Sewer	Stormwater - Pipes	StormWater Collection					$193.5																										HW Capital Budget	30-20-30-20	3-6-10-14
1.014	Perth Street, Wardour Street, Fort Sackville Road - Deep Storm Sewer Installation	Stormwater - Pipes	StormWater Collection											$362																				HW Capital Budget	30-20-30-20	3-6-10-14
1.019	Drainage Remediation Program Surveys/Studies	Stormwater - Pipes	StormWater Collection	$40	$40	$160	$200	$240	$280	$320	$360	$400	$440																					HW Capital Budget	20-80	8-10
1.021	Crestfield Avenue (Uplands Phase 3) - Deep Storm Sewer Installation	Stormwater - Pipes	StormWater Collection			$216																												HW Capital Budget	30-20-30-20	3-6-10-14
1.030	Glengary Drive - New Storm Sewer	Stormwater - Pipes	StormWater Collection											$90																				HW Capital Budget	30-20-30-20	3-6-10-14
1.038	Integrated Stormwater Projects - Program	Stormwater - Pipes	StormWater Collection	$150	$157.5	$172.5	$172.5	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	$180	HW Capital Budget	70-30	8-10
1.041	Ellerslie Crescent - Storm Sewer Upgrade	Stormwater - Pipes	StormWater Collection											$90																				HW Capital Budget	30-20-30-20	3-6-10-14
1.042	Deep Storm Sewer Installation Program	Stormwater - Pipes	StormWater Collection	$240	$90		$135	$150																										HW Capital Budget	30-20-30-20	3-6-10-14
1.053	Barrington Street Storm Sewer Separation	Stormwater - Pipes	StormWater Collection											$90																				HW Capital Budget	30-20-30-20	3-6-10-14
1.006	Clement Street Berm - Removal and Inlet Structure Reconfiguration	Stormwater - Structures	StormWater Collection					$20																										HW Capital Budget	20-20-20-20-20	3-6-8-10-14
4.009	Integrated Resource Plan (split W-WW-SW)	Stormwater - Pipes	StormWater Collection	$33			$38	$38				$38	$38				$38	$38				$38	$38				$38	$38				$38	$38	HW Capital Budget	33-33-33	7-8-10
2.009	North Preston Sewershed - Wastewater Collection System Replacement Program	Wastewater - Collection Sanitary	Wastewater Collection											$64	$288	$288																		HW Capital Budget	30-10-20-20-20	3-6-8-10-14
2.011	Eastern Passage Sewage Collection System Upgrades	Wastewater - Collection Sanitary	Wastewater Collection											$100	$200	$1,200	$1,400	$1,600	$2,000	$2,400														HW Capital Budget	30-10-20-20-20	3-6-8-10-14

2.075	Beaver Crescent Collection System Replacement	Wastewater - Collection Sanitary	Wastewater Collection											$100	$360	$360																			HW Capital Budget	30-10-20-20-20	3-6-8-10-14
2.232	Springfield Lake Collection Upgrade	Wastewater - Collection Sanitary	Wastewater Collection	$30		$50	$50																												HW Capital Budget	30-10-20-20-20	3-6-8-10-14
2.086	Ellenvale Holding Tank Sewershed	Wastewater - Collection Combined	Wastewater Collection											$200	$200	$200	$200	$200	$200	$200															HW Capital Budget	30-10-20-20-20	3-6-8-10-14
Sub-Total Objective 10 (Capital Projects and Programs)				$573	$288	$599	$656	$1,142	$460	$500	$540	$618	$658	$1,276	$1,228	$2,228	$1,818	$2,018	$2,380	$2,780	$180	$218	$218	$180	$180	$180	$218	$218	$180	$180	$180	$218	$218	$180			

	Objective:11	Adapt to future climate change			Capital Expenditure profile in $k																																
	Project Name / Description	Asset Group	Opex Group	Year Zero (2012/2013)	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	Type of Program/Project	Objective Allocation	Objectives
1.603 (PR)	Climate Change Adaptation Program	Stormwater - Pipes	StormWater Collection		$200	$250	$250																												Program	100	11
Sub-Total Objective 11 (Capital Projects and Programs)				$0	$200	$250	$250	$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			

	Objective:12	Reduce energy consumption, operating costs, and reduce greenhouse gas (GHG) contributions			Capital Expenditure profile in $k																																
	Project Name / Description	Asset Group	Opex Group	Year Zero (2012/2013)	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	Type of Program/Project	Objective Allocation	Objectives
2.136	Roach's Pond PS HVAC Study/Upgrade	Wastewater - Energy	Wastewater Treatment	$250																															HW Capital Budget	100	12
2.209	Dartmouth WWTF - UV Disinfection System Upgrades	Wastewater - Energy	Wastewater Treatment						$60																										HW Capital Budget	20-80	1-12
2.210	Dartmouth WWTF - Ventilation Air Heat Recovery	Wastewater - Energy	Wastewater Treatment				$750																												HW Capital Budget	100	12
2.211	Dartmouth WWTF - Waste Heat Recovery	Wastewater - Energy	Wastewater Treatment						$750																										HW Capital Budget	100	12
2.212	DWWTF Heat Recovery System Study	Wastewater - Energy	Wastewater Treatment	$50																															HW Capital Budget	100	12
2.215	Halifax WWTF - UV Disinfection System Upgrades	Wastewater - Energy	Wastewater Treatment						$60																										HW Capital Budget	20-80	1-12
2.216	Halifax WWTF - Ventilation Air Heat Recovery	Wastewater - Energy	Wastewater Treatment						$1,000																										HW Capital Budget	100	12
2.217	Halifax WWTF - Waste Heat Recovery	Wastewater - Energy	Wastewater Treatment					$750																											HW Capital Budget	100	12
2.218	HCWWTF Heat Recovery System Study	Wastewater - Energy	Wastewater Treatment	$50																															HW Capital Budget	100	12
2.219	Herring Cove WWTF - UV Disinfection System Upgrades	Wastewater - Energy	Wastewater Treatment		$80																														HW Capital Budget	20-80	1-12
2.220	Herring Cove WWTF - Ventilation Air Heat Recovery	Wastewater - Energy	Wastewater Treatment	$600																															HW Capital Budget	100	12
2.221	Herring Cove WWTF - Waste Heat Recovery	Wastewater - Energy	Wastewater Treatment						$500																										HW Capital Budget	100	12
2.224	Mill Cove WWTF - Bio-Gas CHP - Installation	Wastewater - Energy	Wastewater Treatment						$650																										HW Capital Budget	100	12
2.224	Mill Cove WWTF - Bio-Gas CHP - Study	Wastewater - Energy	Wastewater Treatment					$100																											HW Capital Budget	100	12
2.225	Mill Cove WWTF - Lighting Upgrades	Wastewater - Energy	Wastewater Treatment	$100																															HW Capital Budget	100	12
2.226	Mill Cove WWTF - Reactive Power Correction	Wastewater - Energy	Wastewater Treatment	$50																															HW Capital Budget	100	12
2.234	Various PS - HVAC Retro-commissioning	Wastewater - Energy	Wastewater Treatment		$150	$150	$150	$150	$150	$150	$150	$150	$250																						HW Capital Budget	100	12
2.235	Various PS - Reactive Power Correction	Wastewater - Energy	Wastewater Treatment		$150	$150	$150	$150	$150	$150	$150																								HW Capital Budget	100	12
2.603 (PR)	Energy Management Plan Update	Wastewater - Energy	Wastewater Treatment		$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	Program	100	12
2.041	Pumping Station and Forcemain Update Study	Wastewater - Structures	Wastewater Collection		$126																														HW Capital Budget	70-30	12-14
2.053	PS Elimination Assessment Program	Wastewater - Structures	Wastewater Collection		$35		$70																												HW Capital Budget	70-30	12-14
2.092	Colpitt Lake PS Elimination	Wastewater - Structures	Wastewater Collection		$504																														HW Capital Budget	70-30	12-14
2.039	Belmont WWTF Decommissioning	Wastewater - Treatment Facilities	Wastewater Treatment				$120	$450	$300																										HW Capital Budget	60-30-10	1-12-14
2.040	Beechville, Lakeside, Timberlea WWTF Upgrade	Wastewater - Treatment Facilities	Wastewater Treatment	$500	$1,750	$1,250																													HW Capital Budget	60-10-30	1-12-13
2.056	Plant Optimization Audit Program	Wastewater - Treatment Facilities	Wastewater Treatment		$13	$18			$38																										HW Capital Budget	20-50-10-20	8-9-12-14
2.057	HHSP Upgrade Program - Halifax WWTF	Wastewater - Treatment Facilities	Wastewater Treatment	$145																															HW Capital Budget	50-50	8-12
2.057	HHSP Upgrade Program - Dartmouth WWTF	Wastewater - Treatment Facilities	Wastewater Treatment	$90	$75																														HW Capital Budget	50-50	8-12
2.079	North Preston 3# - Johnson Rd Forcemain Capacity Upgrade	Wastewater - Forcemains	Wastewater Collection											$800																					HW Capital Budget	100	12
2.097	Eastern Passage WWTF Design Build Upgrade	Wastewater - Treatment Facilities	Wastewater Treatment	$2,000	$3,230																														HW Capital Budget	60-10-10-20	1-9-12-13
2.124	Mill Cove WWTF UV Upgrade	Wastewater - Treatment Facilities	Wastewater Treatment					$108																											HW Capital Budget	90-10	1-12
2.208	Dartmouth HHSP ARV's	Wastewater - Treatment Facilities	Wastewater Treatment	$14																															HW Capital Budget	30-70	8-12
2.222	HHSP Deficiency Management	Wastewater - Treatment Facilities	Wastewater Treatment	$125																															HW Capital Budget	50-25-25	1-9-12
4.014	Power Meter/Data Logger (50/50 split W/WW)	Wastewater - Equipment	Wastewater Treatment	$5																															HW Capital Budget	100	12
3.281	J D Kline - Replace Pump Motors #1 and #3	Water - Treatment Facilities	Water Treatment						$140																										HW Capital Budget	50-50	8-12
3.268	Heat Recovery Study and Upgrade	Water - Energy	Water Treatment	$300	$300																														HW Capital Budget	100	12
3.284	JD Kline - Industrial Process Pumps Upgrade	Water - Energy	Water Treatment			$110																													HW Capital Budget	100	12
3.285	JD Kline - Raw Water Supply Pump Energy Study	Water - Energy	Water Treatment	$50																															HW Capital Budget	100	12
3.286	JD Kline - Wind Energy Development - 4.6 MW	Water - Energy	Water Treatment						$600	$10,600																									HW Capital Budget	100	12
3.288	Lake Major - Wind Energy Development - 11.5 MW	Water - Energy	Water Treatment						$1,000	$25,200																									HW Capital Budget	100	12
3.296	Long Lake - Wind Energy Development - 4.6 MW	Water - Energy	Water Treatment						$600	$10,600																									HW Capital Budget	100	12
3.308	PRV Energy Recovery Pilot Project - Orchard Central Chamber	Water - Energy	Water Treatment	$100	$410																														HW Capital Budget	100	12
3.313	Various - Chamber HVAC Retro-commissioning	Water - Energy	Water Treatment		$150	$150	$150	$150																											HW Capital Budget	100	12
3.608 (PR)	Energy Management Plan Update	Water - Energy	Water Treatment		$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	Program	100	12
Sub-Total Objective 12 (Capital Projects and Programs)				$4,429	$7,053	$1,908	$1,470	$1,938	$6,078	$46,780	$380	$230	$330	$880	$80	$80	$80	$80	$80	$80	$80	$80	$80	$80	$80	$80	$80	$80	$80	$80	$80	$80	$80	$80			

Financial Model 40-4

Driver: Growth \

Objective: 13 — **Provide regional water, wastewater, and stormwater infrastructure needed to support planned growth**

Capital Expenditure profile in $k

	Project Name / Description	Asset Group	Opex Group	Year Zero (2012/2013)	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	Type of Program/Project	Objective Allocation	Objectives
2.043	Overflow Monitoring Program	Wastewater - Collection Combined	Wastewater Collection		$60	$75	$75	$75																										HW Capital Budget	50-20-30	3-6-13
4.009	Integrated Resource Plan (split W-WW-SW)	Wastewater - Collection Combined	Wastewater Collection	$15			$23	$23				$23	$23				$23	$23				$23	$23				$23	$23				$23	$23		HW Capital Budget	40-20-25-15	1-3-8-13
2.040	Beechville, Lakeside, Timberlea WWTF Upgrade	Wastewater - Treatment Facilities	Wastewater Treatment	$1,500	$5,250	$3,750																												HW Capital Budget	60-10-30	1-12-13
2.097	Eastern Passage WWTF Design Build Upgrade	Wastewater - Treatment Facilities	Wastewater Treatment	$4,000	$6,460																													HW Capital Budget	60-10-10-20	1-9-12-13
2.016	Aerotech WWTF Upgrade - Design/Construction	Wastewater - Airport Aerotech System	Wastewater Treatment	$75	$2,925	$3,000																												HW Capital Budget	50-20-30	1-8-13
2.016 (O&M)	New O&M costs associated with additional treatment at Aerotech WWTF - energy for aeration, chemical costs for TP removal. Increase in labour, allowance for sludge handling (energy), energy and labour costs associated with additional EQ volume, and filtration costs (energy, media replacement, chemical costs, replacement parts allowance and additional labour)	Wastewater - Airport Aerotech System (O&M)	Wastewater Treatment				$371	$371	$371	$371	$371	$371	$371	$371	$371	$371	$371	$371	$371	$371	$371	$371	$371	$371	$371	$371	$371	$371	$371	$371	$371	$371	$371	$371	O&M (yearly costs)	25-75	1-13
2.853	Bio-Solids Processing Facility Expansion	Wastewater - Airport Aerotech System	Wastewater Treatment									$1,200																						XCG Project	100	13
2.853 (O&M)	New incremental O&M costs associated with Bio-solids Processing\ Facility Upgrade	Wastewater - Airport Aerotech System (O&M)	Wastewater Treatment	$0	$63	$127	$190	$253	$317	$380	$443	$507	$570	$633	$697	$760	$823	$887	$950	$1,013	$1,077	$1,140	$1,203	$1,267	$1,330	$1,393	$1,457	$1,520	$1,583	$1,647	$1,710	$1,773	$1,837	$1,900	O&M (yearly costs)	100	13
2.236	Aerotech WW Servicing Options Assessment	Wastewater - Airport Aerotech System	Wastewater Treatment		$75																													HW Capital Budget	40-30-30	1-4-13
2.801	Upgrade Aerotech Drive Pumping station to 145 L/s, from 15 L/s (130 L/s upgrade) (AT1)	Wastewater - Structures	Wastewater Collection																				$1,248												RWWFP Project	100	13
2.801 (O&M)	New O&M costs associated with additional wastewater pumping at Aerotech	Wastewater - Airport Aerotech System (O&M)	Wastewater Treatment																					$9	$9	$9	$9	$9	$9	$9	$9	$9	$9	$9	O&M (yearly costs)	100	13
2.802	Upgrade Aerotech WWTF to service employment growth flows (AT2)	Wastewater - Treatment Facilities	Wastewater Treatment																				$21,760												RWWFP Project	100	13
2.803	Upgrade sewer conveyance to WWTF, from Aerotech Drive PS to WWTF (AT3)	Wastewater - Collection Sanitary	Wastewater Collection																				$2,363												RWWFP Project	100	13
2.804	Re-locate treated effluent discharge location to Soldiers Lake (AT4)	Wastewater - Collection Sanitary	Wastewater Collection																				$17,264												RWWFP Project	100	13
2.805	Upgrade Aerotech Drive PS forcemain to 145 L/s, from 15 L/s (130 L/s upgrade) (AT5)	Wastewater - Structures	Wastewater Collection																				$512												RWWFP Project	100	13
2.806	450 mm WWFM from BLT PS to 125 m south of Governors Lake Dr (BL1)	Wastewater - Forcemains	Wastewater Collection										$7,968																						RWWFP Project	100	13
2.807	New BLT PS WWPS at Timberlea Village Pky (Site to be confirmed) WWPS (BL2)	Wastewater - Structures	Wastewater Collection													$2,112																			RWWFP Project	100	13
2.807 (O&M)	New O&M costs associated with additional wastewater pumping at BLT PS Village Parkway	Wastewater - Pumping (O&M)	Wastewater Treatment														$33	$33	$33	$33	$33	$33	$33	$33	$33	$33	$33	$33	$33	$33	$33	$33	$33	$33	O&M (yearly costs)	100	13
2.808	New wastewater pumping station at Church St WWPS (Exact site to be determined) (BL3)	Wastewater - Structures	Wastewater Collection										$2,112																						RWWFP Project	100	13
2.808 (O&M)	New O&M costs associated with additional wastewater pumping at Church St PS	Wastewater - Pumping (O&M)	Wastewater Treatment														$37	$37	$37	$37	$37	$37	$37	$37	$37	$37	$37	$37	$37	$37	$37	$37	$37	$37	O&M (yearly costs)	100	13
2.809	600 mm WWM from Governor Lake Drive to Church St PS (BL4)	Wastewater - Trunk Sewers	Wastewater Collection													$1,906																			RWWFP Project	100	13
2.810	450 mm WWFM from Church St PS to upstream of Bayers Lake PS (BL5)	Wastewater - Forcemains	Wastewater Collection													$8,200																			RWWFP Project	100	13
2.811	600 mm Hwy 3 WWM from RAMP SSH-4 to Bicentennial Hwy and North West Arm Dr (BL6)	Wastewater - Trunk Sewers	Wastewater Collection													$1,327																			RWWFP Project	100	13
2.812	Upgrade Bayers lake PS (BL7)	Wastewater - Structures	Wastewater Collection													$2,112																			RWWFP Project	100	13
2.812 (O&M)	New O&M costs associated with additional wastewater pumping at Bayers Lake PS	Wastewater - Pumping (O&M)	Wastewater Treatment														$87	$87	$87	$87	$87	$87	$87	$87	$87	$87	$87	$87	$87	$87	$87	$87	$87	$87	O&M (yearly costs)	100	13
2.813	450mm WWFM from Bayers Lake PS (BL8)	Wastewater - Forcemains	Wastewater Collection													$2,110																			RWWFP Project	100	13
2.814	600mm WWM to Bayers lake PS (BL9)	Wastewater - Trunk Sewers	Wastewater Collection													$870																			RWWFP Project	100	13
2.817	Sewer twinning along existing roads - Albro Lake/Slayter St to Ferry St PS (DA3)	Wastewater - Collection Combined	Wastewater Collection					$9,481																											RWWFP Project	100	13
2.818	Storage at Shannon Park vicinity (DA4)	Wastewater - Structures	Wastewater Collection																				$23,040												RWWFP Project	100	13
2.819	Storage at Anderson Lake vicinity (DA5)	Wastewater - Structures	Wastewater Collection																												$18,880				RWWFP Project	100	13
2.820	Upgrade of Ferry Rd PS by 807 L/s to provide total capacity of 900 L/s (existing PS has 93 L/s) (DA6)	Wastewater - Structures	Wastewater Collection							$9,684																									RWWFP Project	100	13
2.820 (O&M)	New O&M costs associated with additional wastewater pumping at Ferry Road	Wastewater - Pumping (O&M)	Wastewater Treatment									$59	$59	$59	$59	$59	$59	$59	$59	$59	$59	$59	$59	$59	$59	$59	$59	$59	$59	$59	$59	$59	$59	$59	O&M (yearly costs)	100	13
2.821	825mm Ø Ferry Rd forcemain for 900l/s (DA7)	Wastewater - Forcemains	Wastewater Collection							$2,835																									RWWFP Project	100	13
2.822	Upgrade of Dartmouth WWTF (DA8)	Wastewater - Treatment Facilities	Wastewater Treatment										$39,200																						RWWFP Project	100	13
2.822 (O&M)	Dartmouth WWTF– Construct a secondary treatment system - CCME component: to produce a secondary effluent that meets CCME requirements. - Increased O&M cost for energy, chemicals, labour and equipment	Wastewater - Treatment Facilities (O&M)	Wastewater Treatment																						$263	$263	$263	$263	$263	$263	$263	$263	$263	$263	O&M (yearly costs)	100	13
2.825	Upgrade of Eastern Passage WWTF - NOT REQUIRED (EP2)	Wastewater - Treatment Facilities	Wastewater Treatment																																RWWFP Project	100	13
2.826	Storage Tank at Bissett Lake-Attwood PS (EP3)	Wastewater - Structures	Wastewater Collection																			$3,680													RWWFP Project	100	13
2.827	Upgrade Quigley's Corner Pumping Station (EP4)	Wastewater - Structures	Wastewater Collection			$96																													RWWFP Project	100	13
2.827 (O&M)	New O&M costs associated with additional wastewater pumping at Quigley's Corner	Wastewater - Pumping (O&M)	Wastewater Collection				$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	O&M (yearly costs)	100	13
2.828	Twinning of existing Pressure Sewer from Caldwell to terminus (EP5)	Wastewater - Forcemains	Wastewater Collection																								$16,979								RWWFP Project	100	13
2.829	Local pipe upgrades throughout system - 300mm (EP6)	Wastewater - Collection Sanitary	Wastewater Collection															$1,946																	RWWFP Project	100	13
2.830	Local pipe upgrades throughout system - 450mm (EP7)	Wastewater - Collection Sanitary	Wastewater Collection															$7,844																	RWWFP Project	100	13
2.831	Local pipe upgrades throughout system - 600mm (EP8)	Wastewater - Collection Sanitary	Wastewater Collection															$1,519																	RWWFP Project	100	13
2.832	Upgrade of Kearney Rd PS (HA1)	Wastewater - Structures	Wastewater Collection										$11,040																						RWWFP Project	100	13
2.833	900 mm WWFM from Kearney Rd PS to Bicentennial Hwy (Hill top) (HA2)	Wastewater - Forcemains	Wastewater Collection										$19,634																						RWWFP Project	100	13
2.834	900 mm WWM from Bicentennial Hwy (Hill top) to St Margarets Bay Rd (HA3)	Wastewater - Trunk Sewers	Wastewater Collection										$15,811																						RWWFP Project	100	13
2.835	Gravity sewer from St Margarets Bay Rd to Armdale Rd PS (HA4)	Wastewater - Collection Sanitary	Wastewater Collection							$6,108																									RWWFP Project	100	13
2.836	Upgrade of Armdale (Rotary) Rd PS (HA5)	Wastewater - Structures	Wastewater Collection										$20,448																						RWWFP Project	100	13
2.836 (O&M)	New O&M costs associated with additional wastewater pumping at Armdale PS	Wastewater - Pumping (O&M)	Wastewater Treatment											$394	$394	$394	$394	$394	$394	$394	$394	$394	$394	$394	$394	$394	$394	$394	$394	$394	$394	$394	$394	$394	O&M (yearly costs)	100	13
2.837	Forcemain from Armdale PS to Punch Bowl Dr (Hill Top) (HA6)	Wastewater - Forcemains	Wastewater Collection										$23,023																						RWWFP Project	100	13
2.837 (O&M)	New O&M costs associated with additional wastewater pumping at Punch Bowl PS	Wastewater - Pumping (O&M)	Wastewater Treatment											$242	$242	$242	$242	$242	$242	$242	$242	$242	$242	$242	$242	$242	$242	$242	$242	$242	$242	$242	$242	$242	O&M (yearly costs)	100	13
2.838	Gravity sewer from hill top to Herring Cove diversion (HA7)	Wastewater - Collection Sanitary	Wastewater Collection										$9,375																						RWWFP Project	100	13
2.840	Gravity sewer from Herring Cove diversion (top end) to Roaches Pond PS (HC1)	Wastewater - Collection Sanitary	Wastewater Collection										$23,464																						RWWFP Project	100	13
2.841	Gravity sewer from Princeton Rd (70m north of Roaches Pond PS) to Herring Cove PS (HC2)	Wastewater - Collection Sanitary	Wastewater Collection															$30,706																	RWWFP Project	100	13
2.842	Upgrade of Herring Cove SPS (HC3)	Wastewater - Structures	Wastewater Collection															$25,920																	RWWFP Project	100	13
2.842 (O&M)	New O&M costs associated with additional wastewater pumping at Village Road	Wastewater - Pumping (O&M)	Wastewater Treatment																$237	$237	$237	$237	$237	$237	$237	$237	$237	$237	$237	$237	$237	$237	$237	$237	O&M (yearly costs)	100	13
2.843	Forcemain from Herring Cove PS (Village Road PS) to Herring Cove WWTF (HC4)	Wastewater - Forcemains	Wastewater Collection															$4,086																	RWWFP Project	100	13
2.844	Upgrade of Herring Cove WWTF (HC5)	Wastewater - Treatment Facilities	Wastewater Treatment																				$135,840												RWWFP Project	100	13
2.844 (O&M)	Herring Cove WWTF– Construct a secondary treatment system -CCME component: to produce a secondary effluent that meets CCME requirements - Increased O&M cost for energy, chemicals, labour and equipment	Wastewater - Treatment Facilities (O&M)	Wastewater Treatment																						$899	$899	$899	$899	$899	$899	$899	$899	$899	$899	O&M (yearly costs)	100	13
2.847	Storage Facility #1 at Glendale/Old Beaver Bank Road (upstream of Bedford Sackville Trunk Sewer) (MC2)	Wastewater - Structures	Wastewater Collection		$19,200																														RWWFP Project	100	13

Financial Model 40-4

2.848	Storage Facility #2 at Bedford Range Park (downstream of Bedford Sackville Trunk Sewer) (MC3)	Wastewater - Structures	Wastewater Collection										$22,400																						RWWFP Project	100	13
2.849	Localized improvments to Bedford Sackville Trunk Sewer sections - diameters range between 525 mm and 1200 mm over 4.44 km (MC4)	Wastewater - Trunk Sewers	Wastewater Collection								$17,231																								RWWFP Project	100	13
2.850	New wastewater pumping station at Mill Cove WWTF for diversion to Halifax (MC5)	Wastewater - Structures	Wastewater Collection								$3,168																								RWWFP Project	100	13
2.850 (O&M)	New O&M costs associated with additional wastewater pumping at Mill Cove	Wastewater - Pumping (O&M)	Wastewater Treatment									$39	$39	$39	$39	$39	$39	$39	$39	$39	$39	$39	$39	$39	$39	$39	$39	$39	$39	$39	$39	$39	$39	$39	O&M (yearly costs)	100	13
2.851	500mm Wastewater forcemain from Mill Cove WWTF to Mill Cove Diversion Sewer (MC6)	Wastewater - Forcemains	Wastewater Collection								$3,383																								RWWFP Project	100	13
2.852	Diversion Sewer from Mill Cove WWTF to Halifax, along Bedford waterfront to Bedford Hwy tunnel (MC7)	Wastewater - Trunk Sewers	Wastewater Collection					$6,049																											RWWFP Project	100	13
2.604 (PR)	Wastewater System Master Plan Update (WW)	Wastewater - Collection Combined	Wastewater Collection							$750					$750					$750					$750					$750					Program	100	13
3.015	Susie Lake Transmission Main (W9)	Water - Transmission	Water Transmission & Distribution																$2,502																GENIVAR	70-30	9-13
3.016	Mainland North Booster Pumping Station to Fill Geizer 158 (W8)	Water - Transmission	Water Transmission & Distribution																										$1,000						GENIVAR	100%	13
3.018	Port Wallace Transmission Main - Phase 1 (E3)	Water - Transmission	Water Transmission & Distribution						$1,358																										GENIVAR	68-32	9-13
3.019	Stokil Tank Connection to Windgate Drive (C3)	Water - Transmission	Water Transmission & Distribution																					$354											GENIVAR	30-70	9-13
3.020	Lucasville Road Transmission Main - Phase 1 (includes beaverbank Reinforcement) (C4)	Water - Transmission	Water Transmission & Distribution						$6,260																										HW Capital Budget	30-70	9-13
3.048	Governor's Brook Phase 3 Oversizing	Water - Transmission	Water Transmission & Distribution	$65	$35																														HW Capital Budget	100	13
3.306	Port Wallace Transmission Main - Phase 2 (E6)	Water - Transmission	Water Transmission & Distribution																$980																GENIVAR	77-23	9-13
3.519	Bennery Distribution System Upgrades	Water - Airport Aerotech System	Water Transmission & Distribution	$22	$22	$22	$22	$22																											HW Capital Budget	80-20	8-13
3.521	Bennery Lake WSP - Raw Water Supply from Grand Lake	Water - Airport Aerotech System	Water Transmission & Distribution											$760																					HW Capital Budget	30-50-20	8-9-13
3.528	Windgate Drive Transmission Main (C2)	Water - Transmission	Water Transmission & Distribution																					$770											GENIVAR	66-34	9-13
3.531	Lucasville Road Transmission Main - Phase 2 (C5)	Water - Transmission	Water Transmission & Distribution											$2,705																					GENIVAR	70-30	9-13
3.541	Burnside - Bedford Connector Transmission Main (E8)	Water - Transmission	Water Transmission & Distribution																										$2,815						GENIVAR	100	9-13
3.542	Burnside - Bedford Connector Transmission Main Extension of 600mm Main on Glendale Dr. to HWY 102 (E9)	Water - Transmission	Water Transmission & Distribution						$686																										GENIVAR	100	9-13
4.009	Integrated Resource Plan (split W-WW-SW)	Water - Transmission	Water Transmission & Distribution	$20			$30	$30				$30	$30				$30	$30				$30	$30				$30	$30				$30	$30		HW Capital Budget	40-40-20	2-8-13
3.609 (PR)	Water System Master Plan Update (W)	Water - Transmission	Water Transmission & Distribution							$750					$750					$750					$750					$750					Program	100	13
3.203 (O&M)	Grand Lake Pumping (O&M)	Water - Pumping (O&M)	Water Transmission & Distribution											$34	$34	$34	$34	$34	$34	$34	$34	$34	$34	$34	$34	$34	$34	$34	$34	$34	$34	$34	$34	$34	GENIVAR O&M Costs (yearly)	30-70	8-13
3.535 (O&M)	Pockwock O&M Increased Pumping at WSP (O&M)	Water - Pumping (O&M)	Water Transmission & Distribution	$103	$156	$211	$266	$323	$381	$440	$500	$562	$625	$689	$755	$822	$890	$960	$1,032	$1,105	$1,179	$1,255	$1,333	$1,413	$1,494	$1,577	$1,662	$1,748	$1,837	$1,927	$2,020	$2,114	$2,210	$2,309	GENIVAR O&M Costs (yearly)	100	13
3.536 (O&M)	Lake Major O&M Increased Pumping at WSP (O&M)	Water - Pumping (O&M)	Water Transmission & Distribution	$93	$141	$189	$239	$290	$342	$396	$450	$506	$562	$620	$680	$740	$802	$866	$930	$996	$1,064	$1,133	$1,204	$1,276	$1,350	$1,425	$1,502	$1,581	$1,661	$1,744	$1,828	$1,914	$2,002	$2,092	GENIVAR O&M Costs (yearly)	100	13
3.537 (O&M)	Bennery Lake O&M Increased Pumping at WSP (O&M)	Water - Pumping (O&M)	Water Transmission & Distribution	$26	$40	$54	$69	$84	$100	$117	$135	$153	$172	$192	$213	$235	$258	$282	$307	$334	$361	$390	$420	$452	$486	$521	$558	$597	$637	$680	$725	$773	$823	$876	GENIVAR O&M Costs (yearly)	100	13
3.538 (O&M)	Chain Lake O&M Increased Pumping at WSP (O&M)	Water - Pumping (O&M)	Water Transmission & Distribution	$0	$0	$1	$1	$1	$1	$1	$1	$1	$2	$2	$2	$2	$2	$2	$2	$3	$3	$3	$3	$3	$3	$4	$4	$4	$4	$4	$4	$5	$5	$5	GENIVAR O&M Costs (yearly)	100	13
3.539 (O&M)	Lake Lamount O&M Increased Pumping at WSP (O&M)	Water - Pumping (O&M)	Water Transmission & Distribution	$0	$1	$1	$1	$1	$2	$2	$2	$2	$3	$3	$3	$3	$4	$4	$4	$5	$5	$5	$5	$6	$6	$6	$7	$7	$7	$7	$8	$8	$8	$9	GENIVAR O&M Costs (yearly)	100	13
Sub-Total Objective 13 (Capital Projects and Programs)				**$5,697**	**$34,027**	**$6,943**	**$150**	**$15,679**	**$8,304**	**$1,500**	**$42,408**	**$1,253**	**$194,527**	**$3,465**	**$1,500**	**$18,638**	**$53**	**$72,075**	**$3,481**	**$1,500**	**$3,680**	**$53**	**$202,080**	**$1,124**	**$1,500**	**$0**	**$53**	**$17,032**	**$3,815**	**$1,500**	**$18,880**	**$53**	**$53**	**$0**			
Sub-Total Objective 13 (O&M)				**$222**	**$401**	**$582**	**$1,144**	**$1,331**	**$1,521**	**$1,714**	**$1,910**	**$2,208**	**$2,411**	**$3,287**	**$3,496**	**$3,710**	**$4,083**	**$4,304**	**$4,779**	**$5,008**	**$5,241**	**$5,479**	**$5,722**	**$5,978**	**$7,392**	**$7,650**	**$7,912**	**$8,180**	**$8,454**	**$8,733**	**$9,019**	**$9,311**	**$9,609**	**$9,914**			

Objective: 14 **Manage flow capacity allocations**

Capital Expenditure profile in $k

	Project Name / Description	Asset Group	Opex Group	Year Zero (2012/2013)	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	Type of Program/Project	Objective Allocation	Objectives
1.003	Ivylea Crescent - New Storm Sewer	Stormwater - Pipes	StormWater Collection					$129																											HW Capital Budget	30-20-30-20	3-6-10-14
1.014	Perth Street, Wardour Street, Fort Sackville Road - Deep Storm Sewer Installation	Stormwater - Pipes	StormWater Collection											$241																					HW Capital Budget	30-20-30-20	3-6-10-14
1.021	Crestfield Avenue (Uplands Phase 3) - Deep Storm Sewer Installation	Stormwater - Pipes	StormWater Collection			$144																													HW Capital Budget	30-20-30-20	3-6-10-14
1.030	Glengary Drive - New Storm Sewer	Stormwater - Pipes	StormWater Collection											$60																					HW Capital Budget	30-20-30-20	3-6-10-14
1.041	Ellerslie Crescent - Storm Sewer Upgrade	Stormwater - Pipes	StormWater Collection											$60																					HW Capital Budget	30-20-30-20	3-6-10-14
1.042	Deep Storm Sewer Installation Program	Stormwater - Pipes	StormWater Collection	$160	$60		$90	$100																											HW Capital Budget	30-20-30-20	3-6-10-14
1.053	Barrington Street Storm Sewer Separation	Stormwater - Pipes	StormWater Collection											$60																					HW Capital Budget	30-20-30-20	3-6-10-14
1.006	Clement Street Berm - Removal and Inlet Structure Reconfiguration	Stormwater - Structures	StormWater Collection					$20																											HW Capital Budget	20-20-20-20-20	3-6-8-10-14
2.009	North Preston Sewershed - Wastewater Collection System Replacement Program	Wastewater - Collection Sanitary	Wastewater Collection											$64	$288	$288																			HW Capital Budget	30-10-20-20-20	3-6-8-10-14
2.011	Eastern Passage Sewage Collection System Upgrades	Wastewater - Collection Sanitary	Wastewater Collection											$100	$200	$1,200	$1,400	$1,600	$2,000	$2,400															HW Capital Budget	30-10-20-20-20	3-6-8-10-14
2.075	Beaver Crescent Collection System Replacement	Wastewater - Collection Sanitary	Wastewater Collection											$100	$360	$360																			HW Capital Budget	30-10-20-20-20	3-6-8-10-14
2.232	Springfield Lake Collection Upgrade	Wastewater - Collection Sanitary	Wastewater Collection	$30		$50	$50																												HW Capital Budget	30-10-20-20-20	3-6-8-10-14
2.086	Ellenvale Holding Tank Sewershed	Wastewater - Collection Combined	Wastewater Collection											$200	$200	$200	$200	$200	$200	$200															HW Capital Budget	30-10-20-20-20	3-6-8-10-14
2.144	Bedford West - FM Design to redirect WW (Hollyhock PS) from Mill Cove to Halifax	Wastewater - Forcemains	Wastewater Collection	$5																															HW Capital Budget	50-50	13-14
2.006	Valleyford Holding Tank	Wastewater - Structures	Wastewater Collection											$330																					HW Capital Budget	40-30-30	3-6--14
2.089	Fairfield Holding Tank	Wastewater - Structures	Wastewater Collection											$1,275																					HW Capital Budget	40-30-30	3-6-14
2.090	Bedford Sackville Trunk Sewer - Holding Tanks	Wastewater - Structures	Wastewater Collection											$600	$1,800	$1,800																			HW Capital Budget	40-30-30	3-6-14
2.228	Outfall Elimination Program	Wastewater - Outfalls	Wastewater Collection	$30	$30	$30	$30	$30																											HW Capital Budget	40-30-30	3-6-14
2.041	Pumping Station and Forcemain Update Study	Wastewater - Structures	Wastewater Collection		$54																														HW Capital Budget	70-30	12-14
2.053	PS Elimination Assessment Program	Wastewater - Structures	Wastewater Collection		$15		$30																												HW Capital Budget	70-30	12-14
2.092	Colpitt Lake PS Elimination	Wastewater - Structures	Wastewater Collection		$216																														HW Capital Budget	70-30	12-14
2.039	Belmont WWTF Decommissioning	Wastewater - Treatment Facilities	Wastewater Treatment				$40	$150	$100																										HW Capital Budget	60-30-10	1-12-14
2.056	Plant Optimization Audit Program	Wastewater - Treatment Facilities	Wastewater Treatment		$25	$36			$75																										HW Capital Budget	20-50-10-20	8-9-12-14
2.854	Springfield Lake forcemain pumping south (SP1)	Wastewater - Forcemains	Wastewater Collection															$2,447																	RWWFP Project	100	14
2.855	New wastewater pumping station at Springfield Lake WWTF to pump flows back to Sackville Dr for diversion to Bedford Sackville Trunk Sewer (SP2)	Wastewater - Structures	Wastewater Collection															$509																	RWWFP Project	100	14
2.855 (O&M)	New O&M costs associated with additional wastewater pumping at Springfield Lake	Wastewater - Pumping (O&M)	Wastewater Treatment																$13	$13	$13	$13	$13	$13	$13	$13	$13	$13	$13	$13	$13	$13	$13	$13	O&M (yearly costs)	100	14
2.856	Diversion Sewer from Springfield to Bedford Sackville Trunk Sewer (SP3)	Wastewater - Collection Sanitary	Wastewater Collection					$1,123																											RWWFP Project	100	14
2.857	Decommission Springfield WWTF (SP4)	Wastewater - Treatment Facilities	Wastewater Treatment																				$3,200												RWWFP Project	100	14
3.024	DMA Program	Water - Structures	Water Transmission & Distribution			$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	HW Capital Budget	50-50	8-14
1.604 (PR)	I/I Reduction Program	Stormwater - Pipes	StormWater Collection		$300	$400	$500	$500																											Program	100	14
3.610 (PR)	Water Efficiency Program	Water - Structures	Water Transmission & Distribution			$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	Program	100	14
Sub-Total Objective 14 (Capital Projects and Programs)				**$225**	**$700**	**$810**	**$890**	**$2,202**	**$325**	**$150**	**$150**	**$150**	**$150**	**$3,240**	**$2,998**	**$3,998**	**$1,750**	**$4,906**	**$2,350**	**$2,750**	**$150**	**$150**	**$3,350**	**$150**	**$150**	**$150**	**$150**	**$150**	**$150**	**$150**	**$150**	**$150**	**$150**	**$150**			
Sub-Total Objective 14 (O&M)				**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$13**	**$13**	**$13**	**$13**	**$13**	**$13**	**$13**	**$13**	**$13**	**$13**	**$13**	**$13**	**$13**	**$13**	**$13**	**$13**			

APPENDIX H-3

Capital and O&M Costs

Summary of Capital, Operational and Maintenance Expenditures

Halifax Water Integrated Resource Plan - Short List Plan 40-4

Summary of Total Capital and O&M Expenditure - All Objectives

Total - All Objectives			Capital Projects Expenditure																											
	NPV 3-Year	NPV 30-Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Water Service Capital Expenditure																															
Water - Land		$3,726	0	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Water - Transmission		$88,328	605	6184	975	720	28694	917	167	317	317	24426	917	167	317	317	24106	917	167	317	317	20143	917	167	317	317	10552	917	167	317	317	1167
Water - Distribution		$13,828	3450	3750	3850	3850	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
Water - Services		$892	240	240	240	240	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
Water - Meters		$4,226	1100	1150	1150	1150	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
Water - Hydrants		$279	75	75	75	75	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
Water - Structures		$52,578	4060	760	1410	450	6547	12160	520	2144	1160	8055	200	200	2337	200	7083	200	1160	200	200	11029	520	200	1160	200	2402	1160	520	6206	1160	3611
Water - Treatment Facilities		$15,276	380	4510	4200	480	2350	1215	215	215	315	215	215	215	215	315	215	215	215	215	315	215	215	215	215	315	215	215	215	215	315	215
Water - Airport Aerotech System		$5,969	250	2420	250	250	0	0	0	0	0	3800	0	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0	0	0
Water - Small Treatment Systems		$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
Water - Energy		$42,892	900	300	190	190	2240	46440	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Water - Fleet		$9,394	200	460	450	465	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Water - IT		$12,468	1959	1657	980	1080	600	600	600	400	500	400	400	400	400	500	400	400	400	400	500	400	400	400	400	500	400	400	400	400	500	400
Water - Security		$980	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Water - Equipment		$284	89	70	76	70	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
Total Water Capital Expenditure	**$46,442**	**$251,120**	$13,358	$21,826	$14,096	$9,270	$41,181	$62,082	$2,292	$3,865	$3,082	$37,686	$2,522	$1,772	$4,058	$2,122	$32,594	$2,522	$2,732	$1,922	$2,122	$32,577	$2,842	$2,092	$2,882	$2,122	$14,359	$3,482	$2,092	$7,927	$3,082	$6,183
Water - Pumping (O&M)		338	456	576	700	826	956	1089	1225	1364	1555	1701	1851	2005	2162	2324	2490	2660	2835	3014	3198	3387	3581	3780	3985	4195	4411	4633	4862	5097	5338
Total Water O&M	**$1,340**	**$62,614**	$338	$456	$576	$700	$826	$956	$1,089	$1,225	$1,364	$1,555	$1,701	$1,851	$2,005	$2,162	$2,324	$2,490	$2,660	$2,835	$3,014	$3,198	$3,387	$3,581	$3,780	$3,985	$4,195	$4,411	$4,633	$4,862	$5,097	$5,338
Total Water Service Expenditure	**$47,782**	**$313,734**	$13,696	$22,282	$14,672	$9,970	$42,007	$63,038	$3,380	$5,090	$4,446	$39,241	$4,223	$3,623	$6,063	$4,284	$34,918	$5,012	$5,392	$4,756	$5,136	$35,775	$6,228	$5,672	$6,662	$6,106	$18,553	$7,893	$6,725	$12,789	$8,178	$11,521
Wastewater Service Capital Expenditure																															
Wastewater - Land & Land Rights		$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
Wastewater - Trunk Sewers		$54,834	850	250	2900	7849	6250	5000	17831	600	21811	0	0	4104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wastewater - Collection Combined		$130,343	5356	5430	1940	12246	3420	2417	1667	1817	1817	2667	3417	2667	2817	2817	2667	3417	1667	1817	1817	1667	2417	1667	1817	1817	1667	2417	1667	1817	1817	174812
Wastewater - Collection Sanitary		$132,598	10350	3580	4948	3223	800	500	6608	500	33339	1820	4740	9740	7500	50516	10500	12500	500	500	20127	500	500	500	500	500	500	500	500	500	500	500
Wastewater - Forcemains		$70,612	1150	538	385	750	0	0	6217	4581	50625	800	0	10310	0	6533	0	0	0	0	0	0	0	0	0	16979	0	0	0	0	0	0
Wastewater - Structures		$169,871	24893	1646	3175	2175	14300	550	13852	0	56000	10350	9900	14124	3900	30329	0	0	3680	0	24800	0	0	0	0	0	0	0	18880	0	0	0
Wastewater - Laterals		$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
Wastewater - Outfalls		$372	100	100	100	100	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
Wastewater - Treatment Facilities		$480,911	51414	13535	929	3385	11250	0	700	0	39200	146368	1320	1320	1320	1320	1320	1320	1320	1320	162120	288200	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320
Wastewater - Airport Aerotech System		$54,473	10700	10020	38	700	852	0	700	1200	700	36640	700	0	700	0	700	0	700	0	700	0	700	0	700	0	700	0	700	0	700	0
Wastewater - Small Treatment Systems		$0	0	0	7	7	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
Wastewater - Energy		$7,133	440	340	1090	1190	3390	340	340	190	290	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Wastewater - Fleet		$20,115	1250	1000	1200	1100	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Wastewater - IT		$12,811	2074	1782	1105	1080	600	600	600	400	500	400	400	400	400	500	400	400	400	400	500	400	400	400	400	500	400	400	400	400	500	400
Wastewater - Security		$3,920	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Wastewater - Equipment		$1,344	60	60	60	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Total Wastewater Capital Expenditure	**$158,476**	**$1,139,337**	$108,837	$38,481	$18,070	$34,068	$42,131	$10,677	$49,785	$10,558	$205,551	$200,355	$21,786	$43,974	$17,946	$93,324	$16,896	$18,946	$9,576	$5,346	$211,374	$292,076	$6,646	$5,196	$6,046	$22,426	$5,896	$5,946	$24,776	$5,346	$6,146	$178,342
Wastewater - Treatment Facilities (O&M)		4	802	1160	1160	1160	1160	1232	1232	1282	1282	1282	1978	1620	1620	1620	1620	1620	1620	1620	1620	1620	3904	3904	3904	3904	3904	3904	3904	3904	3904	3904
Wastewater - Pumping (O&M)		0	0	7	7	7	7	7	7	106	106	742	742	742	899	899	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148	1148
Wastewater - Airport Aerotech System (O&M)		63	127	723	786	850	913	976	1040	1103	1166	1230	1293	1356	1420	1483	1546	1610	1673	1736	1808	1872	1935	1998	2062	2125	2188	2252	2315	2378	2442
Total Wastewater O&M	**$2,813**	**$109,878**	$68	$929	$1,891	$1,954	$2,017	$2,152	$2,216	$2,427	$2,491	$3,191	$3,950	$3,655	$3,875	$3,938	$4,251	$4,315	$4,378	$4,441	$4,505	$4,577	$6,924	$6,988	$7,051	$7,114	$7,178	$7,241	$7,304	$7,368	$7,431	$7,494
Total Wastewater Service Expenditure	**$161,289**	**$1,249,215**	$108,905	$39,411	$19,961	$36,022	$44,149	$12,829	$52,000	$12,985	$208,042	$203,545	$25,736	$47,630	$21,821	$97,262	$21,148	$23,261	$13,954	$9,788	$215,878	$296,653	$13,571	$12,184	$13,098	$29,540	$13,074	$13,188	$32,081	$12,714	$13,578	$185,836
Stormwater Service Capital Expenditure																															
Stormwater - Pipes		$37,040	1750	2686	2515	13978	3117	1167	1217	1382	1432	2872	767	767	882	882	767	767	967	882	882	767	767	767	882	882	767	767	767	882	882	767
Stormwater - Culverts/Ditches		$2,747	361	400	362	749	151	423	0	142	0	0	0	0	0	0	0	117	106	232	0	0	0	0	0	0	0	0	0	351	0	0
Stormwater - Structures		$931	350	150	200	300	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
Stormwater - Fleet		$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
Stormwater - IT		$1,590	315	325	325	200	200	200	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stormwater - Security		$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
Stormwater - Equipment		$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
Total Stormwater Capital Expenditure	**$9,165**	**$42,308**	$2,776	$3,561	$3,402	$15,227	$3,468	$1,790	$1,417	$1,524	$1,432	$2,872	$767	$767	$882	$882	$767	$884	$1,073	$1,114	$882	$767	$767	$767	$882	$882	$767	$767	$767	$1,232	$882	$767
Total Capital Expenditure	**$218,040**	**$1,551,920**	**$125,377**	**$65,254**	**$38,035**	**$61,218**	**$89,624**	**$77,656**	**$56,797**	**$19,599**	**$213,919**	**$245,658**	**$30,725**	**$52,019**	**$28,766**	**$102,428**	**$56,832**	**$29,156**	**$20,418**	**$15,658**	**$221,895**	**$333,195**	**$20,566**	**$18,623**	**$20,641**	**$36,528**	**$32,394**	**$21,847**	**$39,572**	**$26,736**	**$22,638**	**$198,124**

Summary of Capital, Operational and Maintenance Expenditures

Water by Objective	NPV 3-Year	NPV 30-Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
1	$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
2	$2,870	$4,978	888	554	1,625	425	940	500	0	60	110	0	0	0	60	110	0	0	0	60	110	0	0	0	60	110	0	0	0	60	110	0
3	$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
4	$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
5	$5,136	$10,227	665	2,464	2,370	70	745	735	235	235	385	235	235	235	235	385	235	235	235	235	385	235	235	235	235	385	235	235	235	235	385	235
6	$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
7	$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
8	$32,388	$102,442	10,749	14,134	9,429	8,103	7,546	2,327	1,687	3,170	2,187	17,799	1,167	1,167	3,363	1,227	9,052	1,167	2,127	1,227	1,227	16,384	1,487	1,487	2,187	1,227	3,369	2,127	1,487	7,232	2,187	4,578
8 (Asset Programs)	$47,647	$286,412	20,390	10,804	19,305	19,680	6,914	10,328	10,326	10,266	10,299	15,750	18,356	18,341	18,281	18,306	7,428	7,676	7,591	7,562	7,546	16,560	17,809	17,902	17,834	17,834	16,598	19,922	19,928	19,904	19,904	18,962
8 (Total)	$80,035	$388,854	31,139	24,938	28,734	27,783	14,459	12,655	12,013	13,437	12,485	33,549	19,522	19,507	21,644	19,532	16,480	8,842	9,718	8,789	8,772	32,944	19,296	19,389	20,021	19,061	19,956	22,049	21,415	27,136	22,090	23,540
9	$4,315	$70,511	100	4,203	280	280	21,117	11,180	180	180	180	15,997	180	180	180	180	19,636	180	180	180	180	14,644	180	180	180	180	6,749	180	180	180	180	1,180
10	$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
11	$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
12	$1,330	$43,012	900	300	190	190	2,380	46,440	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
13	$124	$17,156	57	22	52	52	8,304	750	0	30	30	3,465	750	0	30	30	3,481	750	0	30	30	1,124	750	0	30	30	3,815	750	0	30	30	0
14	$279	$2,794	0	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
Water Total			33,748	32,630	33,401	28,950	48,095	72,410	12,918	14,182	13,380	53,426	20,877	20,112	22,839	20,427	40,022	10,197	10,223	9,484	9,667	49,127	20,651	19,934	20,710	19,956	30,996	23,404	23,029	27,831	22,869	25,145

Wastewater by Objective	NPV 3-Year	NPV 30-Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
1	$46,964	$56,803	35,833	12,584	342	2,173	6,713	0	245	60	305	0	245	0	305	60	245	0	245	60	305	0	245	0	305	60	245	0	245	60	305	0
2	$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
3	$2,167	$31,879	1,005	789	490	545	300	300	300	330	380	5,436	6,312	7,812	4,770	5,120	3,600	4,200	300	330	380	300	300	300	330	380	300	300	300	330	380	300
4	$329	$312,430	320	7	13	275	545	0	245	0	245	183,008	1,565	1,320	1,565	1,320	1,565	1,320	1,565	1,320	1,565	288,200	1,565	1,320	1,565	1,320	1,565	1,320	1,565	1,320	1,565	1,320
5	$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
6	$22,679	$117,475	14,348	5,784	3,603	2,230	500	500	500	500	550	4,437	4,324	4,824	2,800	2,950	1,600	1,800	500	500	550	500	500	500	500	550	500	500	500	500	550	173,645
7	$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
8	$31,385	$135,057	12,561	9,411	11,276	9,643	28,760	8,602	4,997	8,205	9,234	3,451	4,605	5,395	5,194	5,184	5,397	5,587	3,197	3,024	3,234	2,987	3,197	2,987	3,234	3,024	3,197	2,987	3,197	3,024	3,234	2,987
8 (Asset Programs)	$79,231	$536,299	27,559	29,450	27,008	28,496	12,352	19,975	20,222	18,933	20,525	18,629	17,475	16,685	16,886	16,896	48,804	49,014	50,950	51,123	50,913	21,727	21,727	21,727	21,689	21,689	32,901	33,111	32,901	33,073	32,863	33,111
8 (Total)	$110,617	$671,356	40,120	38,861	38,284	38,139	41,112	28,577	25,219	27,138	29,760	22,080	22,080	22,080	22,080	22,080	54,201	54,601	54,147	54,147	54,147	24,714	24,924	24,714	24,924	24,714	36,098	36,098	36,098	36,098	36,098	36,098
9	$6,028	$9,171	4,309	1,212	768	525	1,442	185	750	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
10	$93	$7,944	0	50	50	0	0	0	0	0	0	464	1,048	2,048	1,600	1,800	2,200	2,600	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	$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
12	$8,660	$15,404	6,153	1,608	1,280	1,748	3,698	340	340	190	290	840	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
13	$39,594	$435,456	33,970	6,921	98	15,627	0	750	42,408	1,223	194,497	0	750	18,638	23	72,045	0	750	3,680	23	202,050	0	750	0	23	72,050	0	750	18,880	23	23	0
14	$577	$17,718	340	116	150	1,303	175	0	0	0	0	2,669	2,848	3,848	1,600	4,756	2,200	2,600	0	0	3,200	0	0	0	0	0	0	0	0	0	0	0
Wastewater Total			136,396	67,931	45,078	62,564	54,484	30,652	70,007	29,491	226,077	218,084	39,202	60,660	34,832	110,220	65,700	67,050	60,527	56,469	262,285	318,803	28,373	26,921	27,736	44,115	38,797	39,057	57,677	38,420	39,010	211,452

Stormwater by Objective	NPV 3-Year	NPV 30-Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
1	$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
2	$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
3	$415	$1,207	90	216	135	364	0	0	0	0	0	632	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	$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
5	$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
6	$276	$10,355	60	144	90	10,992	0	0	0	0	0	421	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	$247	$575	75	113	113	0	0	0	38	38	38	0	0	0	38	38	0	0	0	38	38	0	0	0	38	38	0	0	0	38	38	0
8	$4,816	$19,755	1,704	1,784	1,618	1,867	3,008	1,290	877	867	735	587	587	587	625	625	587	704	893	857	625	587	587	587	625	625	587	587	587	976	625	587
8 (Asset Programs)	$65	$65,981	6	0	65	0	216	0	367	225	367	367	367	367	367	367	6,767	6,650	6,461	6,497	6,729	367	367	367	367	367	16,083	16,083	16,083	15,694	16,045	16,083
8 (Total)	$4,881	$85,736	1,710	1,784	1,683	1,867	3,224	1,290	1,244	1,092	1,102	954	954	954	992	992	7,354	7,354	7,354	7,354	7,354	954	954	954	992	992	16,670	16,670	16,670	16,670	16,670	16,670
9	$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
10	$1,351	$7,376	288	549	606	1,142	460	500	540	618	658	812	180	180	218	218	180	180	180	218	218	180	180	180	218	218	180	180	180	218	218	180
11	$659	$659	200	250	250	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
12	$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
13	$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
14	$1,402	$2,381	360	544	590	749	0	0	0	0	0	421	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stormwater Total			2,782	3,561	3,467	15,227	3,684	1,790	1,784	1,749	1,799	3,239	1,134	1,134	1,249	1,249	7,534	7,534	7,534	7,611	7,611	1,134	1,134	1,134	1,249	1,249	16,850	16,850	16,850	16,927	16,927	16,850

O&M by Objective	NPV 3-Year	NPV 30-Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
1	$2,075	$29,126	4	802	1,323	1,323	1,323	1,389	1,389	1,438	1,438	1,438	1,438	1,081	1,081	1,081	1,081	1,081	1,081	1,081	1,081	1,081	1,081	1,081	1,081	1,081	1,081	1,081	1,081	1,081	1,081	1,081
2	$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
3	$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
4	$0	$20,093	0	0	0	0	0	1	1	1	1	1	696	696	696	696	696	696	696	696	696	696	1,819	1,819	1,819	1,819	1,819	1,819	1,819	1,819	1,819	1,819
5	$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
6	$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
7	$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
8	$355	$0	0	0	0	0	0	5	5	5	5	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
9	$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
10	$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
11	$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
12	$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
13	$2,079	$122,749	401	582	1,144	1,331	1,521	1,714	1,910	2,208	2,411	3,287	3,496	3,710	4,083	4,304	4,766	4,995	5,228	5,466	5,709	5,965	7,379	7,636	7,899	8,167	8,441	8,720	9,006	9,297	9,596	9,901
14	$0	$168	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
O&M Total	$4,153	$172,492	405	1,385	2,467	2,654	2,844	3,108	3,304	3,652	3,855	4,745	5,651	5,506	5,880	6,101	6,575	6,804	7,038	7,276	7,518	7,774	10,311	10,569	10,831	11,099	11,373	11,652	11,938	12,230	12,528	12,833

New Asset Renewal by Objective	NPV 3-Year	NPV 30-Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
1	$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
2	$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
3	$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
4	$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
5	$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
6	$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
7	$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
8	$0	$84,706	0	0	0	0	0	0	0	0	0	0	0	9,170	3,289	1,000	3,096	3,536	1,393	1,599	356	9,738	20,767	14,325	12,948	7,265	7,170	13,025	10,014	7,905	2,848	39,801
9	$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
10	$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
11	$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
12	$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
13	$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
14	$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
New Asset Renewal Total	$0	$84,706	0	0	0	0	0	0	0	0	0	0	0	9,170	3,289	1,000	3,096	3,536	1,393	1,599	356	9,738	20,767	14,325	12,948	7,265	7,170	13,025	10,014	7,905	2,848	39,801

Summary of Capital, Operational and Maintenance Expenditures

Summary of Capital, O&M and New Asset Renewal Expenditure - By Objective

Objective: 1	Meet Current Nova Scotia Environment (NSE) WWTF Permit to Operate Requirements																															
		NPV 3-Year	NPV 30-Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
	Water Service Capital Expenditure																																
	Water - Land			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
	Water - Transmission			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
	Water - Distribution			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
	Water - Services			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
	Water - Meters			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
	Water - Hydrants			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
	Water - Structures			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
	Water - Treatment Facilities			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
	Water - Airport Aerotech System			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
	Water - Small Treatment Systems			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
	Water - Energy			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
	Water - Fleet			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
	Water - IT			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
	Water - Security			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
	Water - Equipment			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
	Total Water Expenditure	**$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
	Wastewater Service Capital Expenditure																																
	Wastewater - Land & Land Rights			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
	Wastewater - Trunk Sewers			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
	Wastewater - Collection Combined			0	0	60	60	0	0	0	60	60	0	0	0	60	60	0	0	0	60	60	0	0	0	60	60	0	0	0	60	60	0
	Wastewater - Collection Sanitary			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
	Wastewater - Forcemains			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
	Wastewater - Structures			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
	Wastewater - Laterals			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
	Wastewater - Outfalls			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
	Wastewater - Treatment Facilities			30593	7577	269	1868	6286	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
	Wastewater - Airport Aerotech System			5220	5007	13	245	397	0	245	0	245	0	245	0	245	0	245	0	245	0	245	0	245	0	245	0	245	0	245	0	245	0
	Wastewater - Small Treatment Systems			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
	Wastewater - Energy			20	0	0	0	30	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
	Wastewater - Fleet			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
	Wastewater - IT			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
	Wastewater - Security			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
	Wastewater - Equipment			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
	Total Wastewater Expenditure	**$46,964**	**$56,803**	$35,833	$12,584	$342	$2,173	$6,713	$0	$245	$60	$305	$0	$245	$0	$305	$60	$245	$0	$245	$60	$305	$0	$245	$0	$305	$60	$245	$0	$245	$60	$305	$0
	Stormwater Service Capital Expenditure																																
	Stormwater - Pipes			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
	Stormwater - Culverts/Ditches			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
	Stormwater - Structures			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
	Stormwater - Fleet			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
	Stormwater - IT			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
	Stormwater - Security			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
	Stormwater - Equipment			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
	Total Stormwater Capital Expenditure	**$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
	Total Capital Expenditure	**$46,964**	**$56,803**	$35,833	$12,584	$342	$2,173	$6,713	$0	$245	$60	$305	$0	$245	$0	$305	$60	$245	$0	$245	$60	$305	$0	$245	$0	$305	$60	$245	$0	$245	$60	$305	$0
	Wastewater O&M Expenditure																																
	Wastewater - Treatment Facilities (O&M)	**$1,917**	**$25,259**	4	802	1160	1160	1160	1226	1226	1276	1276	1276	1276	918	918	918	918	918	918	918	918	918	918	918	918	918	918	918	918	918	918	918
	Wastewater - Pumping (O&M)	**$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
	Wastewater - Airport Aerotech System (O&M)	**$157**	**$3,867**	0	0	162	162	162	162	162	162	162	162	162	162	162	162	162	162	162	162	162	162	162	162	162	162	162	162	162	162	162	162
	Water O&M Expenditure																																
	Water - Pumping (O&M)	**$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
	Total O&M Expenditure	**$2,075**	**$29,126**	$4	$802	$1,323	$1,323	$1,323	$1,389	$1,389	$1,438	$1,438	$1,438	$1,438	$1,081	$1,081	$1,081	$1,081	$1,081	$1,081	$1,081	$1,081	$1,081	$1,081	$1,081	$1,081	$1,081	$1,081	$1,081	$1,081	$1,081	$1,081	$1,081
	New Asset Renewal Expenditure																																
	New Asset Renewal			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
	Total New Asset Renewal Expenditure	**$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

Objective: 2	Meet Current NSE WSP Permit to Operate Requirements																																
		NPV 3-Year	NPV 30-Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
	Water Service Capital Expenditure																																
	Water - Land			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
	Water - Transmission			0	0	60	60	0	0	0	60	60	0	0	0	60	60	0	0	0	60	60	0	0	0	60	60	0	0	0	60	60	0
	Water - Distribution			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
	Water - Services			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
	Water - Meters			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
	Water - Hydrants			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
	Water - Structures			8	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
	Water - Treatment Facilities			215	215	1565	315	940	500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Water - Airport Aerotech System			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
	Water - Small Treatment Systems			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
	Water - Energy			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
	Water - Fleet			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
	Water - IT			665	339	0	50	0	0	0	0	50	0	0	0	0	50	0	0	0	0	50	0	0	0	0	50	0	0	0	0	50	0
	Water - Security			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
	Water - Equipment			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
	Total Water Capital Expenditure	**$2,870**	**$4,978**	$888	$554	$1,625	$425	$940	$500	$0	$60	$110	$0	$0	$0	$60	$110	$0	$0	$0	$60	$110	$0	$0	$0	$60	$110	$0	$0	$0	$60	$110	$0
	Wastewater Service Capital Expenditure																																
	Wastewater - Land & Land Rights			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
	Wastewater - Trunk Sewers			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
	Wastewater - Collection Combined			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
	Wastewater - Collection Sanitary			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
	Wastewater - Forcemains			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
	Wastewater - Structures			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
	Wastewater - Laterals			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
	Wastewater - Outfalls			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
	Wastewater - Treatment Facilities			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
	Wastewater - Airport Aerotech System			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
	Wastewater - Small Treatment Systems			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
	Wastewater - Energy			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
	Wastewater - Fleet			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
	Wastewater - IT			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
	Wastewater - Security			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
	Wastewater - Equipment			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
	Total Wastewater Capital Expenditure	**$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
	Stormwater Service Capital Expenditure																																
	Stormwater - Pipes			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
	Stormwater - Culverts/Ditches			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
	Stormwater - Structures			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
	Stormwater - Fleet			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
	Stormwater - IT			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
	Stormwater - Security			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
	Stormwater - Equipment			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
	Total Stormwater Capital Expenditure	**$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
	Total Capital Expenditure	**$2,870**	**$4,978**	$888	$554	$1,625	$425	$940	$500	$0	$60	$110	$0	$0	$0	$60	$110	$0	$0	$0	$60	$110	$0	$0	$0	$60	$110	$0	$0	$0	$60	$110	$0
	Wastewater O&M Expenditure																																
	Wastewater - Treatment Facilities (O&M)	**$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
	Wastewater - Pumping (O&M)	**$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
	Wastewater - Airport Aerotech System (O&M)	**$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
	Water O&M Expenditure																																
	Water - Pumping (O&M)	**$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
	Total O&M Expenditure	**$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
	New Asset Renewal Expenditure																																
	New Asset Renewal			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
	Total New Asset Renewal Expenditure	**$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

Summary of Capital, Operational and Maintenance Expenditures

Objective: 3	Meet Current Overflow Compliance Requirements																															
	NPV 3-Year	NPV 30-Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Water Service Capital Expenditure																																
Water - Land			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
Water - Transmission			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
Water - Distribution			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
Water - Services			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
Water - Meters			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
Water - Hydrants			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
Water - Structures			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
Water - Treatment Facilities			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
Water - Airport Aerotech System			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
Water - Small Treatment Systems			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
Water - Energy			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
Water - Fleet			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
Water - IT			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
Water - Security			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
Water - Equipment			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
Total Water Capital Expenditure	**$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
Wastewater Service Capital Expenditure																																
Wastewater - Land & Land Rights			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
Wastewater - Trunk Sewers			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
Wastewater - Collection Combined			300	335	375	455	300	300	300	330	330	600	600	600	630	630	600	600	300	330	330	300	300	300	330	330	300	300	300	330	330	300
Wastewater - Collection Sanitary			0	75	75	0	0	0	0	0	0	396	1272	2772	2100	2400	3000	3600	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wastewater - Forcemains			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
Wastewater - Structures			0	0	0	0	0	0	0	0	0	4440	4440	4440	2040	2040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wastewater - Laterals			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
Wastewater - Outfalls			40	40	40	40	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
Wastewater - Treatment Facilities			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
Wastewater - Airport Aerotech System			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
Wastewater - Small Treatment Systems			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
Wastewater - Energy			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
Wastewater - Fleet			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
Wastewater - IT			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
Wastewater - Security			665	339	0	50	0	0	0	0	50	0	0	0	0	50	0	0	0	0	50	0	0	0	0	50	0	0	0	50	0	0
Wastewater - Security			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
Wastewater - Equipment			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
Total Wastewater Capital Expenditure	**$2,167**	**$31,879**	$1,005	$789	$490	$545	$300	$300	$300	$330	$380	$5,436	$6,312	$7,812	$4,770	$5,120	$3,600	$4,200	$300	$330	$380	$300	$300	$300	$330	$380	$300	$300	$300	$330	$380	$300
Stormwater Service Capital Expenditure																																
Stormwater - Pipes			90	216	135	344	0	0	0	0	0	632	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stormwater - Culverts/Ditches			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
Stormwater - Structures			0	0	0	20	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
Stormwater - Fleet			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
Stormwater - IT			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
Stormwater - Security			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
Stormwater - Equipment			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
Total Stormwater Capital Expenditure	**$415**	**$1,207**	$90	$216	$135	$364	$0	$0	$0	$0	$0	$632	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Capital Expenditure	**$2,581**	**$33,086**	$1,095	$1,005	$625	$909	$300	$300	$300	$330	$380	$6,068	$6,312	$7,812	$4,770	$5,120	$3,600	$4,200	$300	$330	$380	$300	$300	$300	$330	$380	$300	$300	$300	$330	$380	$300
Wastewater O&M Expenditure																																
Wastewater - Treatment Facilities (O&M)	**$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
Wastewater - Pumping (O&M)	**$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
Wastewater - Airport Aerotech System (O&M)	**$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
Water O&M Expenditure																																
Water - Pumping (O&M)	**$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
Total O&M Expenditure	**$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
New Asset Renewal Expenditure																																
New Asset Renewal			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
Total New Asset Renewal Expenditure	**$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

Objective: 4	Meet Future WWTF Effluent Requirements																															
	NPV 3-Year	NPV 30-Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Water Service Capital Expenditure																																
Water - Land			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
Water - Transmission			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
Water - Distribution			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
Water - Services			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
Water - Meters			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
Water - Hydrants			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
Water - Structures			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
Water - Treatment Facilities			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
Water - Airport Aerotech System			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
Water - Small Treatment Systems			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
Water - Energy			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
Water - Fleet			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
Water - IT			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
Water - Security			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
Water - Equipment			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
Total Water Capital Expenditure	**$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
Wastewater Service Capital Expenditure																																
Wastewater - Land & Land Rights			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
Wastewater - Trunk Sewers			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
Wastewater - Collection Combined			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
Wastewater - Collection Sanitary			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
Wastewater - Forcemains			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
Wastewater - Structures			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
Wastewater - Laterals			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
Wastewater - Outfalls			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
Wastewater - Treatment Facilities			0	0	0	30	300	0	0	0	0	146368	1320	1320	1320	1320	1320	1320	1320	1320	1320	288200	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320
Wastewater - Airport Aerotech System			320	7	13	245	245	0	245	0	245	36640	245	0	245	0	245	0	245	0	245	0	245	0	245	0	245	0	245	0	245	0
Wastewater - Small Treatment Systems			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
Wastewater - Energy			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
Wastewater - Fleet			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
Wastewater - IT			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
Wastewater - Security			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
Wastewater - Equipment			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
Total Wastewater Capital Expenditure	**$329**	**$312,430**	$320	$7	$13	$275	$545	$0	$245	$0	$245	$183,008	$1,565	$1,320	$1,565	$1,320	$1,565	$1,320	$1,565	$1,320	$1,565	$288,200	$1,565	$1,320	$1,565	$1,320	$1,565	$1,320	$1,565	$1,320	$1,565	$1,320
Stormwater Service Capital Expenditure																																
Stormwater - Pipes			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
Stormwater - Culverts/Ditches			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
Stormwater - Structures			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
Stormwater - Fleet			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
Stormwater - IT			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
Stormwater - Security			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
Stormwater - Equipment			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
Total Stormwater Capital Expenditure	**$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
Total Capital Expenditure	**$329**	**$312,430**	$320	$7	$13	$275	$545	$0	$245	$0	$245	$183,008	$1,565	$1,320	$1,565	$1,320	$1,565	$1,320	$1,565	$1,320	$1,565	$288,200	$1,565	$1,320	$1,565	$1,320	$1,565	$1,320	$1,565	$1,320	$1,565	$1,320
Wastewater O&M Expenditure																																
Wastewater - Treatment Facilities (O&M)	**$0**	**$20,093**	0	0	0	0	0	1	1	1	1	1	696	696	696	696	696	696	696	696	696	696	1819	1819	1819	1819	1819	1819	1819	1819	1819	1819
Wastewater - Pumping (O&M)	**$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
Wastewater - Airport Aerotech System (O&M)	**$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
Water O&M Expenditure																																
Water - Pumping (O&M)	**$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
Total O&M Expenditure	**$0**	**$20,093**	$0	$0	$0	$0	$0	$1	$1	$1	$1	$1	$696	$696	$696	$696	$696	$696	$696	$696	$696	$696	$1,819	$1,819	$1,819	$1,819	$1,819	$1,819	$1,819	$1,819	$1,819	$1,819
New Asset Renewal Expenditure																																
New Asset Renewal			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
Total New Asset Renewal Expenditure	**$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

Summary of Capital, Operational and Maintenance Expenditures

Objective: 5 Meet Future NSE/Health Canada Drinking Water Quality Requirements

	NPV 3-Year	NPV 30-Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Water Service Capital Expenditure																															
Water - Land			0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Water - Transmission			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
Water - Distribution			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
Water - Services			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
Water - Meters			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
Water - Hydrants			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
Water - Structures			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
Water - Treatment Facilities			0	1550	2350	0	725	715	215	215	315	215	215	215	215	315	215	215	215	215	315	215	215	215	215	315	215	215	215	215	315	215
Water - Airport Aerotech System			0	555	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
Water - Small Treatment Systems			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
Water - Energy			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
Water - Fleet			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
Water - IT			665	339	0	50	0	0	0	0	50	0	0	0	0	50	0	0	0	0	50	0	0	0	0	50	0	0	0	0	50	0
Water - Security			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
Water - Equipment			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
Total Water Capital Expenditure	**$5,136**	**$10,227**	$665	$2,464	$2,370	$70	$745	$735	$235	$235	$385	$235	$235	$235	$235	$385	$235	$235	$235	$235	$385	$235	$235	$235	$235	$385	$235	$235	$235	$235	$385	$235
Wastewater Service Capital Expenditure																															
Wastewater - Land & Land Rights			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
Wastewater - Trunk Sewers			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
Wastewater - Collection Combined			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
Wastewater - Collection Sanitary			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
Wastewater - Forcemains			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
Wastewater - Structures			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
Wastewater - Laterals			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
Wastewater - Outfalls			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
Wastewater - Treatment Facilities			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
Wastewater - Airport Aerotech System			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
Wastewater - Small Treatment Systems			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
Wastewater - Energy			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
Wastewater - Fleet			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
Wastewater - IT			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
Wastewater - Security			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
Wastewater - Equipment			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
Total Wastewater Capital Expenditure	**$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
Stormwater Service Capital Expenditure																															
Stormwater - Pipes			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
Stormwater - Culverts/Ditches			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
Stormwater - Structures			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
Stormwater - Fleet			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
Stormwater - IT			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
Stormwater - Security			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
Stormwater - Equipment			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
Total Stormwater Capital Expenditure	**$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
Total Capital Expenditure	**$5,136**	**$10,227**	$665	$2,464	$2,370	$70	$745	$735	$235	$235	$385	$235	$235	$235	$235	$385	$235	$235	$235	$235	$385	$235	$235	$235	$235	$385	$235	$235	$235	$235	$385	$235
Wastewater O&M Expenditure																															
Wastewater - Treatment Facilities (O&M)	**$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
Wastewater - Pumping (O&M)	**$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
Wastewater - Airport Aerotech System (O&M)	**$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
Water O&M Expenditure																															
Water - Pumping (O&M)	**$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
Total O&M Expenditure	**$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
New Asset Renewal Expenditure																															
New Asset Renewal			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
Total New Asset Renewal Expenditure	**$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

Objective: 6 Meet Future Regulations for Overflow Volume and Frequency

	NPV 3-Year	NPV 30-Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Water Service Capital Expenditure																															
Water - Land			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
Water - Transmission			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
Water - Distribution			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
Water - Services			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
Water - Meters			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
Water - Hydrants			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
Water - Structures			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
Water - Treatment Facilities			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
Water - Airport Aerotech System			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
Water - Small Treatment Systems			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
Water - Energy			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
Water - Fleet			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
Water - IT			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
Water - Security			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
Water - Equipment			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
Total Water Capital Expenditure	**$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
Wastewater Service Capital Expenditure																															
Wastewater - Land & Land Rights			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
Wastewater - Trunk Sewers			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
Wastewater - Collection Combined			3803	3060	50	50	0	0	0	0	0	100	100	100	100	100	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	173145
Wastewater - Collection Sanitary			9850	2355	3523	2100	500	500	500	500	500	632	924	1424	1200	1300	1500	1700	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Wastewater - Forcemains			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
Wastewater - Structures			0	0	0	0	0	0	0	0	0	3705	3300	3300	1500	1500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wastewater - Laterals			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
Wastewater - Outfalls			30	30	30	30	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
Wastewater - Treatment Facilities			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
Wastewater - Airport Aerotech System			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
Wastewater - Small Treatment Systems			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
Wastewater - Energy			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
Wastewater - Fleet			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
Wastewater - IT			665	339	0	50	0	0	0	0	50	0	0	0	0	50	0	0	0	0	50	0	0	0	0	50	0	0	0	0	50	0
Wastewater - Security			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
Wastewater - Equipment			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
Total Wastewater Capital Expenditure	**$22,679**	**$117,475**	$14,348	$5,784	$3,603	$2,230	$500	$500	$500	$500	$550	$4,437	$4,324	$4,824	$2,800	$2,950	$1,600	$1,800	$500	$500	$550	$500	$500	$500	$500	$550	$500	$500	$500	$500	$550	$173,645
Stormwater Service Capital Expenditure																															
Stormwater - Pipes			60	144	90	10972	0	0	0	0	0	421	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stormwater - Culverts/Ditches			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
Stormwater - Structures			0	0	0	20	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
Stormwater - Fleet			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
Stormwater - IT			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
Stormwater - Security			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
Stormwater - Equipment			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
Total Stormwater Capital Expenditure	**$276**	**$10,355**	$60	$144	$90	$10,992	$0	$0	$0	$0	$0	$421	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Capital Expenditure	**$22,955**	**$127,831**	$14,408	$5,928	$3,693	$13,222	$500	$500	$500	$500	$550	$4,858	$4,324	$4,824	$2,800	$2,950	$1,600	$1,800	$500	$500	$550	$500	$500	$500	$500	$550	$500	$500	$500	$500	$550	$173,645
Wastewater O&M Expenditure																															
Wastewater - Treatment Facilities (O&M)	**$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
Wastewater - Pumping (O&M)	**$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
Wastewater - Airport Aerotech System (O&M)	**$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
Water O&M Expenditure																															
Water - Pumping (O&M)	**$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
Total O&M Expenditure	**$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
New Asset Renewal Expenditure																															
New Asset Renewal			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
Total New Asset Renewal Expenditure	**$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

Summary of Capital, Operational and Maintenance Expenditures

Objective: 7 Meet Future Stormwater Quality Compliance Requirements

	NPV 3-Year	NPV 30-Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Water Service Capital Expenditure																															
Water - Land			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
Water - Transmission			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
Water - Distribution			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
Water - Services			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
Water - Meters			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
Water - Hydrants			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
Water - Structures			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
Water - Treatment Facilities			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
Water - Airport Aerotech System			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
Water - Small Treatment Systems			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
Water - Energy			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
Water - Fleet			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
Water - IT			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
Water - Security			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
Water - Equipment			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
Total Water Capital Expenditure	**$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
Wastewater Service Capital Expenditure																															
Wastewater - Land & Land Rights			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
Wastewater - Trunk Sewers			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
Wastewater - Collection Combined			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
Wastewater - Collection Sanitary			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
Wastewater - Forcemains			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
Wastewater - Structures			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
Wastewater - Laterals			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
Wastewater - Outfalls			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
Wastewater - Treatment Facilities			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
Wastewater - Airport Aerotech System			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
Wastewater - Small Treatment Systems			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
Wastewater - Energy			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
Wastewater - Fleet			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
Wastewater - IT			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
Wastewater - Security			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
Wastewater - Equipment			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
Total Wastewater Capital Expenditure	**$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
Stormwater Service Capital Expenditure																															
Stormwater - Pipes			75	75	113	113	0	0	0	38	38	0	0	0	38	38	0	0	0	38	38	0	0	0	38	38	0	0	0	38	38	0
Stormwater - Culverts/Ditches			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
Stormwater - Structures			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
Stormwater - Fleet			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
Stormwater - IT			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
Stormwater - Security			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
Stormwater - Equipment			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
Total Stormwater Capital Expenditure	**$247**	**$575**	$75	$75	$113	$113	$0	$0	$0	$38	$38	$0	$0	$0	$38	$38	$0	$0	$0	$38	$38	$0	$0	$0	$38	$38	$0	$0	$0	$38	$38	$0
Total Capital Expenditure	**$247**	**$575**	$75	$75	$113	$113	$0	$0	$0	$38	$38	$0	$0	$0	$38	$38	$0	$0	$0	$38	$38	$0	$0	$0	$38	$38	$0	$0	$0	$38	$38	$0
Wastewater O&M Expenditure																															
Wastewater - Treatment Facilities (O&M)	**$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
Wastewater - Pumping (O&M)	**$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
Wastewater - Airport Aerotech System (O&M)	**$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
Water O&M Expenditure																															
Water - Pumping (O&M)	**$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
Total O&M Expenditure	**$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
New Asset Renewal Expenditure																															
New Asset Renewal			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
Total New Asset Renewal Expenditure	**$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

Objective: 8 Implement Optimal Level of Asset Reinvestment

	NPV 3-Year	NPV 30-Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Water Service Capital Expenditure																															
Water - Land			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
Water - Transmission			570	2261	885	630	3771	167	167	227	227	7803	167	167	227	227	3569	167	167	227	227	4555	167	167	227	227	167	167	167	227	227	167
Water - Distribution			3350	3650	3750	3750	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
Water - Services			240	240	240	240	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
Water - Meters			1100	1150	1150	1150	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
Water - Hydrants			75	75	75	75	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
Water - Structures			4052	610	1260	300	2147	1010	370	1994	1010	7905	50	50	2187	50	4533	50	1010	50	50	10879	370	50	1010	50	2252	1010	370	6056	1010	3461
Water - Treatment Facilities			165	2745	285	165	478	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
Water - Airport Aerotech System			228	1843	228	228	0	0	0	0	0	1140	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0	0	0	0
Water - Small Treatment Systems			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
Water - Energy			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
Water - Fleet			200	460	450	465	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Water - IT			630	980	980	980	600	600	600	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
Water - Security			50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Water - Equipment			89	70	76	70	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
Total Water Capital Expenditure	**$32,388**	**$102,442**	$10,749	$14,134	$9,429	$8,103	$7,546	$2,327	$1,687	$3,170	$2,187	$17,799	$1,167	$1,167	$3,363	$1,227	$9,052	$1,167	$2,127	$1,227	$1,227	$16,384	$1,487	$1,487	$2,187	$1,227	$3,369	$2,127	$1,487	$7,232	$2,187	$4,578
Wastewater Service Capital Expenditure																															
Wastewater - Land & Land Rights			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
Wastewater - Trunk Sewers			850	250	2900	1800	6250	5000	600	600	6000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wastewater - Collection Combined			1193	1960	1358	2103	3120	1367	1367	1404	1404	1567	1567	1567	1604	1604	1567	1567	1367	1404	1404	1367	1367	1367	1404	1404	1367	1367	1367	1404	1404	1367
Wastewater - Collection Sanitary			500	1050	1250	0	300	0	0	0	0	264	848	1848	1400	1600	2000	2400	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wastewater - Forcemains			575	269	193	675	0	0	0	4581	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wastewater - Structures			4743	1550	3075	2175	14285	415	1000	0	0	0	360	360	360	360	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wastewater - Laterals			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
Wastewater - Outfalls			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
Wastewater - Treatment Facilities			550	536	500	780	2775	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
Wastewater - Airport Aerotech System			2160	2006	11	210	210	0	210	0	210	0	210	0	210	0	210	0	210	0	210	0	210	0	210	0	210	0	210	0	210	0
Wastewater - Small Treatment Systems			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
Wastewater - Energy			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
Wastewater - Fleet			1250	1000	1200	1100	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Wastewater - IT			480	530	530	530	550	550	550	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
Wastewater - Security			200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Wastewater - Equipment			60	60	60	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Total Wastewater Capital Expenditure	**$31,385**	**$135,057**	$12,561	$9,411	$11,276	$9,643	$28,760	$8,602	$4,997	$8,205	$9,234	$3,451	$4,605	$5,395	$5,194	$5,184	$5,397	$5,587	$3,197	$3,024	$3,234	$2,987	$3,197	$2,987	$3,234	$3,024	$3,197	$2,987	$3,197	$3,024	$3,234	$2,987
Stormwater Service Capital Expenditure																															
Stormwater - Pipes			678	909	791	1018	2657	667	677	725	735	587	587	587	625	625	587	587	787	625	625	587	587	587	625	625	587	587	587	625	625	587
Stormwater - Culverts/Ditches			361	400	302	429	151	423	0	142	0	0	0	0	0	0	0	117	106	232	0	0	0	0	0	0	0	0	0	351	0	0
Stormwater - Structures			350	150	200	220	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
Stormwater - Fleet			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
Stormwater - IT			315	325	325	200	200	200	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stormwater - Security			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
Stormwater - Equipment			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
Total Stormwater Capital Expenditure	**$4,816**	**$19,755**	$1,704	$1,784	$1,618	$1,867	$3,008	$1,290	$877	$867	$735	$587	$587	$587	$625	$625	$587	$704	$893	$857	$625	$587	$587	$587	$625	$625	$587	$587	$587	$976	$625	$587
Total Capital Expenditure	**$68,589**	**$257,254**	$25,014	$25,329	$22,323	$19,613	$39,313	$12,218	$7,560	$12,242	$12,156	$21,836	$6,358	$7,148	$9,183	$7,036	$15,035	$7,457	$6,216	$5,108	$5,086	$19,957	$5,270	$5,060	$6,046	$4,876	$7,152	$5,700	$5,270	$11,232	$6,046	$8,151
Wastewater O&M Expenditure																															
Wastewater - Treatment Facilities (O&M)	**$0**	**$107**	0	0	0	0	0	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Wastewater - Pumping (O&M)	**$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
Wastewater - Airport Aerotech System (O&M)	**$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
Water O&M Expenditure																															
Water - Pumping (O&M)	**$0**	**$248**	0	0	0	0	0	0	0	0	0	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Total O&M Expenditure	**$0**	**$355**	$0	$0	$0	$0	$0	$5	$5	$5	$5	$19	$19	$19	$19	$19	$19	$19	$19	$19	$19	$19	$19	$19	$19	$19	$19	$19	$19	$19	$19	$19
New Asset Renewal Expenditure																															
New Asset Renewal			0	0	0	0	0	0	0	0	0	0	0	9170	3289	1000	3096	3536	1393	1599	356	9738	20767	14325	12948	7265	7170	13025	10014	7905	2848	39801
Total New Asset Renewal Expenditure	**$0**	**$84,706**	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$9,170	$3,289	$1,000	$3,096	$3,536	$1,393	$1,599	$356	$9,738	$20,767	$14,325	$12,948	$7,265	$7,170	$13,025	$10,014	$7,905	$2,848	$39,801

Summary of Capital, Operational and Maintenance Expenditures

Objective: 9 Enhance Reliability of Critical Assets

	NPV 3-Year	NPV 30-Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Water Service Capital Expenditure																																
Water - Land			0	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180
Water - Transmission			0	3923	0	0	16619	0	0	0	0	13917	0	0	0	0	17056	0	0	0	0	0	14464	0	0	0	0	6569	0	0	0	0	1000
Water - Distribution			100	100	100	100	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
Water - Services			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
Water - Meters			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
Water - Hydrants			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
Water - Structures			0	0	0	0	4250	11000	0	0	0	0	0	0	0	0	2400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water - Treatment Facilities			0	0	0	0	68	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
Water - Airport Aerotech System			0	0	0	0	0	0	0	0	0	1900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water - Small Treatment Systems			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
Water - Energy			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
Water - Fleet			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
Water - IT			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
Water - Security			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
Water - Equipment			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
Total Water Capital Expenditure	**$4,315**	**$70,511**	$100	$4,203	$280	$280	$21,117	$11,180	$180	$180	$180	$15,997	$180	$180	$180	$180	$19,636	$180	$180	$180	$180	$14,644	$180	$180	$180	$180	$6,749	$180	$180	$180	$180	$1,180
Wastewater Service Capital Expenditure																																
Wastewater - Land & Land Rights			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
Wastewater - Trunk Sewers			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
Wastewater - Collection Combined			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
Wastewater - Collection Sanitary			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
Wastewater - Forcemains			575	269	193	75	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
Wastewater - Structures			0	0	0	0	15	135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wastewater - Laterals			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
Wastewater - Outfalls			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
Wastewater - Treatment Facilities			3469	368	0	0	1377	0	700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wastewater - Airport Aerotech System			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
Wastewater - Small Treatment Systems			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
Wastewater - Energy			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
Wastewater - Fleet			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
Wastewater - IT			265	575	575	450	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Wastewater - Security			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
Wastewater - Equipment			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
Total Wastewater Capital Expenditure	**$6,028**	**$9,171**	$4,309	$1,212	$768	$525	$1,442	$185	$750	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50
Stormwater Service Capital Expenditure																																
Stormwater - Pipes			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
Stormwater - Culverts/Ditches			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
Stormwater - Structures			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
Stormwater - Fleet			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
Stormwater - IT			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
Stormwater - Security			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
Stormwater - Equipment			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
Total Stormwater Capital Expenditure	**$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
Total Capital Expenditure	**$10,343**	**$79,682**	$4,409	$5,415	$1,048	$805	$22,558	$11,365	$930	$230	$230	$16,047	$230	$230	$230	$230	$19,686	$230	$230	$230	$230	$14,694	$230	$230	$230	$230	$6,799	$230	$230	$230	$230	$1,230
Wastewater O&M Expenditure																																
Wastewater - Treatment Facilities (O&M)	**$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
Wastewater - Pumping (O&M)	**$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
Wastewater - Airport Aerotech System (O&M)	**$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
Water O&M Expenditure																																
Water - Pumping (O&M)	**$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
Total O&M Expenditure	**$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
New Asset Renewal Expenditure																																
New Asset Renewal			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
Total New Asset Renewal Expenditure	**$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

Objective: 10 Ensure Exisiting Storm System is Adequately Sized for Minor Storm Conveyance

	NPV 3-Year	NPV 30-Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Water Service Capital Expenditure																																
Water - Land			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
Water - Transmission			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
Water - Distribution			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
Water - Services			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
Water - Meters			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
Water - Hydrants			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
Water - Structures			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
Water - Treatment Facilities			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
Water - Airport Aerotech System			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
Water - Small Treatment Systems			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
Water - Energy			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
Water - Fleet			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
Water - IT			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
Water - Security			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
Water - Equipment			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
Total Water Capital Expenditure	**$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
Wastewater Service Capital Expenditure																																
Wastewater - Land & Land Rights			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
Wastewater - Trunk Sewers			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
Wastewater - Collection Combined			0	0	0	0	0	0	0	0	0	200	200	200	200	200	200	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wastewater - Collection Sanitary			0	50	50	0	0	0	0	0	0	264	848	1848	1400	1600	2000	2400	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wastewater - Forcemains			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
Wastewater - Structures			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
Wastewater - Laterals			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
Wastewater - Outfalls			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
Wastewater - Treatment Facilities			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
Wastewater - Airport Aerotech System			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
Wastewater - Small Treatment Systems			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
Wastewater - Energy			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
Wastewater - Fleet			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
Wastewater - IT			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
Wastewater - Security			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
Wastewater - Equipment			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
Total Wastewater Capital Expenditure	**$93**	**$7,944**	$0	$50	$50	$0	$0	$0	$0	$0	$0	$464	$1,048	$2,048	$1,600	$1,800	$2,200	$2,600	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Stormwater Service Capital Expenditure																																
Stormwater - Pipes			288	549	546	802	460	500	540	618	658	812	180	180	218	218	180	180	180	218	218	180	180	180	218	218	180	180	180	218	218	180
Stormwater - Culverts/Ditches			0	0	60	320	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
Stormwater - Structures			0	0	0	20	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
Stormwater - Fleet			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
Stormwater - IT			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
Stormwater - Security			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
Stormwater - Equipment			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
Total Stormwater Capital Expenditure	**$1,351**	**$7,376**	$288	$549	$606	$1,142	$460	$500	$540	$618	$658	$812	$180	$180	$218	$218	$180	$180	$180	$218	$218	$180	$180	$180	$218	$218	$180	$180	$180	$218	$218	$180
Total Capital Expenditure	**$1,443**	**$15,319**	$288	$599	$656	$1,142	$460	$500	$540	$618	$658	$1,276	$1,228	$2,228	$1,818	$2,018	$2,380	$2,780	$180	$218	$218	$180	$180	$180	$218	$218	$180	$180	$180	$218	$218	$180
Wastewater O&M Expenditure																																
Wastewater - Treatment Facilities (O&M)	**$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
Wastewater - Pumping (O&M)	**$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
Wastewater - Airport Aerotech System (O&M)	**$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
Water O&M Expenditure																																
Water - Pumping (O&M)	**$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
Total O&M Expenditure	**$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
New Asset Renewal Expenditure																																
New Asset Renewal			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
Total New Asset Renewal Expenditure	**$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

Summary of Capital, Operational and Maintenance Expenditures

Objective:11 Adapt to Future Climate Change

	NPV 3-Year	NPV 30-Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Water Service Capital Expenditure																																
Water - Land			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
Water - Transmission			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
Water - Distribution			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
Water - Services			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
Water - Meters			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
Water - Hydrants			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
Water - Structures			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
Water - Treatment Facilities			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
Water - Airport Aerotech System			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
Water - Small Treatment Systems			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
Water - Energy			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
Water - Fleet			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
Water - IT			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
Water - Security			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
Water - Equipment			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
Total Water Capital Expenditure	**$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
Wastewater Service Capital Expenditure																																
Wastewater - Land & Land Rights			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
Wastewater - Trunk Sewers			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
Wastewater - Collection Combined			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
Wastewater - Collection Sanitary			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
Wastewater - Forcemains			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
Wastewater - Structures			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
Wastewater - Laterals			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
Wastewater - Outfalls			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
Wastewater - Treatment Facilities			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
Wastewater - Airport Aerotech System			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
Wastewater - Small Treatment Systems			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
Wastewater - Energy			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
Wastewater - Fleet			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
Wastewater - IT			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
Wastewater - Security			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
Wastewater - Equipment			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
Total Wastewater Capital Expenditure	**$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
Stormwater Service Capital Expenditure																																
Stormwater - Pipes			200	250	250	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
Stormwater - Culverts/Ditches			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
Stormwater - Structures			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
Stormwater - Fleet			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
Stormwater - IT			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
Stormwater - Security			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
Stormwater - Equipment			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
Total Stormwater Capital Expenditure	**$659**	**$659**	$200	$250	$250	$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
Total Capital Expenditure	**$659**	**$659**	$200	$250	$250	$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
Wastewater O&M Expenditure																																
Wastewater - Treatment Facilities (O&M)	**$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
Wastewater - Pumping (O&M)	**$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
Wastewater - Airport Aerotech System (O&M)	**$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
Water O&M Expenditure																																
Water - Pumping (O&M)	**$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
Total O&M Expenditure	**$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
New Asset Renewal Expenditure																																
New Asset Renewal			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
Total New Asset Renewal Expenditure	**$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

Objective:12 Reduce Energy Consumption, Operating Costs, and Reduce Greenhouse Gas (GHG) Contributions

	NPV 3-Year	NPV 30-Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Water Service Capital Expenditure																																
Water - Land			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
Water - Transmission			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
Water - Distribution			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
Water - Services			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
Water - Meters			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
Water - Hydrants			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
Water - Structures			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
Water - Treatment Facilities			0	0	0	0	140	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
Water - Airport Aerotech System			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
Water - Small Treatment Systems			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
Water - Energy			900	300	190	190	2240	46440	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Water - Fleet			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
Water - IT			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
Water - Security			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
Water - Equipment			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
Total Water Capital Expenditure	**$1,330**	**$43,012**	$900	$300	$190	$190	$2,380	$46,440	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40
Wastewater Service Capital Expenditure																																
Wastewater - Land & Land Rights			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
Wastewater - Trunk Sewers			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
Wastewater - Collection Combined			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
Wastewater - Collection Sanitary			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
Wastewater - Forcemains			0	0	0	0	0	0	0	0	0	800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wastewater - Structures			665	0	70	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
Wastewater - Laterals			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
Wastewater - Outfalls			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
Wastewater - Treatment Facilities			5068	1268	120	558	338	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
Wastewater - Airport Aerotech System			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
Wastewater - Small Treatment Systems			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
Wastewater - Energy			420	340	1090	1190	3360	340	340	190	290	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Wastewater - Fleet			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
Wastewater - IT			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
Wastewater - Security			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
Wastewater - Equipment			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
Total Wastewater Capital Expenditure	**$8,660**	**$15,404**	$6,153	$1,608	$1,280	$1,748	$3,698	$340	$340	$190	$290	$840	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40
Stormwater Service Capital Expenditure																																
Stormwater - Pipes			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
Stormwater - Culverts/Ditches			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
Stormwater - Structures			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
Stormwater - Fleet			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
Stormwater - IT			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
Stormwater - Security			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
Stormwater - Equipment			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
Total Stormwater Capital Expenditure	**$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
Total Capital Expenditure	**$9,991**	**$58,416**	$7,053	$1,908	$1,470	$1,938	$6,078	$46,780	$380	$230	$330	$880	$80	$80	$80	$80	$80	$80	$80	$80	$80	$80	$80	$80	$80	$80	$80	$80	$80	$80	$80	$80
Wastewater O&M Expenditure																																
Wastewater - Treatment Facilities (O&M)	**$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
Wastewater - Pumping (O&M)	**$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
Wastewater - Airport Aerotech System (O&M)	**$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
Water O&M Expenditure																																
Water - Pumping (O&M)	**$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
Total O&M Expenditure	**$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
New Asset Renewal Expenditure																																
New Asset Renewal			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
Total New Asset Renewal Expenditure	**$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

Summary of Capital, Operational and Maintenance Expenditures

Objective: 13 Provide Regional Water, Wastewater, and Stormwater Infrastructure Needed to Support Planned Growth

	NPV 3-Year	NPV 30-Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Water Service Capital Expenditure																																
Water - Land			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
Water - Transmission			35	0	30	30	8304	750	0	30	30	2705	750	0	30	30	3481	750	0	30	30	1124	750	0	30	30	3815	750	0	30	30	0
Water - Distribution			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
Water - Services			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
Water - Meters			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
Water - Hydrants			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
Water - Structures			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
Water - Treatment Facilities			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
Water - Airport Aerotech System			22	22	22	22	0	0	0	0	0	760	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water - Small Treatment Systems			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
Water - Enerov			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
Water - Fleet			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
Water - IT			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
Water - Security			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
Water - Equipment			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
Total Water Capital Expenditure	**$124**	**$17,156**	$57	$22	$52	$52	$8,304	$750	$0	$30	$30	$3,465	$750	$0	$30	$30	$3,481	$750	$0	$30	$30	$1,124	$750	$0	$30	$30	$3,815	$750	$0	$30	$30	$0
Wastewater Service Capital Expenditure																																
Wastewater - Land & Land Rights			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
Wastewater - Trunk Sewers			0	0	0	6049	0	0	17231	0	15811	0	0	4104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wastewater - Collection Combined			60	75	98	9578	0	750	0	23	23	0	750	0	23	23	0	750	0	23	23	0	750	0	23	23	0	750	0	23	23	0
Wastewater - Collection Sanitary			0	0	0	0	0	0	6108	0	32839	0	0	0	0	42016	0	0	0	0	19627	0	0	0	0	0	0	0	0	0	0	0
Wastewater - Forcemains			0	0	0	0	0	0	6217	0	50625	0	0	10310	0	4086	0	0	0	0	0	0	0	0	0	16979	0	0	0	0	0	0
Wastewater - Structures			19200	96	0	0	0	0	12852	0	56000	0	0	4224	0	25920	0	0	3680	0	24800	0	0	0	0	0	0	0	18880	0	0	0
Wastewater - Laterals			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
Wastewater - Outfalls			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
Wastewater - Treatment Facilities			11710	3750	0	0	0	0	0	0	39200	0	0	0	0	0	0	0	0	0	157600	0	0	0	0	0	0	0	0	0	0	0
Wastewater - Airport Aerotech System			3000	3000	0	0	0	0	0	1200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wastewater - Small Treatment Systems			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
Wastewater - Energy			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
Wastewater - Fleet			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
Wastewater - IT			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
Wastewater - Security			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
Wastewater - Equipment			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
Total Wastewater Capital Expenditure	**$39,594**	**$435,456**	$33,970	$6,921	$98	$15,627	$0	$750	$42,408	$1,223	$194,497	$0	$750	$18,638	$23	$72,045	$0	$750	$3,680	$23	$202,050	$0	$750	$0	$23	$17,002	$0	$750	$18,880	$23	$23	$0
Stormwater Service Capital Expenditure																																
Stormwater - Pipes			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
Stormwater - Culverts/Ditches			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
Stormwater - Structures			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
Stormwater - Fleet			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
Stormwater - IT			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
Stormwater - Security			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
Stormwater - Equipment			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
Total Stormwater Capital Expenditure	**$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
Total Capital Expenditure	**$39,717**	**$452,612**	$34,027	$6,943	$150	$15,679	$8,304	$1,500	$42,408	$1,253	$194,527	$3,465	$1,500	$18,638	$53	$72,075	$3,481	$1,500	$3,680	$53	$202,080	$1,124	$1,500	$0	$53	$17,032	$3,815	$1,500	$18,880	$53	$53	$0
Wastewater O&M Expenditure																																
Wastewater - Treatment Facilities (O&M)	**$0**	**$9,021**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1162	1162	1162	1162	1162	1162	1162	1162	1162	1162
Wastewater - Pumping (O&M)	**$7**	**$18,333**	0	0	7	7	7	7	7	106	106	742	742	742	899	899	1135	1135	1135	1135	1135	1135	1135	1135	1135	1135	1135	1135	1135	1135	1135	1135
Wastewater - Airport Aerotech System (O&M)	**$731**	**$33,030**	63	127	561	624	687	751	814	877	941	1004	1067	1131	1194	1257	1321	1384	1447	1511	1574	1646	1709	1773	1836	1899	1963	2026	2089	2153	2216	2279
Water O&M Expenditure																																
Water - Pumping (O&M)	**$1,340**	**$62,365**	338	456	576	700	826	956	1089	1225	1364	1540	1687	1836	1990	2148	2310	2475	2646	2820	2999	3183	3372	3566	3766	3970	4180	4397	4619	4847	5082	5324
Total O&M Expenditure	**$2,079**	**$122,749**	$401	$582	$1,144	$1,331	$1,521	$1,714	$1,910	$2,208	$2,411	$3,287	$3,496	$3,710	$4,083	$4,304	$4,766	$4,995	$5,228	$5,466	$5,709	$5,965	$7,379	$7,636	$7,899	$8,167	$8,441	$8,720	$9,006	$9,297	$9,596	$9,901
New Asset Renewal Expenditure																																
New Asset Renewal			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
Total New Asset Renewal Expenditure	**$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

Objective: 14 Manage Flow Capacity Allocations

	NPV 3 year	NPV 30 Year	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Water Service Capital Expenditure																																
Water - Land			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
Water - Transmission			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
Water - Distribution			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
Water - Services			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
Water - Meters			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
Water - Hydrants			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
Water - Structures			0	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
Water - Treatment Facilities			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
Water - Airport Aerotech System			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
Water - Small Treatment Systems			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
Water - Energy			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
Water - Fleet			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
Water - IT			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
Water - Security			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
Water - Equipment			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
Total Water Capital Expenditure	**$279**	**$2,794**	$0	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150
Wastewater Service Capital Expenditure																																
Wastewater - Land & Land Rights			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
Wastewater - Trunk Sewers			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
Wastewater - Collection Combined			0	0	0	0	0	0	0	0	0	200	200	200	200	200	200	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wastewater - Collection Sanitary			0	50	50	1123	0	0	0	0	0	264	848	1848	1400	1600	2000	2400	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wastewater - Forcemains			0	0	0	0	0	0	0	0	0	0	0	0	0	2447	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wastewater - Structures			285	0	30	0	0	0	0	0	0	2205	1800	1800	0	509	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wastewater - Laterals			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
Wastewater - Outfalls			30	30	30	30	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
Wastewater - Treatment Facilities			25	36	40	150	175	0	0	0	0	0	0	0	0	0	0	0	0	0	3200	0	0	0	0	0	0	0	0	0	0	0
Wastewater - Airport Aerotech System			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
Wastewater - Small Treatment Systems			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
Wastewater - Energy			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
Wastewater - Fleet			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
Wastewater - IT			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
Wastewater - Security			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
Wastewater - Equipment			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
Total Wastewater Capital Expenditure	**$577**	**$17,718**	$340	$116	$150	$1,303	$175	$0	$0	$0	$0	$2,669	$2,848	$3,848	$1,600	$4,756	$2,200	$2,600	$0	$0	$3,200	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Stormwater Service Capital Expenditure																																
Stormwater - Pipes			360	544	590	729	0	0	0	0	0	421	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stormwater - Culverts/Ditches			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
Stormwater - Structures			0	0	0	20	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
Stormwater - Fleet			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
Stormwater - IT			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
Stormwater - Security			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
Stormwater - Equipment			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
Total Stormwater Capital Expenditure	**$1,402**	**$2,381**	$360	$544	$590	$749	$0	$0	$0	$0	$0	$421	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Capital Expenditure	**$2,258**	**$22,894**	$700	$810	$890	$2,202	$325	$150	$150	$150	$150	$3,240	$2,998	$3,998	$1,750	$4,906	$2,350	$2,750	$150	$150	$3,350	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150
Wastewater O&M Expenditure																																
Wastewater - Treatment Facilities (O&M)	**$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
Wastewater - Pumping (O&M)	**$0**	**$168**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Wastewater - Airport Aerotech System (O&M)	**$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
Water O&M Expenditure																																
Water - Pumping (O&M)	**$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
Total O&M Expenditure	**$0**	**$168**	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$13	$13	$13	$13	$13	$13	$13	$13	$13	$13	$13	$13	$13	$13	$13	$13
New Asset Renewal Expenditure																																
New Asset Renewal			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
Total New Asset Renewal Expenditure	**$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

APPENDIX H-4

Asset Renewal Costs

Asset Renewal Costs

Halifax Water Integrated Resource Plan - Short List Plan 40-4

Water Asset Renewal Costs (Halcrow)	NPV 3	NPV 30	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Trans Mains (A)		$58,817	5422	5422	5422	5422	3577	3577	3577	3577	3577	2782	2782	2782	2782	2782	414	414	414	414	414	1450	1450	1450	1450	1450	3491	3491	3491	3491	3491	3491
Distribution Mains (C)		$108,031	6582	6582	6582	6582	4323	4323	4323	4323	4323	6967	6967	6967	6967	6967	4378	4378	4378	4378	4378	6567	6567	6567	6567	6567	4170	4170	4170	4170	4170	4170
Meters (C)		$8,942	517	453	466	446	446	450	448	448	480	480	471	456	456	481	481	481	396	427	411	407	374	467	459	459	443	443	449	485	485	483
Valves (C)		$957	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	77	77	77	77	77	75	75	75	75	75	75
Water Pumping Stations (C)		$28,529	3255	3255	3255	3255	220	220	220	220	220	966	966	966	966	966	1116	1116	1116	1116	1116	34	34	34	34	34	3255	3255	3255	3255	3255	3255
Small WSP (C)		$3,020	135	135	135	135	122	122	122	122	122	135	135	135	135	135	17	17	17	17	17	400	400	400	400	400	168	168	168	168	168	168
PRVs (C)		$18,314	576	576	576	576	1397	1397	1397	1397	1397	1118	1118	1118	1118	1118	1030	1030	1030	1030	1030	732	732	732	732	732	576	576	576	576	576	576
Large WSP (C)		$76,924	5708	5708	5708	5708	0	0	0	0	0	5914	5914	5914	5914	5914	0	0	0	0	0	7557	7557	7557	7557	7557	5708	5708	5708	5708	5708	5708
		$303,535																														

Water Asset Renewal Costs	NPV 3	NPV 30	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Transmission Mains (5yr Capital)																																
Total for Projects Allocated to Objective 8	$3,495	$20,462	570	2,261	885	630	3,771	167	167	227	227	7,803	167	167	227	227	3,569	167	167	227	227	4,555	167	167	227	227	167	167	167	227	227	167
Total for Projects Allocated to Objective 9	$3,698	$50,895	0	3,923	0	0	16,619	0	0	0	0	13,917	0	0	0	0	17,056	0	0	0	0	14,464	0	0	0	0	6,569	0	0	0	0	1,000
Total for Objective 8 and 9	$7,193	$71,357	570	6,184	885	630	20,390	167	167	227	227	21,721	167	167	227	227	20,625	167	167	227	227	19,019	167	167	227	227	6,736	167	167	227	227	1,167
Total 5yr Capital Transmission Mains	$15,336	$58,817	5,422	5,422	5,422	5,422	3,577	3,577	3,577	3,577	3,577	2,782	2,782	2,782	2,782	2,782	414	414	414	414	414	1,450	1,450	1,450	1,450	1,450	3,491	3,491	3,491	3,491	3,491	3,491
Difference of IRP Asset Renewal minus (-) Total for Objective 8 and 9 (from 5yr Capital)			4,852	-763	4,537	4,792	-16,813	3,410	3,410	3,350	3,350	-18,939	2,615	2,615	2,555	2,555	-20,210	248	248	188	188	-17,569	1,283	1,283	1,223	1,223	-3,245	3,325	3,325	3,265	3,265	2,325
Water Transmission Mains Asset Renewal Programs	$8,862	$41,025	4,852	0	4,537	4,792	0	3,410	3,410	3,350	3,350	0	2,615	2,615	2,555	2,555	0	248	248	188	188	0	1,283	1,283	1,223	1,223	0	3,325	3,325	3,265	3,265	2,325
Distribution (5yr Capital)																																
Total for Projects Allocated to Objective 8	$9,983	$13,271	3,300	3,600	3,700	3,700	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
Total for Projects Allocated to Objective 9	$283	$372	100	100	100	100	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
Total for Objective 8 and 9	$10,266	$13,642	3,400	3,700	3,800	3,800	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
Total 5yr Capital Distribution	$18,618	$108,031	6,582	6,582	6,582	6,582	4,323	4,323	4,323	4,323	4,323	6,967	6,967	6,967	6,967	6,967	4,378	4,378	4,378	4,378	4,378	6,567	6,567	6,567	6,567	6,567	4,170	4,170	4,170	4,170	4,170	4,170
Difference of IRP Asset Renewal minus (-) Total for Objective 8 and 9 (from 5yr Capital)			3,182	2,882	2,782	2,782	4,323	4,323	4,323	4,323	4,323	6,967	6,967	6,967	6,967	6,967	4,378	4,378	4,378	4,378	4,378	6,567	6,567	6,567	6,567	6,567	4,170	4,170	4,170	4,170	4,170	4,170
Water Distribution Asset Renewal Programs	$8,352	$94,388	3,182	2,882	2,782	2,782	4,323	4,323	4,323	4,323	4,323	6,967	6,967	6,967	6,967	6,967	4,378	4,378	4,378	4,378	4,378	6,567	6,567	6,567	6,567	6,567	4,170	4,170	4,170	4,170	4,170	4,170
Meters (5yr Capital)																																
Total for Projects Allocated to Objective 8	$3,204	$4,226	1,100	1,150	1,150	1,150	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
Total for Projects Allocated to Objective 9	$0	$0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total for Objective 8 and 9	$3,204	$4,226	1,100	1,150	1,150	1,150	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
Total 5yr Capital Meters	$1,355	$8,942	517	453	466	446	446	450	448	448	480	480	471	456	456	481	481	481	396	427	411	407	374	467	459	459	443	443	449	485	485	483
Difference of IRP Asset Renewal minus (-) Total for Objective 8 and 9 (from 5yr Capital)			-583	-697	-684	-704	446	450	448	448	480	480	471	456	456	481	481	481	396	427	411	407	374	467	459	459	443	443	449	485	485	483
Water Meters Asset Renewal Programs	$0	$7,190	0	0	0	0	446	450	448	448	480	480	471	456	456	481	481	481	396	427	411	407	374	467	459	459	443	443	449	485	485	483
Valves (5yr Capital)																																
Total for Projects Allocated to Objective 8	$141	$186	50	50	50	50	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
Total for Projects Allocated to Objective 9	$0	$0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total for Objective 8 and 9	$141	$186	50	50	50	50	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
Total 5yr Capital Valves	$110	$957	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	77	77	77	77	77	75	75	75	75	75	75
Difference of IRP Asset Renewal minus (-) Total for Objective 8 and 9 (from 5yr Capital)			-11	-11	-11	-11	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	77	77	77	77	77	75	75	75	75	75	75
Water Valves Asset Renewal Programs	$0	$813	0	0	0	0	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	77	77	77	77	77	75	75	75	75	75	75
Pumping Stations (5yr Capital)																																
Total for Projects Allocated to Objective 8	$464	$687	0	250	250	250	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
Total for Projects Allocated to Objective 9	$0	$0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total for Objective 8 and 9	$464	$687	0	250	250	250	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
Total 5yr Capital Pumping Stations	$9,208	$28,529	3,255	3,255	3,255	3,255	220	220	220	220	220	966	966	966	966	966	1,116	1,116	1,116	1,116	1,116	34	34	34	34	34	3,255	3,255	3,255	3,255	3,255	3,255
Difference of IRP Asset Renewal minus (-) Total for Objective 8 and 9 (from 5yr Capital)			3,255	3,005	3,005	3,005	220	220	220	220	220	966	966	966	966	966	1,116	1,116	1,116	1,116	1,116	34	34	34	34	34	3,255	3,255	3,255	3,255	3,255	3,255
Water Pumping Stations Asset Renewal Programs	$8,744	$27,843	3,255	3,005	3,005	3,005	220	220	220	220	220	966	966	966	966	966	1,116	1,116	1,116	1,116	1,116	34	34	34	34	34	3,255	3,255	3,255	3,255	3,255	3,255
Pockwock and Lake Major Water Treatment Works (5yr Capital)																																
Total for Projects Allocated to Objective 8	$3,008	$3,567	165	2,745	285	165	478	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
Total for Projects Allocated to Objective 9	$0	$58	0	0	0	0	68	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
Total for Objective 8 and 9	$3,008	$3,625	165	2,745	285	165	545	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
Total 5yr Capital Pockwock and Lake Major Water Treatment Works	$16,145	$76,924	5,708	5,708	5,708	5,708	0	0	0	0	0	5,914	5,914	5,914	5,914	5,914	0	0	0	0	0	7,557	7,557	7,557	7,557	7,557	5,708	5,708	5,708	5,708	5,708	5,708
Difference of IRP Asset Renewal minus (-) Total for Objective 8 and 9 (from 5yr Capital)			5,543	2,963	5,423	5,543	-545	0	0	0	0	5,914	5,914	5,914	5,914	5,914	0	0	0	0	0	7,557	7,557	7,557	7,557	7,557	5,708	5,708	5,708	5,708	5,708	5,708
Large WSPs Asset Renewal Programs	$13,137	$73,769	5,543	2,963	5,423	5,543	0	0	0	0	0	5,914	5,914	5,914	5,914	5,914	0	0	0	0	0	7,557	7,557	7,557	7,557	7,557	5,708	5,708	5,708	5,708	5,708	5,708
Small System Water Treatment Works (5yr Capital)																																
Total for Projects Allocated to Objective 8	$0	$0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total for Projects Allocated to Objective 9	$0	$0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total for Objective 8 and 9	$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
Total 5yr Capital Small System Water Treatment Works	$383	$3,020	135	135	135	135	122	122	122	122	122	135	135	135	135	135	17	17	17	17	17	400	400	400	400	400	168	168	168	168	168	168
Difference of IRP Asset Renewal minus (-) Total for Objective 8 and 9 (from 5yr Capital)	406	4,923	135	135	135	135	122	122	122	122	122	135	135	135	135	135	17	17	17	17	17	400	400	400	400	400	168	168	168	168	168	168
Small WSPs Asset Renewal Programs	383	3,020	135	135	135	135	122	122	122	122	122	135	135	135	135	135	17	17	17	17	17	400	400	400	400	400	168	168	168	168	168	168
PRV Chamber etc																																
Total for Projects Allocated to Objective 8	$292	$292	0	310	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
Total for Projects Allocated to Objective 9	$0	$0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total for Objective 8 and 9	$292	$292	0	310	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
Total 5yr Capital PRV Chamber	$1,630	$18,314	576	576	576	576	1,397	1,397	1,397	1,397	1,397	1,118	1,118	1,118	1,118	1,118	1,030	1,030	1,030	1,030	1,030	732	732	732	732	732	576	576	576	576	576	576
Difference of IRP Asset Renewal minus (-) Total for Objective 8 and 9 (from 5yr Capital)	1,419	26,834	576	266	576	576	1,397	1,397	1,397	1,397	1,397	1,118	1,118	1,118	1,118	1,118	1,030	1,030	1,030	1,030	1,030	732	732	732	732	732	576	576	576	576	576	576
PRVs WSPs Asset Renewal Programs	1,338	18,022	576	266	576	576	1,397	1,397	1,397	1,397	1,397	1,118	1,118	1,118	1,118	1,118	1,030	1,030	1,030	1,030	1,030	732	732	732	732	732	576	576	576	576	576	576

Water New Asset Renewal Costs (Halcrow)	NPV 3	NPV 30	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Water Treatment Facilities		$1,656	0	0	0	0	0	0	0	0	0	0	0	38	451	420	48	235	122	22	22	32	22	22	60	473	452	70	257	143	43	53
Water Structures		$10,839	0	0	0	0	0	0	0	0	0	0	0	406	76	141	45	655	1216	52	214	116	806	2050	806	1015	386	4027	6755	1592	1144	814
Water Meters		$2,272	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1100	1150	1150	1150	0	0	0	0	0
Water Airport Aerotech System		$574	0	0	0	0	0	0	0	0	0	0	0	25	242	25	25	0	0	0	0	0	380	0	25	242	25	25	0	0	0	0
Total Water Asset Renewal Programs	**40,815**	**266,070**	**17,544**	**9,252**	**16,459**	**16,834**	**6,547**	**9,961**	**9,960**	**9,900**	**9,932**	**15,619**	**18,225**	**18,210**	**18,150**	**18,175**	**7,061**	**7,309**	**7,224**	**7,196**	**7,179**	**15,775**	**17,024**	**17,117**	**17,049**	**17,049**	**14,396**	**17,721**	**17,727**	**17,702**	**17,702**	**16,761**
Total Aerotech-Airport Water Asset Renewal Programs (from below)	**4,227**	**20,342**	**2,847**	**1,552**	**2,847**	**2,847**	**367**	**367**	**367**	**367**	**367**	**131**	**131**	**131**	**131**	**131**	**367**	**367**	**367**	**367**	**367**	**785**	**785**	**785**	**785**	**785**	**2,201**	**2,201**	**2,201**	**2,201**	**2,201**	**2,201**
Total Water New Asset Renewal Projects	**0**	**15,341**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**469**	**769**	**586**	**118**	**890**	**1,338**	**74**	**236**	**148**	**1,207**	**3,172**	**2,041**	**2,879**	**2,012**	**4,121**	**7,011**	**1,735**	**1,187**	**867**
Total Water 5-yr Capital Projects	**46,442**	**251,120**	**13,358**	**21,826**	**14,096**	**9,270**	**41,181**	**62,082**	**2,292**	**3,865**	**3,082**	**37,686**	**2,522**	**1,772**	**4,058**	**2,122**	**32,594**	**2,522**	**2,732**	**1,922**	**2,122**	**32,577**	**2,842**	**2,092**	**2,882**	**2,122**	**14,359**	**3,482**	**2,092**	**7,927**	**3,082**	**6,183**
Total Water Expenditure	**94,089**	**552,873**	**33,748**	**32,630**	**33,401**	**28,950**	**48,095**	**72,410**	**12,618**	**14,132**	**13,380**	**53,436**	**20,877**	**20,581**	**23,108**	**21,013**	**40,140**	**11,087**	**11,660**	**9,558**	**9,903**	**49,285**	**21,858**	**23,166**	**22,756**	**22,835**	**32,969**	**27,525**	**29,031**	**29,566**	**24,172**	**26,012**

Asset Renewal Costs

Wastewater Asset Renewal Costs (Halcrow)	NPV 3	NPV 30	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Sewers (B)		74,287	4545	4545	4545	4545	3030	3030	3030	3030	3030	4545	4545	4545	4545	4545	3030	3030	3030	3030	3030	4545	4545	4545	4545	4545	3030	3030	3030	3030	3030	3030
Trunks (C)		11,854	725	725	725	725	483	483	483	483	483	725	725	725	725	725	483	483	483	483	483	725	725	725	725	725	483	483	483	483	483	483
Forcemains (B)		56,116	142	142	142	142	2951	2951	2951	2951	2951	2746	2746	2746	2746	2746	832	832	832	832	832	2582	2582	2582	2582	2582	9260	9260	9260	9260	9260	9260
WW Pumping Stations (A)		127,169	11185	11185	11185	11185	4022	4022	4022	4022	4022	4537	4537	4537	4537	4537	10164	10164	10164	10164	10164	2151	2151	2151	2151	2151	6347	6347	6347	6347	6347	6347
WWTF (A)		331,706	18554	18554	18554	18554	13526	13526	13526	13526	13526	7507	7507	7507	7507	7507	35462	35462	35462	35462	35462	13091	13091	13091	13091	13091	14931	14931	14931	14931	14931	14931
		601,132																														
Wastewater Asset Renewal Costs	NPV 3	NPV 30	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Sanitary Sewers (5yr Capital)																																
Total for Projects Allocated to Objective 8	$10,582	$60,739	2543	3260	5508	3903	9670	6367	1967	2004	7404	1831	2415	3415	3004	3204	3567	3967	1367	1404	1404	1367	1367	1367	1404	1404	1367	1367	1367	1404	1404	1367
Total for Projects Allocated to Objective 9	$0	$240	0	0	0	0	0	0	150	150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total for Objective 8 and 9	$10,582	$60,979	2543	3260	5508	3903	9670	6367	2117	2154	7404	1831	2415	3415	3004	3204	3567	3967	1367	1404	1404	1367	1367	1367	1404	1404	1367	1367	1367	1404	1404	1367
Total 5yr Capital Sewers	$12,855	$74,287	4545	4545	4545	4545	3030	3030	3030	3030	3030	4545	4545	4545	4545	4545	3030	3030	3030	3030	3030	4545	4545	4545	4545	4545	3030	3030	3030	3030	3030	3030
Total 5yr Capital Trunk Sewers	$2,051	$11,854	725	725	725	725	483	483	483	483	483	725	725	725	725	725	483	483	483	483	483	725	725	725	725	725	483	483	483	483	483	483
Difference of IRP Asset Renewal minus (-) Total for Objective 8 and 9 (from 5yr Capital)			**2,727**	**2,010**	**-238**	**1,367**	**-6,157**	**-2,854**	**1,396**	**1,359**	**-3,891**	**3,439**	**2,855**	**1,855**	**2,265**	**2,065**	**-54**	**-454**	**2,146**	**2,109**	**2,109**	**3,903**	**3,903**	**3,903**	**3,865**	**3,865**	**2,146**	**2,146**	**2,146**	**2,109**	**2,109**	**2,146**
Wastewater Sewers Asset Renewal Programs	**4,542**	**36,379**	**2,727**	**2,010**	**0**	**1,367**	**0**	**0**	**1,396**	**1,359**	**0**	**3,439**	**2,855**	**1,855**	**2,265**	**2,065**	**0**	**0**	**2,146**	**2,109**	**2,109**	**3,903**	**3,903**	**3,903**	**3,865**	**3,865**	**2,146**	**2,146**	**2,146**	**2,109**	**2,109**	**2,146**
Forcemain Twin (5yr Capital)																																
Total for Projects Allocated to Objective 8	$988	$5,204	575	269	193	675	0	0	0	4581	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total for Projects Allocated to Objective 9	$988	$1,055	575	269	193	75	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
Total for Objective 8 and 9	$1,976	$6,259	1150	538	385	750	0	0	0	4581	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total 5yr Capital Forcemains	$403	$56,116	142	142	142	142	2951	2951	2951	2951	2951	2746	2746	2746	2746	2746	832	832	832	832	832	2582	2582	2582	2582	2582	9260	9260	9260	9260	9260	9260
Difference of IRP Asset Renewal minus (-) Total for Objective 8 and 9 (from 5yr Capital)			**-1,008**	**-396**	**-243**	**-608**	**2,951**	**2,951**	**2,951**	**-1,630**	**2,951**	**2,746**	**2,746**	**2,746**	**2,746**	**2,746**	**832**	**832**	**832**	**832**	**832**	**2,582**	**2,582**	**2,582**	**2,582**	**2,582**	**9,260**	**9,260**	**9,260**	**9,260**	**9,260**	**9,260**
Wastewater Forcemains Asset Renewal Programs	**0**	**53,258**	**0**	**0**	**0**	**0**	**2,951**	**2,951**	**2,951**	**0**	**2,951**	**2,746**	**2,746**	**2,746**	**2,746**	**2,746**	**832**	**832**	**832**	**832**	**832**	**2,582**	**2,582**	**2,582**	**2,582**	**2,582**	**9,260**	**9,260**	**9,260**	**9,260**	**9,260**	**9,260**
WW Pumping Stations (5yr Capital)																																
Total for Projects Allocated to Objective 8	$5,013	$21,424	1043	1550	2775	2175	14285	415	1000	0	0	0	360	360	360	360	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total for Projects Allocated to Objective 9	$0	$126	0	0	0	0	15	135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total for Objective 8 and 9	$5,013	$21,550	1043	1550	2775	2175	14300	550	1000	0	0	0	360	360	360	360	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total 5yr Capital WW Pumping Stations	$31,637	$127,169	11185	11185	11185	11185	4022	4022	4022	4022	4022	4537	4537	4537	4537	4537	10164	10164	10164	10164	10164	2151	2151	2151	2151	2151	6347	6347	6347	6347	6347	6347
Difference of IRP Asset Renewal minus (-) Total for Objective 8 and 9 (from 5yr Capital)			**10,142**	**9,635**	**8,410**	**9,010**	**-10,278**	**3,472**	**3,022**	**4,022**	**4,022**	**4,537**	**4,177**	**4,177**	**4,177**	**4,177**	**10,164**	**10,164**	**10,164**	**10,164**	**10,164**	**2,151**	**2,151**	**2,151**	**2,151**	**2,151**	**6,347**	**6,347**	**6,347**	**6,347**	**6,347**	**6,347**
Wastewater Pumping Stations Asset Renewal Programs	**26,624**	**114,484**	**10,142**	**9,635**	**8,410**	**9,010**	**0**	**3,472**	**3,022**	**4,022**	**4,022**	**4,537**	**4,177**	**4,177**	**4,177**	**4,177**	**10,164**	**10,164**	**10,164**	**10,164**	**10,164**	**2,151**	**2,151**	**2,151**	**2,151**	**2,151**	**6,347**	**6,347**	**6,347**	**6,347**	**6,347**	**6,347**
Treatment Facilities (5yr Capital)																																
Total for Projects Allocated to Objective 8	$1,586	$5,141	550	536	500	780	2775	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
Total for Projects Allocated to Objective 9	$3,837	$5,913	3469	368	0	0	1377	0	700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total for Objective 8 and 9	$5,423	$11,054	4019	904	500	780	4152	0	700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total 5yr Capital WW Treatment Facilities	$55,661	$511,738	18554	18554	18554	18554	13526	13526	13526	13526	13526	7507	7507	7507	7507	7507	35462	35462	35462	35462	35462	13091	13091	13091	13091	13091	14931	14931	14931	14931	14931	14931
Difference of IRP Asset Renewal minus (-) Total for Objective 8 and 9 (from 5yr Capital)			**14,535**	**17,650**	**18,054**	**17,774**	**9,375**	**13,526**	**12,826**	**13,526**	**13,526**	**7,507**	**7,507**	**7,507**	**7,507**	**7,507**	**35,462**	**35,462**	**35,462**	**35,462**	**35,462**	**13,091**	**13,091**	**13,091**	**13,091**	**13,091**	**14,931**	**14,931**	**14,931**	**14,931**	**14,931**	**14,931**
Wastewater Treatment Facilities Asset Renewal Programs	**47,270**	**321,652**	**14,535**	**17,650**	**18,054**	**17,774**	**9,375**	**13,526**	**12,826**	**13,526**	**13,526**	**7,507**	**7,507**	**7,507**	**7,507**	**7,507**	**35,462**	**35,462**	**35,462**	**35,462**	**35,462**	**13,091**	**13,091**	**13,091**	**13,091**	**13,091**	**14,931**	**14,931**	**14,931**	**14,931**	**14,931**	**14,931**
Wastewater New Asset Renewal Costs (Halcrow)	NPV 3	NPV 30	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Wastewater Structures		$35,939	0	0	0	0	0	0	0	0	0	0	0	2489	165	318	394	1430	55	1385	0	5600	1035	10947	4560	1825	4925	6114	1650	5964	1385	24704
Wastewater Treatment Facilities		$28,425	0	0	0	0	0	0	0	0	0	0	0	5141	1354	93	2515	1131	0	70	0	3920	14861	136	5277	1489	229	2650	1267	136	206	14040
Wastewater Airport Aerotech System		$5,001	0	0	0	0	0	0	0	0	0	0	0	1070	1002	4	70	85	0	70	120	70	3664	70	1070	1072	4	140	85	70	70	190
Total Wastewater Asset Renewal Programs	**78,435**	**525,773**	**27,403**	**29,294**	**26,463**	**28,150**	**12,326**	**19,950**	**20,196**	**18,907**	**20,500**	**18,229**	**17,285**	**16,285**	**16,696**	**16,496**	**46,458**	**46,458**	**48,605**	**48,567**	**48,567**	**21,727**	**21,727**	**21,727**	**21,689**	**21,689**	**32,685**	**32,685**	**32,685**	**32,647**	**32,647**	**32,685**
Total Aerotech-Airport Wastewater Asset Renewal Programs (from below)	**796**	**10,526**	**156**	**156**	**544**	**346**	**26**	**26**	**26**	**26**	**26**	**400**	**190**	**400**	**190**	**400**	**2,346**	**2,556**	**2,346**	**2,556**	**2,346**	**0**	**0**	**0**	**0**	**0**	**216**	**426**	**216**	**426**	**216**	**426**
Total Wastewater New Asset Renewal Projects	**0**	**69,365**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**8,701**	**2,520**	**414**	**2,978**	**2,646**	**55**	**1,525**	**120**	**9,590**	**19,560**	**11,153**	**10,907**	**4,386**	**5,157**	**8,904**	**3,002**	**6,170**	**1,661**	**38,934**
Total Wastewater 5-yr Capital Projects	**158,476**	**1,139,337**	**108,837**	**38,481**	**18,070**	**34,068**	**42,131**	**10,677**	**49,785**	**10,558**	**205,551**	**200,355**	**21,786**	**43,974**	**17,946**	**93,324**	**16,896**	**18,946**	**9,576**	**5,346**	**211,374**	**292,076**	**6,646**	**5,196**	**6,046**	**22,426**	**5,896**	**5,946**	**24,776**	**5,346**	**6,146**	**178,342**
Total Wastewater Expenditure	**237,708**	**1,745,000**	**136,396**	**67,931**	**45,078**	**62,564**	**54,484**	**30,652**	**70,007**	**29,491**	**226,077**	**218,984**	**39,262**	**69,360**	**37,352**	**110,634**	**68,678**	**70,607**	**60,582**	**57,995**	**262,406**	**323,393**	**47,933**	**38,076**	**38,643**	**48,501**	**43,954**	**47,961**	**60,680**	**44,589**	**40,671**	**250,386**

Asset Renewal Costs

Stormwater Asset Renewal Costs (Halcrow)	NPV 3	NPV 30	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Sewers (B)		64,600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6987	6987	6987	6987	6987	0	0	0	0	0	16303	16303	16303	16303	16303	16303
Culverts (A)		7,194	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367
Structures - see specific projects in Objective 8		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
		71,794																														

Stormwater Asset Renewal Costs	NPV 3	NPV 30	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Storm Sewers (5yr Capital)																																
Total for Projects Allocated to Objective 8	$2,238	$14,898	678	909	791	1018	2657	667	677	725	735	587	587	587	625	625	587	587	787	625	625	587	587	587	625	625	587	587	587	625	625	587
Total for Projects Allocated to Objective 9	$0	$0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total for Objective 8 and 9	$2,238	$14,898	678	909	791	1018	2657	667	677	725	735	587	587	587	625	625	587	587	787	625	625	587	587	587	625	625	587	587	587	625	625	587
Total 5yr Capital Storm Sewers	$0	$64,600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6987	6987	6987	6987	6987	0	0	0	0	0	16303	16303	16303	16303	16303	16303
Difference of IRP Asset Renewal minus (-) Total for Objective 8 and 9 (from 5yr Capital)			-678	-909	-791	-1,018	-2,657	-667	-677	-725	-735	-587	-587	-587	-625	-625	6,400	6,400	6,200	6,362	6,362	-587	-587	-587	-625	-625	15,716	15,716	15,716	15,678	15,678	15,716
Stormwater Sewers Asset Renewal Programs	0	61,062	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,400	6,400	6,200	6,362	6,362	0	0	0	0	0	15,716	15,716	15,716	15,678	15,678	15,716
Culverts (5yr Capital)																																
Total for Projects Allocated to Objective 8	$1,004	$2,408	361	400	302	429	151	423	0	142	0	0	0	0	0	0	0	117	106	232	0	0	0	0	0	0	0	0	0	351	0	0
Total for Projects Allocated to Objective 9	$0	$0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total for Objective 8 and 9	$1,004	$2,408	361	400	302	429	151	423	0	142	0	0	0	0	0	0	0	117	106	232	0	0	0	0	0	0	0	0	0	351	0	0
Total 5yr Capital Culverts	$1,038	$7,194	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367
Difference of IRP Asset Renewal minus (-) Total for Objective 8 and 9 (from 5yr Capital)			6	-33	65	-62	216	-56	367	225	367	367	367	367	367	367	367	250	261	135	367	367	367	367	367	367	367	367	367	16	367	367
Stormwater Culverts Asset Renewal Programs	65	4,918	6	0	65	0	216	0	367	225	367	367	367	367	367	367	367	250	261	135	367	367	367	367	367	367	367	367	367	16	367	367
Stormwater Structures (5yr Capital)																																
Total for Projects Allocated to Objective 8	$664	$860	350	150	200	220	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
Total for Projects Allocated to Objective 9	$0	$0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total for Objective 8 and 9	$664	$860	350	150	200	220	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
Total 5yr Capital Stormwater Structures	$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
Difference of IRP Asset Renewal minus (-) Total for Objective 8 and 9 (from 5yr Capital)			-350	-150	-200	-220	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
Stormwater Structures Asset Renewal Programs	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
Total Stormwater Asset Renewal Programs	65	65,981	6	0	65	0	216	0	367	225	367	367	367	367	367	367	6,767	6,650	6,461	6,497	6,729	367	367	367	367	367	16,083	16,083	16,083	15,694	16,045	16,083
Total Stormwater 5-yr Capital Projects	9,165	42,308	2,776	3,561	3,402	15,227	3,468	1,790	1,417	1,524	1,432	2,872	767	767	882	882	767	884	1,073	1,114	882	767	767	767	882	882	767	767	767	1,232	882	767
Total Stormwater Expenditure	9,230	108,289	2,782	3,561	3,467	15,227	3,684	1,790	1,784	1,749	1,799	3,239	1,134	1,134	1,249	1,249	7,534	7,534	7,534	7,611	7,611	1,134	1,134	1,134	1,249	1,249	16,850	16,850	16,850	16,927	16,927	16,850

Asset Renewal Costs

Aerotech-Airport Water Asset Renewal Costs (Halcrow)	NPV 3	NPV 30	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Water Treatment Facility (A)		$16,653	2201	2201	2201	2201	367	367	367	367	367	0	0	0	0	0	367	367	367	367	367	0	0	0	0	0	2201	2201	2201	2201	2201	2201
Pumping Station Airport (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
Pumping Station Aerotech (B)		$5,430	785	785	785	785	0	0	0	0	0	131	131	131	131	131	0	0	0	0	0	785	785	785	785	785	0	0	0	0	0	0
Water Distribution System (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
Aerotech-Airport Water Asset Renewal Costs	NPV 3	NPV 30	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Aerotech-Airport Water Treatment Facility (5yr Capital)																																
Total for Projects Allocated to Objective 8	$1,489	$1,741	140	1,435	140	140	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
Total for Projects Allocated to Objective 9	$0	$0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total for Objective 8 and 9	$1,489	$1,741	140	1,435	140	140	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
Total 5yr Capital Aerotech-Airport Water Treatment Facility	$4,212	$16,653	2,201	2,201	2,201	2,201	367	367	367	367	367	0	0	0	0	0	367	367	367	367	367	0	0	0	0	0	2,201	2,201	2,201	2,201	2,201	2,201
Difference of IRP Asset Renewal minus (-) Total for Objective 8 and 9 (from 5yr Capital)			**2,061**	**766**	**2,061**	**2,061**	**367**	**367**	**367**	**367**	**367**	**0**	**0**	**0**	**0**	**0**	**367**	**367**	**367**	**367**	**367**	**0**	**0**	**0**	**0**	**0**	**2,201**	**2,201**	**2,201**	**2,201**	**2,201**	**2,201**
Aerotech-Airport Water Treatment Asset Renewal Programs	**$2,724**	**$14,912**	**$2,061**	**$766**	**$2,061**	**$2,061**	**$367**	**$367**	**$367**	**$367**	**$367**	**$0**	**$0**	**$0**	**$0**	**$0**	**$367**	**$367**	**$367**	**$367**	**$367**	**$0**	**$0**	**$0**	**$0**	**$0**	**$2,201**	**$2,201**	**$2,201**	**$2,201**	**$2,201**	**$2,201**
Pumping Station Airport (5yr Capital)																																
Total for Projects Allocated to Objective 8	$0	$0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total for Projects Allocated to Objective 9	$0	$0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total for Objective 8 and 9	$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
Total 5yr Capital Airport Pumping Station	$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
Difference of IRP Asset Renewal minus (-) Total for Objective 8 and 9 (from 5yr Capital)			**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**
Pumping Station Airport Asset Renewal Programs	**$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**
Pumping Station Aerotech (5yr Capital)																																
Total for Projects Allocated to Objective 8	$0	$0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total for Projects Allocated to Objective 9	$0	$0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total for Objective 8 and 9	$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
Total 5yr Capital Aerotech Pumping Station	$1,503	$5,430	785	785	785	785	0	0	0	0	0	131	131	131	131	131	0	0	0	0	0	785	785	785	785	785	0	0	0	0	0	0
Difference of IRP Asset Renewal minus (-) Total for Objective 8 and 9 (from 5yr Capital)			**785**	**785**	**785**	**785**	**0**	**0**	**0**	**0**	**0**	**131**	**131**	**131**	**131**	**131**	**0**	**0**	**0**	**0**	**0**	**785**	**785**	**785**	**785**	**785**	**0**	**0**	**0**	**0**	**0**	**0**
Pumping Station Aerotech Asset Renewal Programs	**$1,503**	**$5,430**	**$785**	**$785**	**$785**	**$785**	**$0**	**$0**	**$0**	**$0**	**$0**	**$131**	**$131**	**$131**	**$131**	**$131**	**$0**	**$0**	**$0**	**$0**	**$0**	**$785**	**$785**	**$785**	**$785**	**$785**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Water Distribution System (5yr Capital)																																
Total for Projects Allocated to Objective 8	$168	$1,682	88	88	408	88	88	0	0	0	0	0	1,140	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0	0	0
Total for Projects Allocated to Objective 9	$0	$0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total for Objective 8 and 9	$168	$1,682	88	88	408	88	88	0	0	0	0	0	1,140	0	0	0	0	0	0	0	0	0	0	0	320	0	0	0	0	0	0	0
Total 5yr Capital Aerotech-Airport Water Distribution System	$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
Difference of IRP Asset Renewal minus (-) Total for Objective 8 and 9 (from 5yr Capital)			**-88**	**-88**	**-408**	**-88**	**-88**	**0**	**0**	**0**	**0**	**0**	**-1,140**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**-320**	**0**	**0**	**0**	**0**	**0**	**0**
Aerotech-Airport Water Distribution System Asset Renewal Programs	**$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**
Total Aerotech-Airport Water Asset Renewal Programs	**$4,227**	**$20,342**	**$2,847**	**$1,552**	**$2,847**	**$2,847**	**$367**	**$367**	**$367**	**$367**	**$367**	**$131**	**$131**	**$131**	**$131**	**$131**	**$367**	**$367**	**$367**	**$367**	**$367**	**$785**	**$785**	**$785**	**$785**	**$785**	**$2,201**	**$2,201**	**$2,201**	**$2,201**	**$2,201**	**$2,201**

Aerotech-Airport WW Asset Renewal Costs (Halcrow)	NPV 3	NPV 30	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Wastewater pumping station (A)		$1,225	156	156	156	156	26	26	26	26	26	0	0	0	0	0	156	156	156	156	156	0	0	0	0	0	26	26	26	26	26	26
Wastewater Forcemains (A)		$268	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	101	101	101	101	101	101
Wastewater collections system (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
Wastewater treatment facilities (A)		$11,223	400	400	400	400	0	0	0	0	0	400	400	400	400	400	2400	2400	2400	2400	2400	0	0	0	0	0	400	400	400	400	400	400
Aerotech-Airport Wastewater Asset Renewal Costs	NPV 3	NPV 30	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43
Wastewater Pumping Station (5yr Capital)																																
Total for Projects Allocated to Objective 8	$0	$0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total for Projects Allocated to Objective 9	$0	$0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total for Objective 8 and 9	$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
Total 5yr Capital Aerotech-Airport Wastewater Pumping Station	$298	$1,225	156	156	156	156	26	26	26	26	26	0	0	0	0	0	156	156	156	156	156	0	0	0	0	0	26	26	26	26	26	26
Difference of IRP Asset Renewal minus (-) Total for Objective 8 and 9 (from 5yr Capital)			**156**	**156**	**156**	**156**	**26**	**26**	**26**	**26**	**26**	**0**	**0**	**0**	**0**	**0**	**156**	**156**	**156**	**156**	**156**	**0**	**0**	**0**	**0**	**0**	**26**	**26**	**26**	**26**	**26**	**26**
Wastewater Pumping Station Asset Renewal Programs	**$298**	**$1,225**	**$156**	**$156**	**$156**	**$156**	**$26**	**$26**	**$26**	**$26**	**$26**	**$0**	**$0**	**$0**	**$0**	**$0**	**$156**	**$156**	**$156**	**$156**	**$156**	**$0**	**$0**	**$0**	**$0**	**$0**	**$26**	**$26**	**$26**	**$26**	**$26**	**$26**
Wastewater Forcemains (5yr Capital)																																
Total for Projects Allocated to Objective 8	$0	$0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total for Projects Allocated to Objective 9	$0	$0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total for Objective 8 and 9	$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
Total 5yr Capital Aerotech-Airport Wastewater Forcemains	$0	$268	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	101	101	101	101	101	101
Difference of IRP Asset Renewal minus (-) Total for Objective 8 and 9 (from 5yr Capital)			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**101**	**101**	**101**	**101**	**101**	**101**
Wastewater Forcemains Asset Renewal Programs	**$0**	**$268**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$101**	**$101**	**$101**	**$101**	**$101**	**$101**
Wastewater collections system (5yr Capital)																																
Total for Projects Allocated to Objective 8	$0	$0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total for Projects Allocated to Objective 9	$0	$0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total for Objective 8 and 9	$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
Total 5yr Capital Aerotech-Airport Wastewater Collections System	$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
Difference of IRP Asset Renewal minus (-) Total for Objective 8 and 9 (from 5yr Capital)			**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**
Wastewater collections system Asset Renewal Programs	**$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**
Wastewater Treatment Facilities (5yr Capital)																																
Total for Projects Allocated to Objective 8	$3,988	$5,877	2,160	2,006	11	210	210	0	210	0	210	0	210	0	210	0	210	0	210	0	210	0	210	0	210	0	210	0	210	0	210	0
Total for Projects Allocated to Objective 9	$0	$0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total for Objective 8 and 9	$3,988	$5,877	2,160	2,006	11	210	210	0	210	0	210	0	210	0	210	0	210	0	210	0	210	0	210	0	210	0	210	0	210	0	210	0
Total 5yr Capital Aerotech-Airport Wastewater Treatment Facilities	$765	$11,223	400	400	400	400	0	0	0	0	0	400	400	400	400	400	2,400	2,400	2,400	2,400	2,400	0	0	0	0	0	400	400	400	400	400	400
Difference of IRP Asset Renewal minus (-) Total for Objective 8 and 9 (from 5yr Capital)			**-1,760**	**-1,606**	**389**	**190**	**-210**	**0**	**-210**	**0**	**-210**	**400**	**190**	**400**	**190**	**400**	**2,190**	**2,400**	**2,190**	**2,400**	**2,190**	**0**	**-210**	**0**	**-210**	**0**	**190**	**400**	**190**	**400**	**190**	**400**
Wastewater Treatment Facility Asset Renewal Programs	**$0**	**$9,301**	**$0**	**$0**	**$389**	**$190**	**$0**	**$0**	**$0**	**$0**	**$0**	**$400**	**$190**	**$400**	**$190**	**$400**	**$2,190**	**$2,400**	**$2,190**	**$2,400**	**$2,190**	**$0**	**$0**	**$0**	**$0**	**$0**	**$190**	**$400**	**$190**	**$400**	**$190**	**$400**
Total Aerotech-Airport Wastewater Asset Renewal Programs	**$298**	**$10,526**	**$156**	**$156**	**$544**	**$346**	**$26**	**$26**	**$26**	**$26**	**$26**	**$400**	**$190**	**$400**	**$190**	**$400**	**$2,346**	**$2,556**	**$2,346**	**$2,556**	**$2,346**	**$0**	**$0**	**$0**	**$0**	**$0**	**$216**	**$426**	**$216**	**$426**	**$216**	**$426**

APPENDIX I

Tellus Statement

TELLUS INSTITUTE
for a Great Transition

STATEMENT CONCERNING HALIFAX WATER IRP DEVELOPMENT, RESULTS AND RECOMMENDATIONS

Prepared by:

James Goldstein, Tellus Institute

With input from:

William Brown, P.E., Wright Pierce and Daniel Sheer, Ph.D., P.E., Hydrologics

October 26, 2012

Background

Integrated Resource Planning (IRP) is a process used by utilities to develop long-range resource plans. It is distinguished from earlier planning approaches in that it considers both demand-side as well as supply-side resources in an integrated fashion, and it explicitly addresses uncertainty. An IRP effort generally results in the identification of a Recommended Resource Plan that describes the utility's strategy for meeting its resource needs over the planning period. Based on the Recommended Plan, a short-run Action Plan is developed, which identifies the tasks to be accomplished between the completion of the IRP and its subsequent review and modification.

The IRP developed by Halifax Regional Water Commission (Halifax Water or HW) was ordered by the UARB in December 2010 and governed by the Terms of Reference (ToR) subsequently approved by the Board. The ToR called for Halifax Water and its consulting team to work collaboratively with the UARB staff and consultants, and to consult with stakeholders. The UARB team of consultants led by James Goldstein of Tellus Institute and assisted by Ms. Heidi MacIntosh of the Board staff participated in the IRP process. Interested parties from government, the private-sector, and non-governmental organizations were provided with key IRP work products including: the ToR; HW's assumptions for alternative resource plan analysis; preliminary modeling results of alternative resource plans, including costs; and refined modeling results with a Recommended Plan. Input was received from a series of Technical Conferences and individual meetings with stakeholders and through extensive oral and written communications. Through this collaboration and consultation, the process requirements of the ToR were met.

This was the first IRP completed by Halifax Water. It was challenging for several reasons including: (1) the need to integrate planning across water, wastewater, and stormwater services; (2) the relatively recent (2007) transfer of responsibility for wastewater and stormwater services and assets from Halifax Regional Municipality to HW; (3) a compressed schedule; and (4) significant regulatory uncertainties such as those relating to future wastewater treatment facility requirements and the management of wastewater overflows, as well as other uncertainties such as the impacts of climate change on HW facilities and operations.

Summary of Halifax Water's IRP Effort

HW's development of the Recommended Plan involved a multi-phase analysis. First, Halifax Water identified three key drivers (growth, regulatory compliance, and asset renewal) and a set of IRP objectives, as well as major planning assumptions and uncertainties. These were the inputs from which HW developed an initial set of alternative resource plans to meet the water, wastewater, and stormwater service needs of the HW service territory through the year 2043. The alternative plans reflect the mid-range population growth projections that were recently updated by Halifax Regional Municipality.

HW's 28 initial resource plans were evaluated not only in terms of 30-year net present value (NPV) costs, but also the approach and timing of compliance, the degree of overflow control, the level of asset renewal investment, and the potential environmental and public health impacts. Based on this analysis, the HW team identified 18 intermediate plans worthy of further consideration. This involved the elimination of a number of plans as less environmentally sustainable, the modification of certain plans to ensure consistent wastewater treatment programs, plus the addition of plans to allow examination of the full range of options for overflow control plans.

The evaluation of the initial and intermediate plans revealed that asset renewal investments has the largest impact on cost of the three IRP drivers and accounted for the greatest variation in cost among the alternative plans. The HW team refined the asset renewal analysis, moving from a generic approach for all assets to one in which the risks and impacts of failure of each asset class were considered separately. Based on this assessment a single composite asset renewal strategy incorporating the risk-based preferred level of asset renewal for each asset class was developed. Applying the composite asset renewal strategy to the 18 intermediate plans resulted in a set of 10 refined alternative resource plans and considerably reduced the NPV cost variation among the remaining plans. From the refined plans four plans were shortlisted based on HW's assessment that a five-year schedule to meet current wastewater compliance requirements and a ten-year schedule to implement an overflow control strategy was achievable and appropriately balanced costs and risks.

From the four short-listed plans a Recommended Plan was selected that incorporates a ten-year timeframe to meet expected new compliance requirements concerning wastewater nutrient levels (of particular relevance to the non-Halifax Harbor Solutions Plants that discharge to sensitive freshwater bodies) and implementation of an enhanced overflow control program that addresses all overflow locations over the 30-year period. The implementation of the Recommended Plan implies resource requirements well beyond HW's existing levels of expenditure and a multiple of the proposed expenditures in its current Five-Year Capital Plan.

Assessment of Halifax Water's IRP

This IRP represents significant progress in HW's understanding of its existing system and its overall approach to planning. It reflects an intensive effort on the part of the HW team in the face of significant challenges and provides a solid foundation upon which to build a more

comprehensive and more fully integrated IRP. However, various data constraints and other uncertainties, outlined below, limited the extent to which the HW team was able to fully address certain key issues that could significantly impact the elements, timing, and cost of the Recommended Plan. As a result, HW's IRP process was unlike conventional IRP processes in at least two important respects. First, in a conventional IRP, each of the alternative resource plans considered meets all compliance requirements from day one and minimization of NPV costs is by far most the important driver in the selection of a preferred plan. Second, this minimization of NPV costs approach provides for a relatively straightforward and objective process that is fully transparent and easily understood.

In the case of this initial HW IRP, the data limitations outlined below required HW to utilize a complex sequence of steps in which considerable professional judgment was required and the criteria for selecting the Recommended Plan included consideration of factors beyond NPV costs. For example, because HW's wastewater treatment facilities are currently not in full compliance with Nova Scotia Environment (NSE) requirements, the timing and nature of wastewater system compliance was an important variable in HW's alternative plans. In addition, the lack of adequate information about existing system conditions as well as regulatory uncertainty led to the inclusion of other variables related to the degree of overflow control, the level of asset renewal investment, and potential environmental and public health risks. The consideration of multiple criteria in selecting the Recommended Plan not only made HW's initial IRP process more complex than a conventional IRP, the need for considerable professional judgment (e.g., concerning the appropriate timing of compliance, the degree of overflow control and related risks) made it less transparent.

The overriding limitation of the IRP relates to the lack of sufficient information. For example, while it is abundantly clear that the wastewater system is in need of substantial repair, upgrades and renewal, it is not possible using existing asset condition data to estimate such important measures as the likelihood of pipe failure or the impacts of overflows on receiving waters. Such information is necessary to identify optimal asset renewal strategies and ultimately the prioritization and timing of individual projects. We note that while this information could not be developed within the time frame of this initial IRP, HW has recently completed an Asset Management Assessment Program that provides a detailed multi-year roadmap to address this gap.

Similarly, sufficient information is not currently available to evaluate the effectiveness of demand management strategies, particularly for the wastewater system, such as inflow and infiltration (I/I) reduction and combined sewer separation. The initial level of analysis presented in the IRP suggests that I/I and other demand management efforts may very well be feasible and cost effective in some areas of the HW system. A better understanding of the potential flow reductions from demand management efforts could have important implications for the technical approach, magnitude and timing of the capital programs required to meet HW's service needs as well as for the asset renewal strategy. We note that HW has outlined a proposed I/I Reduction Pilot Program in the Recommended Plan (as well as an overall Wet Weather System Plan). We support this proposal and urge HW to develop a detailed scope of work, methodology and schedule to plan and implement the I/I Reduction Pilot Program in an expeditious manner.

Results from this effort are needed prior to commitment of major capital resources to accommodate growth.

Halifax Water has acknowledged several other important uncertainties and/or data gaps (e.g., stormwater quality assessment, climate change vulnerability assessment and adaptation plan, fiscal impact assessment, as well as the Regional Stormwater Functional Plan being conducted by HRM). These limitations need to be addressed to ensure HW's planning is comprehensive and fully integrated, provides robust strategies for cost effectively meeting its service requirements, and the benefits of the IRP are realized to the maximum extent possible.

While HW's initial IRP utilizes the best available information and does a credible job in addressing the purposes identified by the Board in its call for an IRP,[1] it does not fully meet them due to the lack of certain critical information described above. In particular, the initial IRP does not provide the Board with adequate information required to make informed decisions about specific major future capital programs. Thus, the results of the IRP should be considered provisional, not final, and subject to modification as the additional information required is developed and the Recommended Plan is modified as appropriate. HW recognizes these limitations in the introductory section of the IRP in its call for an adaptive management approach.

Based on the IRP results and Recommended Plan, HW prepared a short-term implementation plan covering the period 2013-2015. HW's implementation plan for this three-year period identifies expenditure levels far greater than existing levels and more than double of those in the current Five-Year Capital Plan for this three-year period. At the same time HW indicates that any significant increase in expenditure levels above the spending identified in the Five-Year Capital Plan for this three-year period is likely unrealistic from the viewpoint of the increased revenue required as well as Halifax Water institutional capacity. Thus, in addition to the technical analyses required to fill in data gaps, there is also a need for an institutional capacity assessment.

We acknowledge that the wastewater system in particular requires significant new investment for system repair, upgrade, and renewal. However, we take no position on the specific expenditure levels identified in the implementation plan for 2013-2015. The results of HW's initial IRP have identified several key data gaps and uncertainties and HW has proposed several programs to address these.

Recommendations Going Forward

HW's immediate priority should be to refine and detail an Action Plan, including milestones and a schedule, for conducting the programs it has proposed to fill the identified information gaps

[1] The purposes outlined in the UARB December 2010 decision were: to provide a framework for Halifax Water to evaluate alternative planning scenarios for its water, wastewater and stormwater services in an integrated fashion; to provide long-term direction for HW; to serve as an umbrella for which more detailed, facility- or program-specific capital investment analyses; to identify and plan for risks; and to provide the Board with the information and context it needs to make more fully informed decisions.

and to establish clear priorities among them. Based on the information currently available, we suggest the following activities should be to priorities:

1) implementation of the recently completed Asset Management Assessment Program roadmap;
2) refinement and implementation of the I/I Reduction Pilot Program and overall Wet Weather System Planning; and
3) an Institutional Capacity Assessment to identify the additional internal personnel and other resources HW requires to effectively oversee the implementation of these and the other proposed endeavors. Note that this activity has not been explicitly identified by HW in the initial IRP.

To preserve options and ensure that major programmatic expenditures are consistent with a more comprehensive and more fully integrated IRP, actions taken over the next three years should reflect a "no regrets" standard or address unavoidable needs. "No regrets" initiatives are those that are appropriate regardless of the outcome of the additional studies to be undertaken. Unavoidable needs are programs and projects that are firm regulatory requirements or those that address system safety or integrity. In particular, over this period vigorous implementation of the Asset Management Assessment Program and the I/I Pilot Reduction Program will begin to fill the most critical data gaps, provide the detailed information required for implementation of an optimal asset renewal program, and inform a more comprehensive and robust IRP.

We suggest the "no regrets" and unavoidable needs approach governs what happens until such time as the IRP is updated to reflect the outcomes of the priority studies. We recognize that this is a necessary but not sufficient basis for UARB decision-making on initiatives that entail expenditures before the IRP is updated, as the Board appropriately takes other factors into consideration as well.

The Action Plan we propose should include a schedule for HW's timely and thorough reporting on progress. Based on our involvement in the IRP process to date and the extensive planning needs summarized above, it will be important for the Board to track Halifax Water's efforts closely as it begins to implement the activities identified. To ensure progress on the priority planning efforts, we suggest continuation of the collaboration and consultation process that has served well in developing this initial IRP.