BENNERY LAKE WATERSHED

SOURCE WATER PROTECTION PLAN

April 2012

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1 INTRODUCTION

Halifax Water is responsible for monitoring and managing all activities that may impact water quality on eleven distinct source water supplies, in order to meet the needs of customers throughout the Halifax Regional Municipality. The following document serves as the Source Water Protection Plan (SWPP) for the Bennery Lake watershed, which uses surface water to service the Halifax Stanfield International Airport and Aerotech Business Park. This SWPP outlines: the current management of the source water area; risk assessment; and the management plan and monitoring program.

2 DESCRIPTION OF THE BENNERY LAKE WATERSHED

The following describes the Bennery Lake watershed location, ownership and geological characteristics, and how the source water supply is managed through provincial designation and regulations, the Bennery Lake Watershed Management Committee and its Terms of Reference, the Halifax Regional Municipality's land use planning by-laws and water supply treatment and facility.

2.1 Location and Ownership

The *Bennery Lake Watershed Protected Water Area* (PWA) is located north of the Bedford Basin, containing the communities of Grand Lake, and Goffs and situated between Highway 102, and the Aerotech Business Park. Following property boundaries and roads closest to the highest points of land rather than the natural watershed boundary delineated the PWA boundary. Though this method simplifies impacts on private parcels of land, it resulted in only 95% (645 ha) of the natural watershed area being protected by the Protected Water Area boundary (660 ha). The remaining 5% is protected through municipal planning and development Land Use By-Law Zones AE-4 and Protected Water Supply (PWS) (see

Appendix E: Halifax Regional Municipality Land Use By-Law Zone Map of Bennery Lake Watershed). Section Land Use Planning By-laws on page 8 further explains how the By-law Zones apply to these areas.

The watershed contains approximately 58 ha of surface water with land ownership consisting of approximately 10% Halifax Water lands, 30% Crown lands and 60% other private landowners. One hundred percent of the Bennery Lake shoreline is owned by either Halifax Water or the Nova Scotia Department of Natural Resources (NSDNR).

The PWA boundary was renewed in 2011 by an accredited land survey hired by Halifax Water. The lines will continue to be monitored yearly and updated as required.

2.2 Geological Setting

The Bennery Lake watershed sits on two geological rock formations: the Goldenville Formation, which sits under the northeastern portion of the PWA, and the Halifax Formation, which sits under the southeastern portion. The Halifax Formation is characterized by acid bearing slates.

The soils in this area are predominantly *Glaciofluvial outwash*; i.e., gravel and sand sediments deposited by pro-glacial melt-water forming outwash plains and terraces. The soil thickness in these areas is between 1 and 30 metres. The remaining areas, approximately 25%, are divided between *Till veneer* (subglacial erosion of sandy matrix and locally derived clasts deposited by ice including exposed bedrock and thicker till deposits; thickness estimated at 0.5 – 5 metres) and *Lacustrine* (sand silt clay sediments deposited from suspension in freshwater lakes, ponds and wetlands; thickness estimated between 1-5 metres). [1]

[1] Source: Nova Scotia Department of Natural Resources, Mineral Resources Branch, Open File Map ME 2011-001 D. J. Utting, April 12, 2011. Overview Map Showing Locations of Surficial Geology Maps of Halifax Metropolitan and

2.3 Designation

The *Bennery Lake Watershed Protected Water Area* (PWA) Designation (see) was enacted in 2003 by the Province of Nova Scotia, designating the area a water supply for Halifax Regional Municipality (HRM) customers at the Halifax Stanfield International Airport and in the Aerotech Business Park.

2.4 Regulations

In May 2006, the Halifax Regional Water Commission assumed responsibility for implementing the Bennery Lake PWA as described in the *Bennery Lake Watershed Protected Water Area Regulations* (see Appendix B: Bennery Lake Watershed Protected Water Area Regulations). Among the Designation Regulations are set requirements for Halifax Water to post signage throughout the protected watershed. They also regulate the use of lakes and watercourses for fishing and hunting; the potential risk activities within the watershed including fire, vehicles, vessels, forestry, chemical application, landfills, construction of corridors, road building and maintenance; and stipulate the requirement for soil erosion and sedimentation control.

Many of the Regulations require approval from an established *Bennery Lake Watershed Management Committee.*

2.5 Management Committee

Under Subsection 105(4) of the ***Environment Act S.N.S. 1994-95, c. 1***

> *The Minister may identify any qualified persons, including water or watershed advisory boards, committees or authorities, and request those persons to promote informed public participation, provide advice to the Minister respecting watershed management and undertake such aspects of watershed management as may be assigned to those persons by the Minister* ***1994-95, c. 1, s. 105; 2006, c. 30, s. 34.***

Under the *Bennery Lake Watershed Protected Water Area Regulations* (2003) the establishment of a committee is

> *"… to provide advice to the Minister and the Water Utility with respect to the management of the Bennery Lake Watershed."*

In 1998, the Bennery Lake Watershed Management Committee was established. The Committee's first tasks included designating the *Bennery Lake Watershed Protected Water Area* and developing regulations of activities within the PWA, which are now part of the *Environment Act*.

2.5.1 Terms of Reference

The Bennery Lake Watershed Management Committee Terms of Reference (ToR), developed and approved in August 2003, outline the responsibilities of the Committee as an advisory group to the Halifax Regional Water Commission (Halifax Water), the

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Surrounding Areas, Halifax and Hants Counties, Nova Scotia. Accessed: April 18, 2012 at http://www.gov.ns.ca/natr/meb/data/mg/ofm/pdf/ofm_2011-001_d447_dp.pdf.

Province of Nova Scotia, and the stakeholders in the management of the Bennery Lake Designated Watershed. The ToR underwent a review in 2008, mainly due to Halifax Water assuming responsibility of the PWA in 2006, and the merger of Halifax Water and HRM's wastewater and stormwater department in 2007. The ToR were amended in March of 2009 to reflect the changes in Halifax Water's responsibilities (see Appendix C: Bennery Lake Watershed Management Committee Terms of Reference)

The Board meets approximately twice a year, sometimes more often, depending on watershed activities. The current Board members and number of representatives (indicated in brackets) are comprised of:

- (1) Nova Scotia Department of Natural Resources
- (2) HRM Planning and Development Services
- (2) Halifax Water
- (1) General Public – District 2
- (1) Halifax Watershed Advisory Board
- (1) Bennery Lake Watershed private landowner
- (1) Technical Advisor (non-voting) from the Nova Scotia Environment Department

2.6 Water Supply and Treatment

Bennery Lake is the water supply for the Halifax Stanfield International Airport and the Aerotech Business Park. The Bennery Lake pumping station has three vertical high-capacity-turbine raw water pumps that draw water from Bennery Lake to supply a maximum of 8.62 million litres per day to the treatment plant (normal operation is about 1 million litres per day). The treatment process includes Manganese and sedimentation removal using dual media filtration. The maximum flow capacity is 0.10/m3/m2/min, the design capacity is 7 950 m3/day and the average production is 3 400 m3/day. As a result of the water treatment filtration process, filter backwash water is created and discharged to a settling lagoon alongside the Bennery Lake Treatment Plant, located inside the PWA. Treatment of the discharge water is done through a natural settling process, where the treated water flows naturally back to Bennery Lake down gradient of the pumping station.

2.7 Land Use Planning By-laws

The Bennery Lake watershed is located within HRM Planning Districts 14 and 17 (Shubenacadie Lakes) Land Use By-law (LUB) area, where four municipal By-law Zones apply: AE-4 (Aerotech Business), PWS (Protected Water Supply), R-1E (Residential Estate) and R-7 (Rural Estate). Within the PWA portion of the watershed, regardless of the By-law Zone, Halifax Water must be consulted before any approvals are permitted by HRM because provincial PWA regulations take precedence over municipal LUBs. In the watershed areas (5%) located outside of the PWA, however, Halifax Water's approval is not required and the applicable HRM Zoning By-laws take precedence.

2.7.1 AE-4 (Aerotech Business) Zone

By-law Zone AE-4 covers 91ha (~14%) of the PWA. This By-law Zone allows general business uses such as retail stores, manufacturing, service and personal service

uses, offices, banks and financial institutions, restaurants, outdoor display courts, indoor commercial recreational uses, service stations and automotive repair shops, parking lots, building supply outlets, warehousing and wholesaling, construction industries and contractors, transportation terminals, motels and hotels, all HRM AE-1 and AE-3 land use zone-permitted uses, automobile race tracks, and harness race tracks. To our knowledge, there is no new development occurring in the area.

2.7.2 PWS (Protected Water Supply) Zone

The PWS Zone covers 515 ha (78%) of the PWA. This zone allows for municipal water distribution or purification facilities, conservation uses, public parks, and single-unit dwellings.

2.7.3 R-1E (Residential Estate) Zone

Approximately 11 ha (1.5%) of the PWA is zoned R-1E. The R-1E Zone allows for residential and community uses that include single and two-unit dwellings, daycare facilities, home businesses and the keeping of certain hoofed animals in conjunction with permitted dwellings.

2.7.4 R-7 (Rural Estate) Zone

Approximately 43 ha (6.5 %) is zoned R-7. The R-7 Zone allows for residential, community and resource uses and covers. Residential uses include single- and two-unit dwellings, day care facilities, home businesses and pet care facilities. Allowable resource uses include forestry and agricultural, which includes intensive agriculture uses.

The HRM LUB watercourse setbacks and buffers conflict with the PWA regulation buffer zone; section 4.17 (Watercourse Setbacks and Buffers) of the LUB identifies a minimum setback of 20m except on slopes where the setback increases by 1m for each additional 2% slope, while the PWA dictates a minimum setback of 100m along Bennery Lake and 30m along all other lakes, tributaries and wetlands within the PWA. A member of HRM Planning Services sits on the Bennery Lake Watershed Management Committee, who is aware of the LUB regulations, advises HRM staff to consult with Halifax Water when plans are submitted for approval. All building permits issued will have a copy of the *Bennery Lake Watershed Protected Water Area Regulations* attached and be copied to Halifax Water.

More LUB details can be found on-line:
http://www.halifax.ca/planning/documents/PlanningDistricts14and17_LUB.pdf

3 RISK IDENTIFICATION AND ASSESSMENT

The following section describes the activities within the Bennery Lake watershed, their potential risks and contaminants, and the measures taken to protect the water supply.

Many of the risks are manageable because:

- approximately 95 per cent of the watershed is provincially designated as a PWA, which restricts the activities that are permitted in the watershed;
- approximately 40% of the Bennery Lake watershed land base is publicly controlled by either Halifax Water or the Crown;
- Halifax Water or NSDNR owns all of the land surrounding Bennery Lake; and
- an additional 100ha (approx.)on both sides of the PWA boundary is governed by HRM's Planning District 14 and 17 Protected Water Supply (PWS) Zoning By-law (see PWS (Protected Water Supply) Zone sections 2.7.2 on page 9 and 3.6.2 on page 16) further limits the activities permitted in the watershed.

The remaining 3 percent (approximately 16 ha) of the natural watershed area that does not fall under the PWA regulations or the PWS Zoning By-law is governed by the Planning District 14 and 17 AE-4 (Aerotech Business) Zoning By-law. Though this small area presents some increased risks due to the types of activities that are permitted in this Zone, through the involvement of HRM planning staff and good communication between HRM and Halifax Water staff, any risks to the water supply should be effectively diverted.

The greatest risk to the watershed is currently associated with the potential activities that could take place in the residential development in the Community of Grand Lake, located south of Bennery Lake and east of Sullivan's Lake. The proximity to metro and the Halifax Stanfield International Airport make Bennery Lake an attractive area to live. Other contamination risks that the watershed potentially faces include activities associated with operation of Halifax Water facilities, recreation, commercial development and forestry.

All raw water parameters analyzed fall within the respective Guidelines for Canadian Drinking Water Quality as determined by Health Canada, indicating that the current water supply exhibits good water quality characteristics, except where noted, under section 3.8.4: Source Water Quality Monitoring on page 20.

Potential risks identified and assessed in association with land use activities in the Bennery Lake watershed are outlined in the following subsections.

3.1 Forestry

Minor to moderate forestry activities have taken place in the north end of the watershed within the last 15 years; all private land related. Due to the potential exposure of acid-bearing slate and proximity to Bennery Lake, forestry activities are only planned as deemed necessary on Halifax Water and Crown lands.

Potential sources of contaminants due to forestry activities within the watershed include:

- Release of hydrocarbons in the event of a fuel or oil spill.
- Sedimentation of streams near roads following road construction, road maintenance or following a heavy rainfall.
- Negative effects resulting from the lack of Best Management Practices (BMPs) (see Appendix F) such as:
    - Incorrectly following provincial regulations such as minimum provincial-set buffers;
    - Poor choice in harvest timing on sensitive areas; and
    - Incorrect sizing and installation of culverts and bridges.

3.1.1 Permits, compliance and monitoring

Before forestry activities can take place within the PWA, the PWA regulations require that a permit must first be obtained from the Nova Scotia Department of Environment (NSE); however, the permit seeker must also seek approval from the Watershed Management Committee and Halifax Water. Compliance and monitoring is a joint responsibility of NSDNR and Halifax Water.

3.1.2 Brown Spruce Longhorn Beetle

In 2007 the Brown Spruce Longhorn Beetle (BSLB) Zone was expanded to include the Bennery Lake watershed. Minor BSLB colonies have been found on the outer fringes of the watershed. Halifax Water is working with government agencies responsible for BSLB monitoring i.e., NSDNR and the Canadian Food Inspection Agency (CFIA) and will consider taking mitigation measures if an outbreak occurs.

3.2 Mining, and Pits and Quarries

To Halifax Water's knowledge, no mining activities have taken place within the Bennery Lake watershed. There is an old pit, immediately North West of Dark Lake that was previously used for aggregate to build the road that now leads to the Bennery Lake water treatment plant. Currently, there is no mining, pit or quarry activity within the watershed.

The Bennery Lake watershed is made up of two major geological rock formations; the Halifax and Goldenville Formations. The Halifax Formation is characterized by acid-bearing slates that if exposed could have a major impact on water quality.

The PWA Regulations pertaining to Sediment and Erosion Control (section 16) do not allow the extraction of peat, gravel rock and minerals within the PWA and conflict with the *Mineral Resources Act Regulations (*described in section 3.2.1 below). In the event of exploration interests, the following subsections describe the restrictions that are currently in place for mining, and pits and quarries:

3.2.1 Mining

Minerals are defined under the *Mineral Resources Act* as a natural solid inorganic or fossilized organic substance prescribed under the *Act,* including any prescribed to be a

mineral, as well as gypsum and non-Crown limestone, but does not include ordinary stone, building stone, construction stone, sand, gravel, peat, peat moss, ordinary soil, oil or natural gas. The materials not considered to be minerals fall under the pits and quarry regulations, which are described in the next subsection, 3.2.2 on page 13.

Any mining activity is subject to the regulations contained in the *Environment Act (*NSE's responsibility*),* the *Mineral Resources Act (MRA)* (an NSDNR responsibility)*,* in the *Halifax Charter* and in any management strategies contained in municipal source water protection plans. Mining is regulated through the *Environment Act*'s *Activities Designation Regulations*. All mining subjected to these regulations require an Industrial Approval and an Environmental Assessment. While the *MRA* focuses on the minerals, how they are recovered, and how the land is reclaimed, it is the *Environment Act* through the Environmental Assessment process and associated regulations (e.g., water approvals and erosion and sedimentation control), which detail how to carry out activities with respect to the environment and communities.

In the "*event of a conflict between the Environment Act and any other enactment, this Act prevails*" (Sec. 6(1)). Furthermore, Section 16(1), of the *Bennery Lake Watershed Protected Water Area Regulations* states "[*n]o person is permitted to authorize or commence an operation to extract peat, gravel, rock or minerals within the Protected Water Area*." Considering the *Bennery Lake Watershed PWA Regulations* were created under section 106(6) of the *Environment Act* this puts the *Act* in conflict with itself.

Landowners are key players in mineral exploration. Mineral exploration and mining companies are expected to take precautions with respect to the environment and affected landowners. All prospectors and exploration companies must have landowner consent to access their land before any exploration or prospecting can occur.

In watershed areas, exploration companies and prospectors must consult with NSDNR and NSE before conducting any exploration activity. Section 73 of the *Mineral Resources Act Regulations* defines the regulations regarding access to municipal water supply watershed lands as:

(1) *In this section*

> (a) *"municipal water supply watershed lands" means lands that are indicated on the claim reference maps of the Department [DNR] as containing municipal water supply watersheds;*
>
> *(b) "regional exploration" means exploration with no ground disturbance, and includes prospecting, geological mapping and geochemical and geophysical surveys, and for greater certainty does not include seismic surveys in which explosives are used;*
>
> *(c)"detailed ground exploration" means exploration with ground disturbance, and includes drilling, blasting, test pitting, trenching, underground excavation, bulk sampling, stripping, road construction and watercourse alteration.*

(2) *A person who conducts regional exploration in municipal water supply watershed lands must notify the Registrar of the dates that the exploration will begin and end prior to commencing exploration.*

(3) *No person is permitted to undertake detailed ground exploration in municipal water supply watershed lands without first obtaining all necessary approvals from the Department of Environment.*

(4) The requirements of subsection (2) and (3) are in addition to any requirements established by the landowner or tenant or under a surface rights permit.

When any exploration is being considered on water supply area lands, in the interest of good relations, companies and prospectors are encouraged to consult with the water utility. The Minister of Natural Resources has the final say on who is issued a mineral exploration license.[2]

Currently, a potential Mineral Exploration License is pending renewal on a site situated immediately adjacent to and outside the PWA, between the southeastern corner of the PWA and the 102 Highway. Halifax Water actively monitors potential mining activities or expansions through the Department of Natural Resource website **http://gis4.natr.gov.ns.ca/website/nsgeomap/viewer.htm**.

3.2.2 Pits and Quarries

A pit is defined under the *Environmental Assessment Regulations* as:

> "*a ground disturbance or excavation made for the purpose of removing aggregate from the environment without using explosives*";
>
> whereas quarry activity "*means a ground disturbance or excavation made for the purpose of removing aggregate from the environment with the use of explosives.*"

Section 16(1) of the *Bennery Lake Watershed Protected Water Area Regulations* prohibits the removal of peat, gravel, rock and minerals, which may be associated with pits and quarrying activity, from inside the PWA.

3.3 Recreation

The growth of HRM and development of nearby communities have placed additional pressures on the Bennery Lake watershed when viewed as an ideal open area for a variety of activities that may be prohibited. As HRM continues to expand, recreationists seek out areas such as the watershed for walking, hiking, biking, hunting, geocaching and cross-country skiing. Halifax Water considers these activities, if practiced in moderation, to be low-risk and are permissible.

Other recreation activities are prohibited or restricted within the PWA as defined in the *Bennery Lake Watershed Protected Water Area Regulations*. Vessels, which are not allowed on any lakes or tributaries,

[2] As per section 28(2) of the Nova Scotia *Mineral Resources Act.*

swimming, garbage dumping and fishing, are prohibited. Open fires are restricted. Halifax Water closely monitors all activities and educates users of the watershed accordingly. The RCMP and the NSDNR task force conduct enforcement. The following subsections provide more details on the risks associated with various recreational activities and the steps taken to mitigate the impacts of such activities.

3.3.1 Swimming, Boating, and Fishing

Impacts from swimming, boating or fishing activities are considered to be very low-risk since they are prohibited by the PWA regulations; however, there has been evidence of illegal wharfs, vessels, and swimming in Bennery and Sullivan Lakes. Halifax Water continues to post signage and educate watershed users regarding the restrictions in place on recreational activities, and to conduct enforcement patrols.

3.3.2 Geocaching

Geocaching is a relatively new recreational activity that is growing. Pristine areas such as those found in our watersheds are a significant attraction for this type of recreation. Currently, there are close to 100 geocaches in Halifax Water watershed areas, though none has been identified in the Bennery Lake PWA. There are 17 different types of geocaching; while about 90% are "traditional", the other types are described at http://www.geocaching.com/about/cache_types.aspx.

3.3.3 Off-highway Vehicles (OHVs)

Use of Off-highway Vehicles (OHVs) such as All-Terrain Vehicles (ATVs), trail bikes and snowmobiles can cause environmental damage that may eventually impair raw water quality. Depending on the activity; e.g., machines going across streams and causing them damage, or an activity directly involving the lake water, as in when a machine goes through ice, the source water supply may be quickly impaired. Halifax Water does not allow these types of activities on its lands.

3.4 Motor Vehicle Use

Due to the risk of fuel spills and sedimentation issues associated with vehicle use on unpaved surfaces, motor vehicle use within the watershed is currently restricted, but only on lands owned by Halifax Water for permitted activity. To fortify the restrictions around the use of motorized vehicles throughout watershed lands owned by Halifax Water, barriers and gates are maintained at key access locations. These locations are well posted with signs indicating that it is illegal to use any motor vehicle on Halifax Water lands without authorization.

3.5 Roads

Roads within the Bennery Lake watershed are mainly under controlled access by Halifax Water; however, there are a small number of publicly accessible roads, namely Cindy Drive and Hartland Drive, and a small section of roads associated with the Aerotech Business Park controlled by the Nova Scotia Department of Transportation and Infrastructure Renewal (TIR). These roads are considered to be low-risk to Halifax Water because they are not major transportation routes.

In the event of a spill of any substance that might pose a risk to the watershed, Halifax Water's *Emergency Response Manual* will be followed. A copy of the manual can be found at the Bennery Lake Treatment Plant or the main office located at 450 Cowie Hill Road in Halifax.

3.5.1 Road Construction

Section 7 of the *Bennery Lake Watershed Protected Water Area Regulations* limit the amount of exposed roadway sub-base and provide timing restrictions around road construction and right-of-way clearing.

3.5.2 Road De-icing

Road de-icing agents applied on public roads and highways may increase surface water chloride concentrations due to accumulation of chloride entering surface waterways through stormwater runoff events. Road de-icing application standards for TIR are found in the department's Highway Maintenance Standards (July, 2009), Chapter 6: Snow and Ice Control, pp. 98-107 found here: http://gov.ns.ca/tran/publications/Highway%20Maintenance%20Standards%20Manual.pdf. The TIR Standards states "[t]he use of salt in environmentally sensitive areas is strictly prohibited" (p. 98).

As per the PWA regulations, the use of a de-icing agent such as road salt on any road or driveway within the PWA is prohibited and is posted as such. Winter road maintenance routes provided by TIR to Halifax Water indicate that sand-only is to be applied to these roads. Due to the location and flat terrain of these roads, they are considered very low risk for impact to water quality. For monitoring purposes, Halifax Water has established a sampling point at Sullivan Pond Brook Inlet, which runs into Bennery Lake, to monitor road effects from November to April, as part of its watershed monitoring program.

3.5.3 Controlled Access

Halifax Water maintains gated control of the treatment plant, pipeline and forest access roads. A second gate with surrounding fence further restricts the treatment plant. In the event of any emergency on these roads, Halifax Water's *Emergency Response Manual* will be followed, a copy of which can be found at the Bennery Lake Treatment Plant or the main office located at 450 Cowie Hill in Halifax.

3.5.4 Water Crossing Inventory

In 2002, a yearly monitoring-and-maintenance program was developed and implemented for water crossing structures (culverts and bridges) and controlled by Halifax Water. Data gathered included GPS coordinates, as well as structure type, dimensions, condition and effectiveness. This information identifies where and how water is crossing the drivable road system and where unmapped streams are located along roads. Knowing the condition and effectiveness of crossings provides a basis for a yearly monitoring-and-maintenance program to repair or replace existing drainage structures. In addition, the inventory has pinpointed where culverts need to

be installed to maintain natural drainage patterns or to improve the control of runoff and ditch water.

The Bennery Lake watershed has a very limited water-crossing inventory, which was updated during the summer of 2009 by Halifax Water staff. The update showed no major repairs or potential threats to water quality.

3.6 Land Use Plan Zoning

Although future municipal land-use planning exercises may influence which activities can occur within the watershed, HRM recognizes the need to restrict the permissible activities defined by the Land Use Planning By-law Zones, to greatly reduce the risks to the watershed. Section 2.7 Land Use Planning By-laws on page 8, describes the land use activities currently permitted in each of the District 14 and 17 By-law Zones within the watershed; i.e., Aerotech Business (AE-4), Protected Water Supply (PWS), Residential Estate, and Rural Estate (R-7). The following subsections define the assessed risks that each By-Law Zone presents to the watershed.

3.6.1 AE-4 Commercial Development Land-Use Zone

Presently there is no risk in this Zone, as no commercial development has taken place within the watershed. The AE-4 By-law Zone restricts the type and extent of commercial development. Although the permit applicant must contact DFO, NSE and NSDNR prior to approval, there is no mention in the By-law wording that the permit applicant or HRM must contact the water utility for comment.

3.6.2 Protected Water Supply (PWS) Land-Use Zone

In addition to the PWA regulations, a Protected Water Supply (PWS) Zone By-law has been created for the District 14 and 17 District Planning Area. Even with the layered restrictions and regulations, residential build-up remains the greatest risk to water quality within the PWS By-law Zone, since it permits single-unit dwellings. As long as residential areas exist within the Bennery Lake watershed, they will continue to pose risks, albeit low, to the source water. Potential risks include improper use or disposal of household products, garbage dumping, infilling, recreational pressures, washing of vehicles in close proximity to tributaries, the use of fertilizers, septic tank failure, and failure of furnace oil tanks.

The municipal PWS By-law does not require a development permit applicant to contact DFO, NSE, DNR, the water utility, or the Watershed Management Committee for comments. Halifax Water's awareness of development permit applications currently relies on consistent communication between Halifax Water staff and HRM development officers. An HRM Development Office representative has a seat on the Bennery Lake Watershed Management Committee.

3.6.3 R-1E and R-7 Land-Use Zones

Presently, Residential Estate (R-1E) and Rural Estate (R-7) Zones overlap with the Bennery Lake PWA; however, a closer look at the topography and contour

lines reveals that these zones may not fall inside the watershed boundary, possibly due to the simplicity of the boundary established when the PWA was designated. Regardless, Halifax Water does not plan to attempt to alter the PWA boundary since both of these zones allow for activities such as intensive agriculture and the keeping of hoofed animals that could pose a risk to water quality. If these Zones remain inside the PWA boundary, the provincial regulations take precedence and require that Halifax Water must be consulted, thereby greatly reducing the risk these activities may otherwise present to the to the source water; whereas both R-1E and R-7 by-laws do not require the permit applicant to contact DFO, NSE, NSDNR, the water utility or the Watershed Management Committee for comments.

Halifax Water will pursue HRM to amend the Shubenacadie Lakes Planning District By-laws to include wording regarding contacting the Water Utility and the Bennery Lake Watershed Management Committee for comments prior to building approval.

Further land use planning by-law information can be found on the Halifax Regional Municipality website http://www.halifax.ca/planning/map.html .

3.7 Municipal Land Use Planning and Development Activities

The land use activities conducted by Halifax Water and others in the Bennery Lake watershed area; the provincial regulations and the zoning by-laws that regulate existing and potential land use activities in the watershed; the potential contaminants and risks associated with the permissible land use activities; and the measures taken to protect the water supply are described below.

3.7.1 Commercial Activities

Currently there are no commercial activities taking place within the watershed area. However, there is potential for commercial activity as described in detail in the Land Use Planning By-law sections 2.7.1 and on page 8 and 3.6.1 on page 16. There is particular concern regarding the activities in these By-law Zones:

Zone AE-4

Commercial land use activities such as automobile and harness race tracks, service stations and parking lots have the potential for pollution associated with petrochemicals, hydrocarbon and nutrient loading.

Zone R-7

Forestry, agriculture and intensive agricultural uses are permitted in this area of the watershed and have the potential to negatively impact the watershed through erosion and sedimentation, and nutrient loading associated with runoff events.

3.7.2 Residential

A residential area that exists within the Bennery Lake PWA, located in the community of Grand Lake, poses the greatest land use activity risk to the watershed. This community is situated in District 14's and 17's PWS By-law Zone (described in sections 2.7.2 PWS (Protected Water Supply) Zone and 2.7.3 R-1E (Residential

Estate) Zone on page 9 and in section 3.6.2 Protected Water Supply (PWS) Land-Use Zone on page16) and governed by the Marine Drive Valley and Canal Community Council. There are 35 residential properties with road access (including five properties which straddle the PWS boundary line, eight of which are without dwellings). Twenty-two of these residential properties fall under both the PWS Zone By-laws and the provincial PWA Regulations. The remaining 13 properties fall under only the PWS Zone By-laws.

The PWS By-law states that the only type of residential units permitted are single-family dwellings in addition to parks and municipal water distribution systems.

Residential uses are also permitted in the R-1E and R-7 and By-law Zones (described in more detail in sections 2.7.3 R-1E (Residential Estate) Zone on page 9 and 2.7.4 R-7 (Rural Estate) Zone on page 9 and section 3.6.3 R-1E and R-7 Land-Use Zones on page 16). Currently there are no residences in this area and none planned though the potential is there.

Residential areas present among the highest risk factors for source water contamination due to:

On-site Septic Systems

Properties located in the PWA rely on on-site septic systems for the treatment of domestic wastewater. Microbial contamination risk associated with on-site septic systems is considered to be a contamination risk factor. Wastewater can impact the surface water supply if: septic systems are improperly installed or maintained; deleterious materials enter the system; there is surface damage to the drainage field; or contaminants leach from the septic system to surface water through ground saturation and high stormwater flow periods.

Home Heating Fuel

Many homes in this area rely on oil-fired heat. Tank spills or failure could pose a risk to the water supply well, regardless of the PWA Zone, due to the potential persistence and movement of petroleum products in a fractured bedrock aquifer. Home heating oil tanks that are exposed to weather, are not installed or maintained properly, or have shifted at their base from frost action have the potential to leak, causing serious environmental problems and property damage.

Household Chemicals

The potential use of household chemicals associated with subdivision residences including persistent, mobile chemicals (e.g., fertilizers, private road and driveway de-icing agents, petroleum products, pesticides, solvents, and other chemicals) could present a risk to surface water quality if repeatedly used in great enough quantities.

3.7.3 Agriculture Uses

Where agriculture uses and intensive agriculture uses are permitted in By-law Zones R-7 and RE-1 which allow the keeping of hoofed animals for personal use, and By-law AE-4 which allows harness racing, there is a potential risk to the PWA due to

leachate from manure piles, or farmland pesticide and fertilizer application runoff flowing into surface waterways within the Bennery Lake watershed. Currently the By-law states that for both Agricultural and Intensive Agriculture Uses (as per sections 11.5(c)(iii) and (e), and 11.6 (b)(ii) respectively) any building intended for agricultural uses must satisfy the requirement whereby "a minimum separation distance of 300 feet (91.5 m) shall be maintained from any watercourse or potable water supply….". Furthermore, section 11.5(e) states "[a]ny disposal area for livestock waste shall be located a minimum distance of 300 feet (91.5 m) from any watercourse or potable water supply…".

Given that the extent of By-law Zones R-7 and RE-1 only cover a total of 50.5 ha (8% of the total PWA) and that a closer look at the topography and contour lines reveal both of these zones may not fall inside the natural watershed boundary (see

Appendix E: Halifax Regional Municipality Land Use By-Law Zone Map of Bennery Lake Watershed); and that there are no existing agricultural uses in the PWA, the risk of potential impacts from agricultural uses is minimal.

Additional agricultural use risk factors include greenhouse operations due to potential runoff containing pesticides and chemical fertilizers.

Conversely, By-law Zone AE-4 (Aerotech Business), which covers 91ha (14%) of the PWA and a slightly greater percentage of the natural watershed area, presents a greater risk of contamination from manure piles should harness racing be permitted in this Zone.

3.8 Water Supply and Treatment Plant

Bennery Lake supplies potable water to the Aerotech Park, the Airport and the HRM wastewater treatment facility located in the Aerotech Park. The following subsections briefly describe the water supply and treatment plant infrastructures including the settling lagoon, power transformers, sampling specifications, chemical use and the service specifications.

3.8.1 Treatment Plant and Pumping Station

The Bennery Lake Water Supply Treatment Plant accesses its water supply from Bennery Lake through an intake pipe located 167m from lakeside to the raw water pumping station. The Bennery Lake pumping station has three vertical high-capacity turbine raw-water pumps that draw water from Bennery Lake, to supply a maximum of 8.62 million litres per day through 237 m of pipe to the treatment plant (normal operation is approximately one million litres per day). Each pump uses greased packed bearings, instead of oil, which is considered to pose little to no risk of water contamination. Potable water is pumped 2.5 km to the pumping station which distributes the water supply to customers.

3.8.2 Settling Lagoon

As a result of the water treatment process, filter backwash water is created and discharged to the settling lagoon that is approximately 0.1 ha in size and situated alongside the Bennery Lake Treatment Plant in the PWA. Treatment of the discharge

water is through a natural settling process where the treated water flows naturally back to Bennery Lake down gradient of the pumping station. Halifax Water is developing a five-year lagoon-maintenance scheduling program to meet NSE discharge guidelines.

The risk to water quality, although low, is due to the creation of discharge water containing levels of aluminum, iron and manganese that are greater than the ambient concentrations within the watershed. Halifax Water is currently conducting monthly testing to establish baseline information that will be used to determine optimal future treatment processes (see section 3.8.4: Source Water Quality Monitoring Program below on this page).

Halifax Water also hired an environmental consultant in 2009 to conduct an intensive receiving water study of the backwash lagoon. The information gathered, determined that the receiving waters were capable of supporting fish and other invertebrates.

3.8.3 Power Transformer

Nova Scotia Power (NSP) maintains a transformer outside of the water treatment plant. The transformer contains 900 litres of oil and is located on an open concrete pad that does not have a containment system in place. In addition to NSP's six-month inspections, Halifax Water staff visually inspects the transformer on a daily basis and immediately reports any leaks to NSP.

3.8.4 Source Water Quality Monitoring

There are three stream water quality in-situ parameter sampling sites (BG1, BG2 BG3) where water is collected monthly for testing in the Bennery Lake watershed: Sullivan's Pond Brook Inlet to Bennery Lake, which is accessible through the woods from Brookhill Estates in Grand Lake; Dark Lake Brook Inlet to Bennery Lake; and the Lagoon Outfall Tributary respectively. The latter two are accessible from Bennery Lake Road (see for details).

The raw water samples that are collected are measured according to the Water Quality Guidelines for the Protection of Aquatic Life (WQGPAL) as they provide the best parameters for source water characterization in its natural state. Bathometry samples are also collected in the spring, summer and fall, from the deepest part of the lake, in close proximity to the mouth of the intake pipe.

Except as described below, raw water quality data collected at the Bennery Lake sample points indicates that the water quality meets or exceeds the Guidelines for Canadian Drinking Water Quality (GCDWQ) as determined by Health Canada, in addition to the WQGPAL parameters, indicating that the current supply exhibits good water quality characteristics.

E. coli

The 2011 sampling season saw increased concentrations of *E. Coli* at the BG1 and BG2 locations during June, July and August. This was likely the result of the heavy rainfall during this time. Since then, the *E. coli* concentrations have returned to baseline conditions.

Treatment Plant Backwash Water

BG3 continues to exhibit higher concentrations of almost all parameters as it contains the backwash water from the water treatment plant. Turbidity, TSS, Total phosphorus, and metals continue to have the highest concentrations; Aluminum, Calcium, Manganese, and Sodium continue to be introduced back into the natural environment at 3 to 5 times their natural limit. Halifax Water had a treatment plan in place in 2011 to reduce the backwash water prior to leaving the lagoon, however, due to unforeseen complications the plan has been delayed until 2012. The plan is to have the treatment process completed by the end of 2012. Halifax Water will continue to collect water samples at BG3 to see if the water quality improves.

Trophic Status

The Deep Lake Monitoring program continues to support the scientific evidence that Bennery Lake remains in a mesotrophic state. The Bennery Lake watershed remained relatively undisturbed in 2011, however, water quality data gathered during the same time period further suggests the natural soil conditions and geological characteristics of the region continue to affect water quality as Aluminum, Iron and Manganese remain at higher concentrations.

3.9 Chemical Use

Chemical application is a cost-effective tool often used by individuals and companies to control unwanted vegetative species, fungus, and insects. Under the *Bennery Lake Watershed Protected Water Area Regulations*, the use of pest control products and biocides are not allowed unless the use is related to the operation of the Bennery Lake water treatment plant and is carried out under the direction of the treatment plant supervisor, or in the event of fire. To report the use of any chemicals, Halifax Water is to be contacted at 902-869-4304 or 902-490-6940. The following describes how chemical use is handled inside the PWA:

3.9.1 Potential Use Beyond Halifax Water Control

Approximately 34 ha (~5%) of the watershed are located outside the PWA where chemical use may be permitted through provincial and/or municipal permitting and regulations. Although this is a small land area, the use of any chemical within the watershed still presents a risk to water quality.

Halifax Water requests that landowners do their part to protect the watersheds and to contact their municipal office or Halifax Water for more information about where their watershed boundary is located.

3.9.2 Bennery Lake Water Treatment Plant Use

The use of chemicals for the Water Treatment Plant are permitted and carried out under the scrutiny of the Supervisor. Approximately 9000 litres of aluminum sulphate is delivered three times per year, and 200 litres of sodium

hypochlorite and sodium hydroxide are delivered four times per year to the Bennery Lake Treatment Plant. Deliveries are made by tractor-trailer via the water treatment plant road off Highway 102. Additional chemicals used continually in the water treatment process, such as lime, polyphosphate, and potassium permanganate, are delivered on a regular basis for plant operations. Diesel fuel for the emergency generator is also delivered as required.

In the event of an emergency, Halifax Water's *Emergency Response Manual* outlines the steps that are to be followed. A copy of the manual can be found at the Bennery Lake Treatment Plant or the main office located at 450 Cowie Hill Road in Halifax.

The risks of chloride concentrations attributed to Halifax Water's use of chloride in its water treatment process, may be remedied with adjustments to the concentration levels.

3.9.3 Forest Fire

In the event of a forest fire, the Department of Natural Resources has informed Halifax Water that Silv-Ex and/or FIRE-TROL Fire Foam 104 will be used for fire suppression as a very last resort. The material safety data sheets indicate that the application of these products poses very little risk of environmental impact because they are readily biodegradable and exhibit little to no biotic toxicity when used according to the manufacturer's recommendations. In the event of a fire in the watershed, the benefits of using the fire suppression chemicals described above outweigh the risk to water quality. Halifax Water has provided written communication to NSDNR indicating they must conduct a follow-up water quality assessment when either chemical is used in the event of a fire inside the watershed. Regardless, in the event of a fire emergency, Halifax Water's *Emergency Response Manual* will be followed, and target-based water quality sampling will be conducted accordingly (see section 5.4.5: Targeted-Based Sampling on page 45). A copy of the manual can be found at the Bennery Lake Treatment Plant or the main office located at 450 Cowie Hill Road in Halifax.

3.10 Emergencies

In the event of an emergency, Halifax Water's *Emergency Response Manual* must be followed. A copy of the manual can be found at the Bennery Lake Treatment Plant or the main office located at 450 Cowie Hill Road in Halifax. For public reporting, signage with contact information is located throughout the watershed.

The following emergencies are considered to be greatest threat to water quality:

3.10.1 Natural Disasters

During forest management planning, Halifax Water and NSDNR target high-risk forest stands prone to natural disasters such as fire, insect, disease and wind damage. This type of management method reduces the potential of water-crippling events from taking place within the watersheds and promotes a vibrant healthy forest:

Forest Health

The Bennery Lake watershed forest is in relatively good health. Due to its low-lying topography, it has experienced minimal wind damage over the last few decades minimizing the likelihood of forest fire due to an accumulation of dead and dying wood.

The Brown Spruce Beetle

The Brown Spruce Longhorn Beetle *(BSLB)* is a species recently introduced to Nova Scotia that is causing major damage to mature softwood stands throughout the province. In 2007 efforts by the Canadian Food Inspection Agency (CFIA) have changed from "*eradication*" to a *"slow the spread*" approach. It has been only within the last few years that small pockets of the BSLB have been found on the outer fringes of the Bennery Lake watershed. Halifax Water will continue to work with applicable government agencies to monitor and develop an action plan to control the spread of the BSLB if needed. There is a high probability that the BSLB will spread mainly due to the presence of the BSLB-preferred host species (spruce) throughout the watershed. Halifax Water's main course of intervention would be to harvest and remove the infected trees to a certified processing facility. If an outbreak of BSLB were to occur in the watershed there is a high probability that infected areas would become a high-risk fire hazard as the beetle consumes the forest. This in turn could impair the raw water quality of Bennery Lake.

3.10.2 Fire

Fires of due accidental causes are a threat to the watershed. The risk assessments of these sources are described below.

Forest fire

Forest fire reporting protocol is found in the *Bennery Lake Watershed Protected Water Area Regulations*; procedures fall under the *Forest Fire Protection Regulations* found http://www.gov.ns.ca/just/regulations/regs/fofire.htm. Also, 911 Emergency Response information signs are strategically placed throughout the watershed.

Additionally, through collaboration with NSE, DNR has developed an in-house forest fire fighting policy for municipal drinking water supply areas, which is currently in draft form. The policy includes firefighting protocol and contact information that is applicable to all municipal locations in the province.

Watershed Operations

As part of the BMPs, contractors hired by Halifax Water must complete a yearly review of the fire regulations before startup when operating inside the watershed during fire season; daily monitoring of the provincial fire index and appropriate operating restrictions must be followed; fire equipment must be maintained on-site; and equipment must be checked daily.

In case of a fire within the water-treatment plant, Halifax Water's *Emergency Response Manual* will be followed. A copy of the manual can be found at the Bennery Lake Treatment Plant or the main office located at 450 Cowie Hill Road in Halifax.

3.10.3 Aircraft Disaster

The Bennery Lake watershed is located within the Halifax Stanfield International Airport's flight path for arrivals and departures. However, the probability of an aircraft disaster happening inside the watershed is low. Transport Canada has jurisdiction over flight routes and the response to an aircraft disaster. If such a disaster occurs, Halifax Water will cooperate with Transport Canada, but will follow Halifax Water's *Emergency Response Manual* to continue operations during the emergency. A copy of the manual can be found at the Bennery Lake Treatment Plant or the main office located at 450 Cowie Hill Road in Halifax.

3.10.4 Malicious intent

Security at Halifax Water is taken very seriously: signage has been posted; fences and gates have been constructed and maintained; security cameras have been installed at main operating locations; regular patrols are performed; and a water-sampling program has been developed and implemented to ensure the safety of HRM's drinking water. Halifax Water has completed an industry-developed risk assessment for its facilities and security measures. The procedures were designed, based on this assessment, to reduce the probability, increase the likelihood of detection, and to lessen the impact of an event. In the event an emergency resulting from malicious intent, Halifax Water's *Emergency Response* Manual will be consulted to continue operations during the emergency. A copy of the manual can be found at the Bennery Lake Treatment Plant or the main office located at 450 Cowie Hill Road in Halifax.

As part of the Airport RCMP terrorist unit located at the Halifax International Stanfield Airport, Halifax Water is kept apprised of watershed unit area lands.

3.11 Risk Activity Potential and Contaminants

Table 1 identifies the known and potential activities that take place within the watershed and summarizes the potential contaminants involved, point or non-point source pollutant and potential impact.

Table 1: Summary of existing and potential activities within the Bennery Lake watershed

Activity	Potential Contaminant	Point Source	Non-Point Source	Potential Impact
Forestry Operations: Harvesting, silviculture, road maintenance and construction.	Fuel, hydraulic fluid, Sedimentation of streams	X		Oil, fuel or hydraulic spill would likely be limited to immediate area as there are usually limited quantities of these fluids, unless there was direct discharge to the stream. Sedimentation of the stream may occur if culvert fails and road is washed away. Exposure of acid-bearing slate could impact lake pH-levels. BMPs do typically help control impacts from road construction and maintenance.
Mining, and Pits and Quarries: Regional or ground exploration, prospecting and quarrying.	Sedimentation of streams; chemical spills	X		Erosion and sedimentation of waterways that lead to Bennery Lake due to groundbreaking activities associated with mining exploration, prospecting and quarrying; chemical contamination is resulting from potential spills or use of chemicals in the ground exploration activity that may leach into waterways leading to Bennery Lake.
Recreation: swimming, boating and fishing, geocaching, OHVs, and pedestrian activities.	Fuel, sedimentation of streams, garbage		X	Fuel from boats or OHVs in streams and lakes, stream-bank erosion and sedimentation of streams from OHV use. Pedestrian activity associated with hiking or land-based geocaching is light impact and sometimes results in garbage left behind.
Roads: Public use, Halifax Water controlled access, water crossings	Automotive fluids, dangerous goods, road salt, water-treatment chemicals, petroleum products	X		Depending on retention time, there may be direct contamination of Cindy Drive Brook and eventual shutdown of plant. Oil, fuel, hydraulic or caustic spill would likely be limited to immediate area, as there are usually limited quantities of these fluids, unless there was direct discharge to stream.
Land-use planning and development activity: Halifax Regional Municipality land-use by-law zoning; residential; commercial; and agricultural.	Automotive fluids, erosion and sedimentation due to soil exposure activity; commercial and residential chemicals; nutrients and bacteria from septic system failure or agricultural activity; petroleum products from fuel spills.		X	Currently there is no risk of commercial or agricultural contamination as these activities have not been established inside the watershed; however, the risks are there if they are permitted inside the watershed. Sediment from exposed soils and runoff. *E. coli* and nutrient matter could make their way into the water source through septic overflows or stormwater runoff from contaminated sites, potentially increasing levels in Bennery lake.
Water Supply and Treatment Plant: Bennery Lake Pumping Station and settling Lagoon.	Diesel fuel, lube oil, oil from NSP transformer. Water treatment by-products.	X		Immediate shutdown of treatment facility if direct spill to source water. Elevated concentrations of aluminum, iron and manganese are being re-introduced back into Bennery Lake.
Chemical use: Treatment plant; forestry activities outside the watershed, forest fire suppressants, commercial, residential.	Caustics, diesel fuel; forest and home and garden biocide, fungicide, insecticide, herbicide use; forest fire suppressants; commercial products	X		Forestry chemical operations outside Halifax Water protected lands. Residential and commercial use in non-protected PWA. Fire suppressant use in watershed.
Emergency: Natural disaster	Fire, wind, insects		X	Soil erosion, increased turbidity.
Emergency: Aircraft disaster	Aircraft and debris from crash ending up in drinking water	X		Total shutdown of water-treatment plant and long-term damage to the water supply.
Emergency: Malicious intent	Terrorism, vandalism, sabotage	X		Total shutdown of water-treatment plant and long-term damage to the water supply.

3.12 Identified Issues Prioritized

Table 2 shows the scale of problem and priority ranking of the known and potential activities within the watershed. Issues of priority concern are containment of spills at pumping station, hydrocarbon spills associated with harvesting activities, and development in the Aerotech Business Park.

Table 2: Scale of existing and potential problems and priority rank of activities within the Bennery Lake watershed

Activity		Contamination Issue	Scale of Problem	Priority Rank
Forestry operations: Harvesting, silviculture, road maintenance, construction.		Fuel and hydraulic fluid	5	4
		Sedimentation of streams	5	4
		Exposure of acid bearing slate	3	3
Mining, Pits and Quarries		Sedimentation of streams	5	5
		chemical spills	5	5
Recreation: swimming, boating and fishing, geocaching, OHVs, and pedestrian activities.		Fuel	2	2
		Sedimentation	3	1
		Garbage	5	5
Roads		Fuel, automotive fluids, dangerous goods	5	1
Land Use:	Aerotech Business Park	Fuels	5	1
		Chemicals	5	1
		Soil exposure	3	1
		Septic field failure	3	2
	Residential areas	Septic field failure	3	2
		Automotive waste and spills	3	2
		Furnace oil tank failure	3	2
		Exposed mineral soil	3	3
		Chemicals	5	1
	Agriculture	Manure fertilization	5	5
		Pesticides	5	5
Water Supply and Treatment:	Bennery Pumping Station	Diesel, lube oil, discharge from transformer	2	1
	Bennery Settling Pond	Water treatment by products	3	2
Chemicals:		Forestry	5	4
		Caustics	4	2
		Residential	5	1
		Diesel	4	2
Emergency :	Natural disaster	Fire	3	1
		Wind	3	3
		Insect	5	5
	Aircraft disaster	Aircraft fluids and debris	5	3
	Malicious intent	Hazardous materials	4	2

**Scale of Problem rank: 1=severe, 3=moderate, 5=minimal*
***Priority rank: 1=high, 3=moderate, 5=low*

4 MANAGEMENT PLAN

This section describes the Management Plan that has been developed in consultation with the Bennery Lake Watershed Management Committee, which provides a forum to address the issues and risks identified in the previous section. The primary goal of the management plan is source water protection, implemented through a multi-barrier approach that ensures the source water is clean and safe for consumption, and that the mechanisms are in place to prove it is safe.

The source water protection management plan options were developed to address the risks and issues described in Section 3: Risk Identification and Assessment. The following describes the components of the implementation strategy and the contingency measures that are in place to address them.

4.1 Background

Prior to 2006, the Halifax Regional Municipality (HRM) was responsible for the Bennery Lake watershed and its associated management plan. As part of HRM's management plan, the Bennery Lake Watershed Management Committee was formed in 1998. Their first task was to designate the Bennery Lake watershed as a Protected Water Area (PWA) and to develop regulation of activities within the newly designated PWA. The area was designated a Protected Water Area under section 106 of the *Environment Act* on December 4, 2003.

In the spring of 2006, Halifax Water assumed responsibility for the PWA and subsequently began developing a Source Water Protection Plan (SWPP). The SWPP includes management efforts for the entire watershed and any associated activities that occur within it including a watershed monitoring program, land purchasing, boundary maintenance, and signage. The SWPP is reviewed annually to ensure proper implementation. A major review is conducted every five years to address progressive changes to the plan. In 2009, Halifax Water determined it was necessary to conduct a major review of the Bennery Lake SWPP prior to the scheduled five-year review, due to the mounting number of changes.

4.2 Implementation Strategy

Halifax Water considers source water protection to be the first step in the multiple-barrier approach for water quality management. Designating the watershed as a PWA has laid the groundwork for source water protection planning. Guided by the Bennery Lake Watershed Management Committee, Halifax Water has set objectives for the strategy implementation including land acquisition; promotion of BMPs and a land access strategy; public communication, and education and awareness programming; fostering water supply area protection through stakeholder collaboration and cooperation on a watershed advisory committee; regulation adherence and reliance on enforcement support from NSDNR and the OHV Task Force; controlled access and boundary maintenance; emergency measures; adhering to treatment plant and pumping station maintenance schedules and a guided sampling plan; and chemical use management plans. Halifax Water and NSE have developed implementation timelines. Halifax Water will inform NSE if changes to those timelines are required.

4.2.1 Land Acquisition Program

Early acquisition of key watershed lands by the Halifax Regional Municipality and the designation of the watershed as a PWA have laid the foundation for

source water protection planning. This strategy has proven to Halifax Water to be the most effective source water protection tool. Halifax Water therefore will continue to investigate any opportunity to purchase private lands within the Bennery Lake watershed. Owning the watershed lands provides Halifax Water with better control over the activities that are conducted on them.

4.2.2 Best Management Practices

Halifax Water manages Company and Crown lands within the Bennery Lake watershed using provincial regulations and Best Management Practices (BMPs) and water quality as the driving factor. In 2001, Halifax Water developed and implemented BMPs to aid in forest management in the Pockwock and Lake Major Protected Watershed Areas, which proved to positively influence the way forestry activities were conducted on watershed lands. In 2009, Halifax Water identified the need to expand and improve the existing BMPs by developing a single working document that reaches beyond forest management. In 2010, Halifax Water developed BMPs to include aggregate removal, recreation, heavy equipment, and various other activities that impact water quality in source water areas. This version (see Appendix F: Halifax Water Best Management Practices) was approved and immediately implemented with support from Elmsdale Lumber Company, NSDNR, NSE, the Bennery Lake Watershed Management Committee, the Pockwock Watershed Management Committee and the Lake Major Watershed Advisory Board.

The BMPs are not intended to replace existing legislation; they are to enhance watershed protection practices on watershed lands. Staff and contractors practicing on Halifax Water and Crown-managed lands are required to be aware of and to follow the BMPs, the legislation and the Standard Operating Procedures (SOPs) before work can begin.

On watershed lands not under Halifax Water control, BMPs are also to be used as an educational tool and guiding document for activities which may pose a risk, however minimal, for watershed contamination. For other privately owned land within the watershed, Halifax Water will continue to monitor and educate landowners about applicable government regulations and BMPs.

Best Management Practices for the agriculture sector are being developed to mitigate the effects of these activities should they be permitted. Halifax Water will make available and promote its BMPs via public communication and awareness efforts, which are outlined in the next section.

4.2.3 Public Communication, Education and Awareness

Public communication, education and awareness are key components in Halifax Water's source water protection strategy. Currently, Halifax Water's communication and awareness program includes: posting information and regulatory signage; conducting educational programming; developing source water protection publications (e.g., newsletters, public notifications and reports); publishing website information and placing advertisements in periodicals.

The objective of communication about and within the watershed area is to inform users of the location of the watershed and PWA, outline the potential impacts of detrimental activities on the water supply and outline measures they can take to avoid such occurrences. Public communication, education and awareness outreach will continue to be developed with the intent to encourage cooperation between Halifax Water, customers and stakeholders alike to ensure quality drinking water.

Considering residential and the potential for industrial activities within the watershed area, Halifax Water will prepare an information package for residents, customers and stakeholders. The objective of the communication will be to inform them that they are located within a designated watershed area, outline the potential impacts of fuel spills, septic treatment failure, and other detrimental activities on water supplies and outline preventative measures that can be taken to avoid such occurrences. Current public communication, education and awareness measures as described below will be enhanced with the intent to encourage cooperation between Halifax Water, Bennery Lake watershed residents, customers, and stakeholders to ensure a quality drinking water supply.

Signs

Currently signs that define restrictions on recreational activities and provide contact information have been posted at main entry points throughout the watershed and along frequently used trails, as well as in the undesignated portions of the watershed areas. Signs are upgraded on an as-needed basis.

Educational Programming

Halifax Water is supportive of non-government organizations such as Clean Nova Scotia and the Discovery Centre, in the development of watershed protection education programs. These programs are delivered to elementary, junior and senior high school students in accordance with the curriculum. Other educational program development activities involve supporting community groups and associations in their efforts to conduct community clean-ups and open houses that serve to educate residents about how to protect the water quality of surface water supplies in the community.

Publications

Publishing newsletters and advertising in local newspapers, outdoor magazines and in the provincial fishing manual are other tools that Halifax Water uses to promote awareness of the water supply area and communicate protection techniques to the broader community.

Website

Halifax Water regularly updates its website www.halifaxwater.ca to provide important information on source water protection.

4.2.4 Watershed Committee

The Bennery Lake Watershed Management Committee meets twice a year, usually in the spring and fall, to provide input to Halifax Water on the management of the watershed and activities that may impair the source water supply. These meetings will continue to occur.

As stated in the Terms of Reference, an annual report is completed for each spring meeting for the committee to review.

4.2.5 Regulations and Land Use By-Laws

Halifax Water continually investigates new opportunities for provincial legislation and local by-laws to be strengthened or created to enhance the protection of HRM's drinking water. A number of small areas (~5%) along the southern boundary of the natural watershed area fall outside of the Designated PWA. However, there are currently no plans to request that these areas be included in the PWA.

Halifax Water continues to work closely with HRM community development staff to review applicable SOPs, by-laws and possible developments related to any relevant source water areas and to update the emergency contact list.

Off-highway Vehicles

Currently, vehicle restrictions within the PWA are limited to lands owned by Halifax Water per section 35 of the *Off-highway Vehicles Act*. Off-highway Vehicles (OHVs) such as all-terrain vehicles (ATVs), snowmobiles and trail bikes are known to access the watershed. While trails and roads continue to be used, these recreational vehicles have the potential to impact water quality through pollution (via fuel or coolant spills) or turbidity increases resulting from damage to stream channels or wetland areas.

Halifax Water continues to post signs, and maintain and expand a patrol presence throughout the watershed. Other ongoing activities include: posting information about watershed restrictions on our website; contacting local ATV and snowmobile clubs to educate riders; connecting with environmental organizations that may enhance the focus on water protection with respect to OHVs; expanding and working with RCMP contacts; and maintaining gates and trail barriers. Halifax Water and NSE have added restrictive wording to the PWA Regulations, on the use of OHVs inside the watershed, which is pending the completion of the legislative review process.

4.2.6 HRM Public Roadways

All public roads running through the Bennery Lake watershed are maintained by TIR. Halifax Water maintains open communication with TIR staff and provides updated contact lists as required.

For monitoring purposes, Halifax Water has established a raw water sample location as described in

Appendix D: Table 3: Bennery Lake Watershed Sampling Locations to monitor road effects as outlined in sub-sections 5.4.3-5.4.7 of the Source Water Monitoring Water Sampling Program section.

Road De-icing

As part of its compliance program, Halifax Water monitors total chloride concentrations in the raw water coming into its water treatment plants on the last week of March and September and in its treated water four times per year – the last week of March and September, the last week of June and the third week of December.

Additionally, as part of its Watershed Monitoring Program Halifax Water Quality Inspectors collect raw water samples from strategic points in the watershed on a monthly basis, where possible, to test for a variety of parameters including total chloride concentrations in the raw water. From this program, if chlorides are found to be above the acceptable levels, recommendations can be made to the TIR and to HRM regarding road de-icing salt applications. Section 5.4.3: Risk-Based Sampling on page 43 provides further details on sampling procedures and parameters.

4.2.7 Enforcement

Halifax Water presently works with the local authorities to enforce *Acts*, regulations and by-laws that apply to the watershed. Even with the cooperation of local authorities, violations occur. Halifax Water is currently investigating the creation of its own watershed enforcement and compliance program in conjunction with NSE. Halifax Water has reviewed and updated the regulations to allow for more enforcement of the watershed regulations; however, timelines will depend on approval processes.

4.2.8 Controlled Access

Halifax Water has established methods to control access to the PWA that includes physical barriers and signage, a land access strategy and stewardship protection methods, and boundary maintenance options as described.

Gates and Fencing

Halifax Water maintains fences, gates, barriers and signs to limit access to its facilities and protected areas, including watershed lands. Gates to restrict unauthorized vehicles from entering the watershed are located at main vehicle entry points. Only personnel authorized by Halifax Water may access the main entry points, including peace officers performing their duties. Halifax Water will continue to monitor these areas and enhance security measures when required. Halifax Water encourages local watershed area users to report illegal activities using the information provided on signs posted throughout the watersheds.

Land Access

Halifax Water and the Crown control much of the land and access into the watershed. For all other private lands within the watershed, Halifax Water encourages open communication with adjacent landowners and others with an interest in accessing the land for other purposes (e.g., recreation). Halifax Water has developed a Land Access Strategy to augment the regulatory and by-law tools available and to limit or establish terms for access to watershed lands in order to ensure a high quality drinking water supply is maintained.

Boundary Maintenance

Halifax Water currently hires licensed land surveyors to establish the legal watershed boundaries as outlined in the PWA designation. An accredited legal survey company refreshed the lines during the summer of 2011. They will continue to be monitored yearly and updated as required.

4.2.9 Bennery Lake Pumping Station and Treatment Plant

The Bennery Lake pumping station and treatment plant are located within the Bennery Lake PWA. Plans and procedures to protect raw water from risks at the pumping station are reviewed on a regular basis through Halifax Water SOPs. All plant operators and contractors working in and around the pumping station and treatment plant are made aware of surrounding risks and educated on response plans and procedures that are located at the applicable treatment facility and found in the *Emergency Response Manual*. Copies of the manual can be found at the Bennery Lake Treatment Plant or the main office located at 450 Cowie Hill Road in Halifax.

Treatment Plant Discharge and Holding Pond

The Bennery Lake treatment plant discharge and holding pond are located within the PWA. All discharge water created from the treatment process flows into the holding pond where sediment settling occurs. The supernatant water is then returned to Bennery Lake, following water quality testing. Halifax Water is currently evaluating options for waste sludge disposal. To date, Halifax Water has been working diligently with NSE to meet all provincial guidelines.

Nova Scotia Power Transformer

In addition to Nova Scotia Power (NSP)'s six-month inspections of the transformer that is located outside of the treatment plant, Halifax Water staff visually inspects the transformer on a daily basis and immediately reports any leaks to NSP. The risk to the watershed, although low, is due to the transformer remaining uncontained and prone to damage from mechanical failure, and vehicle and snow plow damage.

In the fall of 2009, Halifax Water requested that NSP install a containment system for the transformer. This request has not been acted upon. Currently NSP inspects the transformer periodically.

Halifax Water also continues to inspect the condition of the transformer and has taken steps to physically protect the transformer from inadvertent contact. In the event of a spill, Halifax Water's *Emergency Response Manual* outlines the steps that are to be followed.

4.2.10 Chemical Use

The use of chemical and winter road maintenance chemical control products in the PWA will continue to be prohibited as per the PWA Regulations and Halifax Water's mandate to protect all watersheds.

4.2.11 Emergencies

For all emergencies that occur within the watershed, Halifax Water maintains open communication with the first responders responsible for the area and provides them with an updated contact list.

A meeting between Halifax Water staff and John Webber of HRM EMO was held in early 2012 to discuss if it was possible to add Halifax Water to the first contact list in the event of an emergency in its watersheds. Due to the complexity and high number of potential responses, it was agreed that Halifax Water would only be contacted if the emergency was a "significant event"; i.e. chemical spill, large vehicle accident, forest fire, malicious intent, or house fire. To facilitate future communications, Halifax Water will fill the watershed area civic address gaps for HRM EMO to compare them with First Response plans.

4.3 Contingency (Mitigation, Preparedness and Response)

The following describes the contingency plans in place for the various land use activities that occur within the watershed.

4.3.1 Forest Management

For forest activities that result in a potential threat to the water supply:

Hydrocarbon spill

Those involved with a hydrocarbon spill will follow the applicable BMP for spills and contact emergency phone numbers. For details see Appendix F: Halifax Water Best Management Practices – Section 6: Emergency Response and Reporting. Contractors will attempt to contain the spill with spill kits and will wait for agencies to guide the site cleanup. Halifax Water will continue to evaluate any threat to the raw water supply through the Source Water Monitoring Program; details are found in section 5.4: Source Water Quality Monitoring Program on page 39.

Forest Fire

In the event of forest fire, the draft forest fire fighting policy developed by DNR on the advice of NSE is currently being followed. The protocol includes

applying water first and only those chemicals described in section 3.9.3 on page 22. Fire retardants will be applied using a helicopter and/or ground crew. NSE has advised DNR to only use the primary drinking water supply as the water source as a last resort.

4.3.2 Mining, and Pits and Quarries

Halifax Water will continue to monitor the NSDNR ArcIMS viewer: Natural Resources – Geology Maps and Databases website (**http://gis4.natr.gov.ns.ca/website/nsgeomap/viewer.htm)** for updates on mineral rights data, including exploration licenses and permits in the area.

4.3.3 Recreation

Recreational practices such as OHV use, boating, fishing, swimming and hiking pose similar levels of risk to the watershed as in the past, while new recreational trends such as geocaching present new challenges. A Private Land Access Strategy has been developed by Halifax Water to ensure watershed users have an organized approach on how to access watershed lands. Establishing working relationships with recreational groups helps to build respect and a collaborative approach to watershed protection.

Geocaching

Geocaching is a relatively new recreational activity that is growing. There are 17 different types of geocaching: about 90% are "traditional" while the other types are described here: http://www.geocaching.com/about/cache_types.aspx. Pristine areas are a significant attraction, particularly in our watershed areas. Currently there are close to 100 geocaches in Halifax Water watershed areas. Currently there are no known geocaches in the Bennery Lake PWA.

Off-highway Vehicles

Halifax Water will continue to evaluate the extent of OHV use inside the PWA. This will be accomplished through continued signage and patrolling programs, which will include encouraging the ATV Task Force to conduct patrols, and distribute information about OHV restrictions in the Bennery Lake watershed. Halifax Water is seeking NSE endorsement to change regulations and stiffen penalties.

4.3.4 Transportation Routes

Relatively minimal threats to the water supply exist via Cindy Drive as no mitigation measures are in place to limit vehicle fluids from entering the watercourse through accidents or runoff. In the event of an emergency spill or accident, Halifax Water's *Emergency Response Manual* will be followed. A copy of the manual can be found at the Bennery Lake Treatment Plant or the main office located at 450 Cowie Hill Road in Halifax.

4.3.5 Boundary Maintenance

If watershed boundary lines have become indistinguishable due to an event such as a natural disaster, a licensed land surveyor will be hired to re-establish the line.

4.3.6 Public Communication, Education and Awareness

Halifax Water will continue to make the public aware of the Bennery Lake watershed through signage, media, newsletters, seminars, education programs and website links.

4.3.7 Commercial

Through consultation with Halifax Water, HRM will consider threats to the Bennery Lake watershed when applications for commercial development are being made. Presently this is being addressed through the Bennery Lake Watershed Management Committee representative from HRM Planning and Development Services.

Businesses with concerns or an emergency can contact their respective municipal office/first responders or Halifax Water (902-490-6940) to report the incident so Halifax Water can activate its emergency-response plan.

In the event of an emergency, Halifax Water's *Emergency Response Manual* will be followed. A copy of the manual can be found at the Bennery Lake Treatment Plant or the main office located at 450 Cowie Hill Road in Halifax.

4.3.8 Residential

Through consultation with Halifax Water, HRM will consider threats to the Bennery Lake watershed when applications for new residential developments are being made. Presently this is being addressed through the Bennery Lake Watershed Management Committee representative from HRM Planning and Development Services.

On-Site Septic Systems

While NSE is responsible for approving on-site septic systems, landowners are responsible for the condition and functioning of their systems. Contaminated water could be discharged into surface water bodies and groundwater supplies if systems are improperly maintained. Halifax Water is not responsible for maintaining those systems; however, it is prudent to inform residents in the PWA of the environmental issues associated with septic system failure, and how to avoid such problems. This will be accomplished through Halifax Water's Communication, Education and Awareness Program.

Oil Spill

Halifax Water is not responsible for the condition of fuel storage tanks within the PWA; the watershed resident is responsible for ensuring that fuel is properly contained. Most insurance companies require that tanks be replaced every ten years and owners take measures that protect the tank from the

elements. However, it would be prudent for residents in the PWA to be informed of the environmental issues associated with fuel spills, and how to avoid such problems. This will be accomplished through Halifax Water's Communication, Education and Awareness Program

Residents with concerns or an emergency can contact their respective municipal office/first responders or Halifax Water (902-490-6940) to report the incident so Halifax Water can activate its emergency-response plan.

In the event of an emergency, Halifax Water's *Emergency Response Manual* will be followed. A copy of the manual can be found at the Bennery Lake Treatment Plant or the main office located at 450 Cowie Hill Road in Halifax.

4.3.9 Halifax Water Operations

The following operations are under Halifax Water's control and responsibility to ensure the water quality is clean and safe to drink. In the event of an emergency associated with any of the situations described below, the Halifax Water corporate emergency-response plan will be used to reduce the impact to source water. A copy of the *Emergency Response Manual* that describes emergency response plans can be found at the Bennery Lake Treatment Plant or the main office located at 450 Cowie Hill Road in Halifax.

Bennery Lake Water Treatment Plant and Pumping Station

Halifax Water has plant operations staff dedicated to the maintenance of the Bennery Lake water treatment plant 8 hours a day, 7 days a week. There is currently a contingency plan in place in the event of an accident that threatens the source water.

To provide power to the pumping station and the water treatment facility during an electrical failure, Halifax Water has a fully contained diesel generator with a double walled 1100 litre fuel tank located in a separate building outside of the treatment plant, which lies within the PWA. Included in the *Emergency Response Manual*, Halifax Water has developed and implemented Standard Operating Procedures (SOPs) for the operation and maintenance of the generator, fuel transfer and storage.

Water Sampling

Halifax Water's *Water Quality Sampling and Permit Compliance Manual* was revised in March2012 to reflect the recent changes to the Bennery Lake Source Water Sampling Program. A copy of the sampling manual can be found by contacting the Water Quality Superintendent.

Chemical Use

If a chemical enters a watercourse inside the watershed and threatens the source water supply, the Halifax Water corporate *Emergency Response Manual* will be used to lessen the impact to source water.

4.4 Emergencies

In case of an emergency, the Halifax Water *Emergency Response Manual* will be followed. A copy of the manual can be found at the Bennery Lake Water Treatment or the main office located at 450 Cowie Hill Road in Halifax. For public reporting, signage with contact information is located throughout the watershed. The following emergencies are considered the greatest threat to water quality:

4.4.1 Natural Disaster

Within the forest management planning process, Halifax Water factors-in natural disasters. Halifax Water maintains good forest management techniques and follows all government legislation to reduce the risk of natural disasters associated with forest management practices such as fire, wind damage, disease and insects.

4.4.2 Aircraft Disaster

Halifax Water will continue to assess the possibility of such an event occurring and will regularly review its emergency-response plans.

4.4.3 Malicious Intent

Halifax Water posts signs, maintains fences and gates, installs security cameras at main operating locations, performs patrols and conducts routine intense water sampling to ensure the safety of HRM's drinking water. Halifax Water encourages watershed users to report any suspicious activities within the watersheds. Contact information can be found on signage throughout the watershed as well as listed on Halifax Water's website, www.halifaxwater.ca.

4.4.4 Back Up Emergency Supply

In the case of an emergency (e.g., contamination, security, disaster, etc.) at the Bennery Lake Water Treatment Plant, senior management will decide whether a shutdown will take place. In this situation, the existing distribution system could function for about 1-2 days on stored water in the reservoir, depending on usage. At this time there is no emergency source water back-up supply for Bennery Lake. In the event water in the reservoir is depleted during an emergency, water will be trucked in from other water storage facilities that are in closest proximity.

All treatment plant operators and engineering staff are fully aware of the emergency procedures to shut down the Bennery Lake Water Treatment Plant, including public notification, customer restrictions, and emergency plant start-up. These procedures are found in the Halifax Water *Emergency Response Manual.*

5 MONITORING AND EVALUATION

Halifax Water is responsible for monitoring the Bennery Lake watershed. Any activity that may impair water quality and requires enforcement is reported to the applicable government agency for their response. The monitoring program consists of maintaining a presence through watershed patrols, encouraging public reporting of any illegal or suspicious activities, conducting raw water sampling, and liaising with various governing agencies and stakeholders to ensure a clean and safe drinking water supply.

Halifax Water revises the monitoring program when periodic evaluations and assessments indicate there is a need to.

5.1 Reporting

Monitoring the watershed involves reciprocal reporting processes: Halifax Water provides annual reports to governing agencies and to the public via the Bennery Lake Watershed Management Committee and via publications such as the website. On the other hand, Halifax Water relies on public reporting to help ensure activities conducted by the public within the watershed are not adversely affecting source water quality.

5.1.1 Annual reports

An annual SWP report is submitted to the Bennery Lake Watershed Management Committee in March for review and comments. This report includes, but is not limited to: status on current risks; identification of new risks; results of the previous year's monitoring program and changes that may need to be made; activities that occurred within the watershed; and possible changes to the SWPP for continuous improvement. Having the Watershed Management Committee review the SWPP each year allows time for Halifax Water to submit possible changes to the SWPP to meet obligations to NSE for the annual 90-day utility report.

5.1.2 Public Reporting

Public access to the watershed is mainly for low-impact recreational activities such as walking, hiking and mountain biking. Halifax Water maintains signage throughout the Bennery Lake watershed that contains contact information for reporting any illegal activities to NSDNR, RCMP or Halifax Water.

5.2 Meetings

Consistent and sustained communication between those who have a responsibility to ensure clean, safe water is paramount. Meetings between stakeholders provide a means to evaluate risks to water quality and contribute to the development of methods that overcome obstacles to ensuring clean, safe potable water for Halifax Water clients. Meetings between Halifax Water and HRM staff and through the Bennery Lake Watershed Management Committee help to reach this goal.

5.2.1 Annual Scheduled Meetings

Halifax Water meets with HRM on an annual basis to exchange information about possible developments or scheduled events that could pose a threat to water quality. These meeting are conducted through the Bennery Lake Watershed Management Committee or through planning meetings with HRM staff as permit applications come up.

5.2.2 Watershed Committee Meeting

The Bennery Lake Watershed Management Committee will continue to meet as per the Terms of Reference. Currently, no new board members are being considered; however, if circumstances warrant new members, then the management committee will consider them as they arise.

5.3 Patrolling

Halifax Water continues to conduct regular patrols throughout the Bennery Lake watershed by foot, ATV, boat and marked vehicles, to identify activities that may be a concern. In addition, the OHV task force continues to conduct random patrols, stopping drivers of OHVs who are in the watershed illegally. Those who are stopped during patrol and enforcement activities are informed that the watershed is a protected area. Halifax Water also encourages other users to report any illegal activities to NSDNR, RCMP or Halifax Water using the contact information located on signs throughout the watershed.

5.4 Source Water Quality Monitoring Program

As of September 2009, Halifax Water has implemented its five-part Source Water Quality Monitoring Program (SWQMP) for the Bennery Lake watershed. Halifax Water has always had an effective raw water sampling program; however, the initial program was designed to monitor raw water quality as it reached the treatment plant, rather than at the source. By incorporating various additional source water collection points within the SWQMP, Halifax Water was able to take a more proactive approach to managing the water and a more comprehensive way to measure the quality of the water.

In 2011, Halifax Water achieved its two-year goal of establishing a water quality trend base line. The trend indicted raw water quality gathered to date indicted the Halifax Water has switched to a risk-based approach to watershed monitoring as part of its source water protection planning strategy.

***Note: Sampling is conducted pending weather conditions.**

The sampling procedures are included in the current *Water Quality Sampling and Permit Compliance Manual*, available through the Water Quality Superintendent. The Source Water Quality Monitoring Program is the responsibility of the watershed manager. All samples taken within the treatment plant are the responsibility of the water-quality superintendent. The following explains each of the five parts of the Source Water Quality Monitoring Program.

5.4.1 General Source Water Monitoring

General source water monitoring is used to set baselines to measure against during changes in activities within the watershed. Results of samples may

guide the investigation of whether changes are associated with land use management activities.

Dominant tributaries and lake-water sampling locations have been identified in Appendix D: Bennery Lake Watershed Area Map and Sample Locations

and

Appendix D: Table 3: Bennery Lake Watershed Sampling Locations outlines the details of each sampling location.

Stream Water Quality In-Situ Parameters:

Stream water in-situ parameters regularly measure the state of the water quality under normal circumstances as outlined in Appendix D: Table 3: Bennery Lake Watershed Sampling Locations. The significance of this sampling regime is described below.

- **Dissolved Oxygen (DO)**

  Dissolved oxygen in water is essential to the metabolism of all aerobic aquatic organisms. DO concentrations are indicative of a stream or lake systems' overall health, as minimum levels are required to support fish and other aquatic life. Dissolved oxygen also plays a key role in the chemical form and solubility of many inorganic nutrients (e.g., shifts between aerobic and anaerobic aquatic conditions influence the biological availability of nutrients and metals). Therefore, long-term changes in dissolved oxygen conditions can drastically alter the productivity and function of an entire lake or stream.

  Dissolved oxygen concentrations are also subject to temperature and daily changes in biological reactions. Shifts in oxygen levels, within the context of time of day and temperature, will trigger Halifax Water to assess the cause of the change and help relate the changes to a specific activity within the watershed.

- **Turbidity**

  Turbidity is a visual property of water, a measurement of light scattered and absorbed due to the presence of suspended material (e.g., organic or inorganic particles originating from the erosion of soil or re-suspension of bottom sediments). Under the monitoring program, Halifax Water can set a baseline to determine if activities carried out in the watershed are linked to turbidity changes, and whether changes in land management should be considered.

- **pH level**

  pH is an indicator of acidity within an aquatic environment. The "p" stands for "potential of" and the H stands for "Hydrogen". The pH is compared to a scale that determines the alkalinity or acidity of the

water. A reading between 0 and 7 is considered acidic, and contains more hydrogen. A reading between 7 and 14 is considered basic or alkaline and contains more hydroxyl groups[3]. Acidification from land use activities and precipitation impacts water quality negatively, affects aquatic biota, and contributes to the mobilization of toxic metals. The monitoring program is intended to establish baseline conditions and track changes in pH to determine if watershed activities cause any acidification effects.

- **Temperature**

Temperature affects many biological (e.g., biotic growth and decay, uptake of toxins, organism behavior) and chemical (e.g., solubility, rates of reaction) processes. Monitoring the source water temperature allows Halifax Water to establish a normal conditions baseline, add context to some of the water quality parameters, and track changes due to anthropogenic activities.

- **Specific conductivity**

Specific conductivity is a measurement of water's ability to conduct electricity and is very dependent on the concentration of dissolved solids such as salt. Monitoring specific conductivity is useful for detecting the effects of road de-icings, as well as other pollution inputs. Specific conductivity deviations from normal baseline conditions are used to assess the effects of cold-weather treatment of roads and highways within the watershed, and provide an indication of events causing potential source water contamination.

Other Water Quality Parameters Monitored:

- **Total suspended sediments (TSS)**

TSS are the solids in water that can be trapped by a filter. Changes in TSS can be indicative of erosion and run-off. For example, forest activities or other land disturbances can increase the amount of sediment released into a stream or lake. Similar to turbidity, regular monitoring helps Halifax Water set a baseline and track changes to determine if any activities carried out in the watershed are linked to TSS.

- **E. Coli**

Halifax Water believes it is important to monitor both developed and undeveloped areas within the Bennery Lake watershed for *E.*

[3] Source: Community Based Environmental Monitoring Network: Water Quality Monitoring Certification Course Materials, (March 25, 2012). Saint Mary's University.

coli. Presently the Brookhill Estates area is of concern to Halifax Water due to recent human development and related activities that could impact water quality. The remainder of the watershed is relatively undisturbed and is potentially susceptible to naturally occurring *E. coli* due to wildlife. At this time, no farmlands or livestock pastures lie within the Bennery Lake watershed. Current sampling procedures allow Halifax Water to evaluate current conditions and track changes.

- **Total Phosphorus and Nitrate-Nitrogen**

Phosphorus is the key limiting nutrient determining the trophic status of aquatic ecosystems, with nitrogen being the second limiting nutrient. Nitrogen occurs in freshwater in numerous forms; however, the major form of inorganic nitrogen is likely in the nitrate form. Total phosphorus and nitrate-nitrogen concentrations are used to monitor nutrient loading in the freshwater system. Excess nutrient loading is harmful to aquatic ecosystem; an increase in trophic status can result in algal and plant growth, drinking quality concerns due to nitrate-nitrogen levels, as well as a loss of biodiversity. Excessive growth places oxygen demands on aquatic systems during organic breakdown of material, and can lead to the secretion of algal toxins.

- **Metals Scan**

Various metals occur naturally within soils and bedrock, but can still be a water quality concern. It is important to determine if any metals are at detectable levels within the source water system as a result of forest management or other watershed activities.

Given the unlikelihood of metal-based contamination, sampling will be done twice a year for the first year of the General Source Water Sampling Plan, after which the need to sample and analyze will be reassessed. Testing will be done once during low-flow conditions and once during high-flow conditions.

- **Total Organic Carbon**

Elevated organic matter concentrations can result in taste and odour issues and can lead to the formation of disinfection byproducts. Dissolved organics can also play a role in the transport and availability of metals (i.e., methyl mercury). Total organic carbon concentration is indicative of organic matter loading to source water supplies.

5.4.2 Deep-Lake Monitoring

Deep-lake monitoring is conducted to collect and build baseline data, and to ensure source water protection through monitoring for changes in baseline water-quality

conditions. Sampling is carried out monthly. Winter lake samples are not collected when staff safety may be compromised.

A single volume-weighted sample using several discrete water samples taken from various depths is collected as follows: During periods of thermal stratification, top, middle and bottom samples from each thermal layer is collected and used for the composite sample.

Sampling results guide investigations to determine whether water quality changes are associated with land-management activities or other activity such as natural disasters or events. Depending on results from the routine source water monitoring program, changes to the sampling program may be required.

5.4.3 Risk-Based Sampling

Risk-based sampling is scheduled and linked to a known risk(s). Results of the sampling may lead to change in management, change in protection efforts, changes in the regulation and restriction of certain activities.

Petroleum Hydrocarbons

Petroleum-hydrocarbon sampling is a result of vehicle traffic in the Brookhill Estates subdivision. Samples are taken twice a year, in March and September during high water-flow periods at the BG1 location.

Total Chloride

The use of road salt within the PWA is prohibited. However, precautionary monitoring is being conducted at BG1 to establish a baseline of chloride and track changes down gradient of the Brookhill Estates Subdivision in the case of prohibited usage. Sampling will be done each month from November to April for at least two years.

As a result of the water treatment process, chloride is discharged to a settling lagoon along with other water treatment by products. The outfall of the lagoon flows directly into an unknown creek where it eventually makes its way to Bennery Lake down gradient of the pumping station. Halifax Water presently monitors the outfall water monthly for chloride levels. Additionally, monitoring is being conducted further downstream at location BG3 to compare and track chloride levels throughout the course of the brook. Sampling will be done twice a year, once during low-flow conditions and once during high-flow conditions.

Metals Scan

As a result of the water treatment process, elevated levels of aluminum, magnesium and iron along with other water treatment by products are discharged to a settling lagoon. The outfall of the lagoon flows directly into an unnamed creek where it eventually makes its way to Bennery Lake, down gradient of the pumping station. Halifax Water presently monitors the outfall water monthly for aluminum levels. Additional

monitoring is being conducted further downstream at location BG3 to compare and track aluminum, magnesium and iron levels throughout the course of the brook. Sampling will be done twice a year; once during low-flow conditions and once during high-flow conditions.

5.4.4 Activity-Based Sampling

Activity-based sampling is scheduled based on events such as forestry land-management activities or any other known activity. This sampling may help determine cause-and-effect relationships as well as short-term and long-term impacts to help change land-management activities and provide results that may require more patrols to monitor activities.

E. coli

Activity-based *E. coli* sampling may follow removal of beaver dams, or a septic field repair within the watersheds. Sampling will be performed daily and continue for one week after operations, or the removal has been completed, when there is a clear and direct path to the lake to ensure the safety of the sample collector.

Total Phosphorus and Nitrate-Nitrogen

Phosphate and nitrate sampling maybe a result of scheduled forestry activities and/or development activities.

Sampling will be conducted weekly during the activity and continue for one week after the activity has stopped. Samples will be taken at any lake, stream or running tributary within 200 metres of the operation within the watershed.

Total Suspended Sediments

Total suspended sediments are typically increased in stream systems during and immediately following forestry activities, road construction and maintenance, as well as any other activities that require crossing a stream. Increased suspended sediments change a stream environment by filling in interstitial spaces between rocks, altering the stream bottom and affecting light penetration in the water column. Each of these effects in turn has a cascading effect (e.g., decreases in dissolved oxygen, stress on aquatic biota, and increase in TSS-associated substances).

Sampling will be conducted daily during stream-crossing activities where there is a clear and direct pathway to the lake to ensure the safety of the sample collector.

Petroleum Hydrocarbons

Activity-based petroleum sampling may be conducted in response to events or spills occurring within the watershed areas of Cindy Lane, Hartland Drive or the Aerotech Business Park.

Sampling will be conducted daily and continue for one week after operations have been completed. Sampling will be obtained within 200m of the scene, as well as affected dominant feeder streams downstream from the operation where they flow into Bennery Lake.

5.4.5 Targeted-Based Sampling

Target-based sampling is done as a response to incidents or unplanned events such as fuel or environmental, significant weather events, or vandalism. Such sampling is considered a warning system to monitor events that have the potential to shut down the treatment plant in order to protect customers.

Petroleum Hydrocarbons

Petroleum-hydrocarbon sampling maybe as a result to incidents or unplanned events that occur within the watershed resulting from activities such as forestry, OHV use, boating, and construction.

Sampling will be conducted within 200 metres of the scene, as well as at all dominant feeder streams downstream of the event at 500-metre intervals every hour until it reaches the lake, then every two hours at 500-metre intervals. If high-level concentrations are sustained within one kilometre of the Bennery Lake Treatment Plant, plant closure is considered. From the samples collected it will be determined if there is a threat to the water treatment plant and if a potential shutdown should be ordered.

E. coli

E. coli sampling may be conducted due to incidents or unplanned events such as septic-tank failure in unserviced areas.

Samples will be collected 200 metres of the scene, as well as at 500-metre intervals downstream on all dominant tributaries every hour until it reaches Bennery Lake. From the sample results it will be determined if there is a threat to the water treatment plant and if a potential shutdown should be ordered.

Total Phosphorus and Nitrate-Nitrogen

Total phosphorus and nitrate-nitrogen sampling may be conducted due to unplanned incidents or events such as chemical spills, accidents, vandalism, and deforestation.

Sampling will be conducted daily during the activity and continue for one week after the activity has stopped. Samples will be collected at any lake, stream or running tributary within 200 metres of the operation within the watershed.

Turbidity

Turbidity sampling may be conducted due to unplanned natural events such as a storm or fire. Sampling will continue daily until two weeks

after the event has subsided. Samples will be collected at the dominant tributary inlets to Bennery Lake.

Chemical Spill

A chemical spill that has the potential to impact water quality will trigger sampling that is conducted within 200 metres of the scene, as well as at all dominant tributaries downstream of the event at 500-metre intervals, every hour until it reaches the lake, then every two hours at 500-metre intervals.

If high concentrations are sustained within one kilometre of the Bennery Lake Treatment Plant, plant closure is considered. From the samples collected it will be determined if there is a threat to the water treatment plant and if a potential shutdown should be ordered.

5.4.6 Operational Raw Water Sampling

Operational raw water sampling, which is performed daily at the treatment plant in order to operate the facility, is the responsibility of the treatment plant operator.

6 ACKNOWLEDGEMENTS

Halifax Water would like to thank its diverse staff for its professional support in the Source Water Protection Program; thanks particularly to Carl Yates, Reid Campbell, Dave Duggan, Barry Geddes and Anna McCarron. Halifax Water would also like to thank the Bennery Lake Watershed Management Committee for its contribution to the SWPP. Having people involved who believe in a goal and following it through help create a positive learning experience for all those involved in the process.

In addition, Halifax Water would also like to thank the members of the Bennery Lake Watershed Management Committee for their continued support in the management of the Bennery Lake watershed.

APPENDIX A: BENNERY LAKE WATERSHED PROTECTED WATER AREA DESIGNATION

Bennery Lake Watershed Protected Water Area Designation

made under Section 106 of the
Environment Act
S.N.S. 1994-95, c. 1
N.S. Reg. 210/2003 (December 4, 2003)

Canada
Province of Nova Scotia

In the Matter of: the ***Environment Act***, S.N.S. 1994-95, c.1, s.106

In the Matter of: the designation of an area surrounding Bennery Lake, Halifax Regional Municipality, as a Protected Water Area, to be known as the "Bennery Lake Watershed Protected Water Area"

Designation of the Bennery Lake Watershed Protected Water Area and the Making of Regulations with Respect Thereto

Whereas Section 106 of Chapter 1 of the Acts of 1994-95, the ***Environment Act***, provides for the designation by the Minister of Environment and Labour of a protected water area and the making of regulations under subsection (6) to prohibit, regulate or require the doing of any act or acts in a protected water area that may impair or prevent the impairment, as the case may be, of the quality of the water in the Protected Water Area;

Whereas the operator of the Bennery Lake Water Treatment Plant, the Halifax Regional Municipality, has requested that the Minister of Environment and Labour designate a portion of the Bennery Lake Watershed as a Protected Water Area in order to protect the quality of the surface water and groundwater resource as a water supply;

And whereas Halifax Regional Municipality has provided opportunities for public consultation, including public meetings and the establishment of the Bennery Lake Watershed Management

Committee, an advisory committee comprising representatives of the Province of Nova Scotia, the Halifax Regional Municipality, the Halifax Watershed Advisory Board, members of the general public and landowners;

Therefore pursuant to Section 106 of Chapter 1 of the Acts of 1994-95, the ***Environment Act***, the undersigned, Kerry Morash, Minister of Environment and Labour hereby

(a) designates an area surrounding Bennery Lake more fully described in Schedule "A" as a protected water area, to be known as the "Bennery Lake Watershed Protected Water Area"; and

(b) makes regulations respecting activity in the Bennery Lake Watershed Protected Water Area, in the form set forth in Schedule "B".

Sgd: ***K. Morash***
Honourable Kerry Morash
Minister of Environment and Labour

Halifax, Nova Scotia
December 4, 2003

Schedule "A" -Bennery Lake Watershed Protected Water Area Boundary Description

All that certain parcel of land situated at Grand Lake, Halifax County, Nova Scotia and being **Parcel BL** shown on a plan titled "Compiled Plan of BENNERY LAKE WATERSHED" prepared by Robert Wentzell, N.S.L.S., dated January 26, 1999 and being on file at the office of the Director of Public Works and Transportation, Design Services, Halifax Regional Municipality as plan File No. 98031601 and being more particularly described as follows:

Commencing at Nova Scotia Co-ordinate Monument No.11751;

thence N 08° 18' 13" E, 767.038 metres to a point on the northwest boundary of Old Guysborough Road being the point of beginning;

thence N 37° 49' 10" W, 1455.218 metres to a point;

thence N 00° 00' 00" W, 2172.155 metres to a point;

thence N 52° 15' 00" W, 200.000 metres to a point;

thence S 74° 02' 10" W, 677.310 metres to a point;

thence S 49° 30' 10" W, 1235.887 metres to a point;

thence S 23° 22' 31" W, 1535.406 metres to a point;

thence S 60° 05' 26" E , 950.148 metres to a point;

thence S 29° 37' 41" W, 118.457 metres to a point;

thence S 77° 09' 02" E , 1149.643 metres to a point;

thence S 21° 41' 45" E , 831.015 metres to a point;

thence S 37° 51' 58" E , 463.052 metres to a point;

thence N 41°18' 25" E along the northwest boundary of the Old Guysborough Road, 990.579 metres to a deflection therein:

thence N 33° 32' 30" E along the northwest boundary of the Old Guysborough Road, 216.116 metres to the point of beginning.

Parcel BL contains 659.8 hectares.

ALL bearings are based on Zone 5, Central ~~Merdian~~ [Meridian] 64°30' West, of the Nova Scotia 3° Modified Transverse Mercator Projection of ATS77 Geodetic Datum.

Last updated: 20-03-2009

APPENDIX B: BENNERY LAKE WATERSHED PROTECTED WATER AREA REGULATIONS

Bennery Lake Watershed Protected Water Area Regulations

made under subsection 106(6) of the
Environment Act
S.N.S. 1994-95, c. 1
N.S. Reg. 211/2003 (December 4, 2003)

Citation

1 These regulations may be cited as the ***Bennery Lake Watershed Protected Water Area Regulations***.

Interpretation

2 In these regulations,

(a) "Act" means the ***Environment Act***;

(b) "biocide" means a substance capable of killing living organisms that is not registered as a pest control product and includes a toxic chemical;

(c) "Committee" means the Bennery Lake Watershed Management Committee;

(d) "Department" means the Department of Environment and Labour;

(e) "developer" means a person who develops or proposes to develop land and includes any agent or contractor who works for the developer;

(f) "development" means any disturbance of land for purposes of constructing roadways, residential dwellings, commercial establishments, recreation areas and parkland;

(g) "forestry operation" means any activity related to the use of a forest for producing timber, wood fiber or Christmas trees, including but not limited to the following activities:

(i) forest management planning,

(ii) silviculture,

(iii) harvesting,

(iv) protection,

(v) road construction, and

(vi) operation, storage and use of equipment and supplies used in any aspect of the activity;

(h) "grab sample" means a sample collected at a time and a place which represents only the composition of the source at that particular time and place;

(i) "Minister" means the Minister of Environment and Labour;

(j) "pesticide" or "pest control product" has the same meaning as set out in clause 2(q) of the ***Pesticide Regulations*** made under the Act;

(k) "Protected Water Area" means the land and water designated by the Minister pursuant to subsection 106(1) of the Act as the Bennery Lake Watershed Protected Water Area, as described in Schedule "A" to the designation;

(l) "release" means to spill, discharge, dispose of, spray, inject, inoculate, abandon, deposit, leak, seep, pour, emit, empty, throw, dump, place, drain, pump or exhaust;

(m) "sulphide bearing material" has the same meaning as set out in clause 2(o) of the ***Sulphide Bearing Material Disposal Regulations*** made under the Act;

(n) "vegetation" means any living plant or tree growth;

(o) "Water Works Operator" means the Halifax Regional Municipality, operator of the Bennery Lake Water Treatment Plant;

(p) "wetland" has the same meaning as set out in clause 2(y) of the ***Environmental Assessment Regulations*** made under the Act.

Restricted activities

3 (1) No person is permitted to swim, bathe, wash, or cut ice at any time in Bennery Lake or any other watercourse within the Protected Water Area.

(2) No person is permitted to fish from the shoreline of or in Bennery Lake or any watercourse within the Protected Water Area.

(3) No person is permitted to wash a vehicle in any watercourse or within 60 m of the shoreline or bank of any watercourse within the Protected Water Area.

(4) No person is permitted to, at any time, operate a vessel of any kind, on, through or over Bennery Lake or any watercourse in the Protected Water Area, unless authorized by the Water Works Operator for the protection of the Protected Water Area.

(5) No person is permitted to fill a gasoline tank or transfer any liquid fuel from tank to tank on or within 100 m of the shoreline or bank of Bennery Lake or any watercourse within the Protected Water Area, except for the purpose of operating the Bennery Lake Water Treatment Plant or a purpose reasonably incidental to the maintenance of private property.

Posting of signs

4 (1) The Water Works Operator must post signs around the perimeter of the Protected Water Area to provide notice to the general public of the designation of the Protected Water Area.

(2) The Water Works Operator must replace any signs posted under subsection (1) that have been damaged or removed.

(3) The Water Works Operator must take reasonable measures to advertise and provide notice to the general public of these regulations.

(4) No person is permitted to remove or alter any sign, notice or advertisement posted pursuant to this Section.

Fire restrictions

5 (1) No person is permitted to set, start, maintain or be responsible for an open fire in the Protected Water Area except for an open fire in a barbecue or fireplace designed for cooking purposes at a residential dwelling.

(2) Despite subsection (1), during the period from April 15 to October 15 of each year, a person may set, start, maintain or be responsible for a fire in the Protected Water Area if

(a) the person has a valid permit to burn issued pursuant to the ***Forest Fire Protection Regulations*** made under the ***Forests Act***;

(b) the person complies with the permit to burn and the ***Forest Fire Protection Regulations***; and

(c) the person complies with all the requirements of Halifax Regional Municipality By-law Number O-103, the Open Air Burning By-law.

Forestry operations

6 (1) No person is permitted to undertake a forestry operation within the Protected Water Area unless the operation is conducted pursuant to a forest management plan that

(a) is prepared by a professional forester in accordance with the objectives and policies approved by the Committee;

(b) does not permit any forestry operation within 100 m of Bennery Lake or within 30 m of any watercourse within the Protected Water Area;

(c) has as its primary objective the protection of the watershed and any watercourse therein, particularly with respect to impacts related to disruption of acid slate or sulphide bearing materials; and

(d) is approved in advance by the Water Works Operator.

(2) A forestry operation within the Protected Water Area must be conducted in accordance with the ***Wildlife Habitat and Watercourses Protection Regulations*** made under the ***Forests Act*** and the "Forest/Wildlife Guidelines and Standards for Nova Scotia" issued by the Department of Natural Resources, or its successor document or code of practice, as amended from time to time.

Road construction and maintenance restrictions

7 (1) No person is permitted to undertake any road construction within the Protected Water Area unless

(a) written approval has been obtained in advance from the Water Works Operator; and

(b) the road construction is undertaken between June 1 and September 30, inclusive, in any year.

(2) A person who is responsible for a road constructed under subsection (1) must maintain and repair the road.

(3) No person is permitted to expose at any one time more than 1900 square metres of roadway subbase in the Protected Water Area.

(4) No person is permitted to expose at any one time more than 1000 square metres of roadway subbase in the Protected Water Area if sulphide bearing or acid slate materials are present in the subbase.

(5) No person is permitted to apply road salt on any roads or driveways within the Protected Water Area.

Watercourse or wetland alteration

8 (1) No person is permitted to construct a bridge or culvert or otherwise alter a watercourse or wetland within the Protected Water Area without first obtaining

(a) written approval from the Water Works Operator; and

(b) an approval from the Department.

(2) An owner, operator or person responsible for a bridge or culvert approved under subsection (1)

(a) must maintain and repair the bridge or culvert; and

(b) is not permitted to remove the bridge or culvert without first obtaining an approval from the Department.

Roads and stream crossings
9 The construction of a forest access or wood lot road, stream crossing, culvert or other watercourse alteration within the Protected Water Area must be in accordance with the ***Wildlife Habitat and Watercourses Protection Regulations*** made under the ***Forests Act*** and the publication "Wood Lot Roads, Stream Crossings" issued by the Department of Natural Resources, or its successor document or code of practice, as amended from time to time.

Pest control products
10 No person is permitted to use a pest control product or biocide within the Protected Water Area unless the use is related to the operation of the Bennery Lake Water Treatment Plant and carried out under the supervision of the Bennery Lake Water Treatment Plant Supervisor.

On-site sewage disposal systems
11 (1) No person is permitted to install an on-site sewage disposal system within the Protected Water Area without first obtaining an approval from the Department.

(2) No person is permitted to construct or install or cause the construction or installation of an on-site sewage disposal system contrary to the ***On-site Sewage Disposal Systems Regulations***, made under the Act, and the terms and conditions of an approval issued by the Department.

Prohibition on release of substance
12 (1) No person is permitted to release or cause or permit the release of oil, petroleum products, soap, detergent, toxic chemicals, pest control product waste, garbage, litter, solid or liquid waste, sulphide bearing or acidic slate materials, or any other material that causes or may cause an adverse effect within the Protected Water Area.

(2) A person who is using mechanical equipment or transporting gasoline or oil within the Protected Water Area is not permitted to release, and must take precautions to prevent the release of, a petroleum product onto the ground or into a watercourse or the runoff from the area.

Prohibition on landfills
13 No person is permitted to establish a dump, landfill, waste disposal site or disposal site for sulphide bearing or acidic slate materials within the Protected Water Area.

Easement restriction

14 No person is permitted to construct a road, pipeline, railway, telephone line, power line or other similar development or grant an easement on, over or across the Protected Water Area, without first obtaining the written approval of the Water Works Operator.

Stormwater management

15 No developer is permitted to commence any development unless the development is conducted according to a Stormwater Control Plan that is

(a) prepared by a professional engineer; and

(b) approved in advance by the Water Works Operator in consultation with the Department.

Erosion and sediment control

16 (1) No person is permitted to authorize or commence an operation to extract peat, gravel, rock or minerals within the Protected Water Area.

(2) No person is permitted to undertake an activity that causes or might cause soil erosion resulting in sedimentation of a watercourse located within the Protected Water Area.

(3) No owner, occupier, contractor or person responsible for a construction operation or an activity within the Protected Water Area requiring grubbing or earth moving that would expose more than 200 m^2 of subbase at any time is permitted to proceed unless they have

(a) developed an erosion and sedimentation control plan as described in the "Erosion and Sedimentation Control Handbook for Construction Sites", published by the Department; and

(b) obtained the prior written approval of the Water Works Operator.

(4) No person is permitted to release water that has a suspended solid concentration greater than 25 mg/L in a grab sample from any area within the Protected Water Area.

(5) All landscaping within the Protected Water Area shall be carried out between May 1 and October 31 inclusive, in any year.

17 If sedimentation occurs in a watercourse within the Protected Water Area, an operator or person responsible for the sedimentation must undertake immediate action to install erosion and sediment control measures, and immediately notify the Water Works Operator.

Vegetation removal restrictions

18 (1) No person is permitted to alter or remove vegetation within 100 m of Bennery Lake or within 30 m of any watercourse or wetland within the Protected Water Area unless such alteration or removal is

(a) approved in advance by the Water Works Operator; or

(b) related to the operation of the Bennery Lake Water Treatment System and following consultation with the Committee.

(2) No person is permitted to alter or remove vegetation within 15 m of any watercourse or wetland located on lands zoned AE-4 (Aerotech Business) under the Halifax Regional Municipality Land Use By-law for Shubenacadie Lakes (Planning Districts 14 and 17), within the Protected Water Area, unless approved by the Water Works Operator.

(3) No person is permitted to remove vegetation from an area greater than 50% of each residential lot at any time prior to and following development of and construction on any residential lot.

Watercourse setbacks and buffers

19 (1) No person is permitted to erect a structure, excavate, fill or alter the grade of land within 100 m of Bennery Lake or within 30 m of any watercourse or wetland located on lands zoned P-4 under the Halifax Regional Municipality Land Use By-law for Shubenacadie Lakes (Planning Districts 14 and 17), within the Protected Water Area, unless such activity is

(a) related to the operation of the Bennery Lake Water Treatment Plant; and

(b) approved in advance by the Water Works Operator.

(2) No person is permitted to erect a structure, excavate, fill or alter the grade of land within 15 m of any watercourse or wetland located on lands zoned AE-4 (Aerotech Business) under the Halifax Regional Municipality Land Use By-law for Shubenacadie Lakes (Planning Districts 14 and 17), within the Protected Water Area, unless such activity is approved in advance by the Water Works Operator.

Consultation with the Committee

20 The Water Works Operator shall consult with the Committee before granting any authorization or approval required by these regulations.

Last updated: 20-03-2009

APPENDIX C: BENNERY LAKE WATERSHED MANAGEMENT COMMITTEE TERMS OF REFERENCE

BENNERY LAKE WATERSHED MANAGEMENT COMMITTEE TERMS OF REFERENCE

Mandate:

These Terms of Reference shall serve to constitute the Bennery Lake Watershed Management Committee as an advisory group to the Halifax Regional Water Commission (Halifax Water), the Province of Nova Scotia, and the stakeholders in management of the Bennery Lake Watershed.

General:

1. The Committee will review and make recommendations in a timely manner, to the Minister of Environment and Halifax Water on all activities or policy issues affecting water quality protection, flows, levels, storm water, development and forest management in the Bennery Lake Watershed Protected Water Area, as requested by Halifax Water, Province of Nova Scotia, and stakeholders in the area.

2. The Committee may, from time to time, request individuals or groups to make representation to the Committee on matters affecting the watershed.

3. The Committee will review and comment on water quality and monitoring programs and other studies related to the watershed. All water quality information available from member agencies shall be made available to the Committee.

4. The Committee will maintain liaison with government agencies not represented on the Committee with regard to matters affecting the watershed.

5. The Committee will develop information and education programs about watershed management and protection for local residents, landowners and other users of watershed lands.

Designation of Watershed as "Protected Water Area"

6. Under the Environment Act, the province has designated a large portion of the Bennery Lake Watershed as a Protected Water Area. The Protected Water Area is described and regulated under the *Bennery Lake Watershed Protected Area Designation and Regulations*.

7. Watershed protection regulations for the Bennery Lake Protected Water Area have been approved by the Minister of the Environment pursuant to the designation.

8. The Committee will provide advice and recommendations to the Waterworks Operator who is responsible, to ensure that terms and responsibilities related to the designated Bennery Lake Protected Water Area and regulations will be followed.

Membership and Meetings:

9. The Committee shall be comprised of representatives from:
    - (1) Nova Scotia Department of Natural Resources
    - (2) HRM Planning and Development Services
    - (2) Halifax Water
    - (1) General Public – District 2
    - (1) Halifax/Halifax County Watershed Advisory Board
    - (1) Bennery Lake Watershed Private Landowner
    - (1) Technical Advisor (non-voting) from:
        i. Nova Scotia Department of Environment

10. All members will serve for a two year term. Subsequent appointments or re-appointments to the Committee shall be a term of two years.

11. Upon expiration of terms, for members representing identifiable groups or organizations, that member will be asked by the Committee to have their organization nominate a member for the subsequent term. Where that is not possible, Halifax Water will contact the organization to request an appointment. For members not representing an identifiable organization; Halifax Water to write all landowners in the area of interest affected by the Bennery Lake Watershed seeking volunteers for the Committee. If new volunteers come forward, the Committee will seek non-professional membership through a balloting process.

12. The Chair and Vice-Chair of the Committee shall be appointed by the membership at the meeting closest to April 1st.

13. Bodies appointing representatives may name an alternate. Alternates may attend all meetings as observers and may vote when the appointed representative is absent.

14. Administrative support shall be provided by Halifax Water.

15. The Committee shall endeavor to conduct business by consensus, but should voting be necessary, all motions will require support from a majority of the members present. Five voting members will constitute a quorum. In the event there is not a quorum, an Information Meeting will be held.

16. The Committee shall meet as necessary, but no less than two times a year. Generally in the Spring and the Fall.

17. The Committee shall be empowered to amend its Terms of Reference by motion, with the approval of the Waterworks Operator.

18. The Committee shall prepare an annual report of its activities to be distributed to all bodies represented on the Committee, and to other interested parties.

19. The Chair shall act as spokesperson.

Committee Review Process:

20. The Committee will review and forward recommendations to the Waterworks Operator for approval within thirty (30) days following receipt of all submissions and requests pertaining to changes in land use activities within the Bennery Lake Watershed Protected Water Area, and as defined in the Protected Water Area regulations.

Land Development:

21. HRM Planning and Development Services will circulate to the Committee proposed Concept and Tentative plans at the same time as other municipal and provincial reviews. Committee reviews and recommendations will be integrated with the HRM development approval process.

March 19, 2009

APPENDIX D: BENNERY LAKE WATERSHED AREA MAP AND SAMPLE LOCATIONS

APPENDIX D: TABLE 3: BENNERY LAKE WATERSHED SAMPLING LOCATIONS

APPENDIX E: HALIFAX REGIONAL MUNICIPALITY LAND USE BY-LAW ZONE MAP OF BENNERY LAKE WATERSHED

Halifax Water
Best Management Practices
For
Halifax Water, and
Crown Managed Lands

April 2010

Compiled By:
Halifax Water

Supported by:
Elmsdale Lumber Company Ltd.
Department of Natural Resources
Pockwock Watershed Management Committee
Lake Major Watershed Advisory Board
Bennery Lake Watershed Advisory Board

Table of Contents

1.0 Introduction

Halifax Water is responsible for managing many activities on its watersheds. As a means of better managing these activities, Halifax Water has developed and implemented the following Best Management Practices (BMPs) to guide activities on Company and Crown managed lands, as supported by Elmsdale Lumber Company, the Pockwock Watershed Management Committee, the Lake Major Watershed Advisory Board, the Bennery Lake Watershed Management Committee and the Department of Natural Resources. For all other watershed lands, these BMPs are meant to be used for educational and awareness purposes. The following BMPs are not considered a complete collection but will continue to evolve to improve outcomes. In addition, these BMPs are not meant to replace existing legislation that governs activities on the watersheds. Furthermore, persons operating on the watersheds, regardless if it is designated as a Protected Water Area or not, should be familiar with current legislation that apply to the activities they are carrying out. A list of applicable legislation sited throughout these BMPs is listed in Appendix 1.

2.0 Definitions

1. ***Watershed*** – For the simplicity of this document, Halifax Water defines well head areas and surface water supply areas collectively under the term *"watershed"*.
2. ***3-Point Contact*** – A combination of 2 hands and one foot or 2 feet and 1 hand.
3. ***Company lands*** –Lands privately owned by Halifax Water.
4. ***Crown managed lands*** – Crown lands managed alone by Halifax Water or jointly by Halifax Water and NSDNR.
5. ***Chicot*** – Standing dead trees.
6. ***Special Management Zone*** (SMZ) – Special Management Zone as defined by the Department of Natural Resource
7. ***Lodged or Spring Trees*** – Trees that have become unsafe while operations are being conducted on the block. For example trees that are leaning against another tree for support or trees whose tops have broken and become lodged in other standing timber.
8. ***Grubbing*** – The removal of vegetative or organic matter by machine exposing bare mineral soil.
9. ***Overburden*** – Vegetative or organic matter which covers bare mineral soil.
10. ***Cultural Heritage Zone*** – An area that has been positively identified or having potential cultural or heritage significance by a trained expert. For example a trapper's cabin, grave stones.
11. ***Fording*** – Traversing of a machine through a watercourse, water body, and wetland as defined under the Environment Act.
12. ***Rip Rap*** – Clean, washed angular aggregate greater then 4 inches in size. Usually used around culverts or for erosion control purposes. The material must be free of sulphide bearing or acid slate.
13. ***Shelterwood Management*** – The practice of removing 30-50% of the stand basal area to create light conditions suitable for growth conditions. This harvest technique favours long lived tree species that are shade-tolerant., NSDNR Forest Research Report, *"Regeneration Following White Pine Shelterwood Cuts in Shelburne Co., NS."* March 1995.
14. **Selection Management –** With respect to *Uneven-aged Management* it is "the practice of leaving 3 or more height classes on site with a minimum height difference of 3m between classes, and one height class greater then 10m." Association for Sustainable Forestry, *"Selection Management."* October 2009.

15. Variable Retention Management – The practice of leaving as much hardwood and shade-tolerant species as operationally possible in the identified harvest block. The residual standing trees would be in addition to the *'Wildlife Habitat and Watercourses Protection Regulations'*.

16. Clear Cut Management – The total removal of all tree species with in an identified harvest block while meeting the minimum *'Wildlife Habitat and Watercourses Protection Regulations'*.

17. Travel Corridor – Solid linear feature that is used to physically break up larger harvest blocks into smaller harvest blocks.

3.0 Heavy Equipment

- Use 3-point contact for mounting and dismounting equipment. Check for hazards prior to dismounting and ensure handles and footholds are intact.
- Hard hats, safety boots and highly visible clothing or straps must be worn at all times. When working in a fully enclosed cab, exception may be given to hard hats.
- Lunch, fueling and maintenance areas will be kept clean and all garbage removed from the watershed on a daily basis. Deposit refuse, garbage, and tires in an approved waste disposal site.
- Be aware of all persons or vehicles around you. When you see a person or vehicle approaching, immediately stop operating your machine and lower the blade or boom to the ground, make eye contact, and signal for safe passage.
- Be aware of potential overhead danger such as a chicot, large dead branches and power lines.
- Shut machine down during times of repairs or maintenance.
- Ensure the blade or boom is always down and emergency brake is on when operator is out of the machine.
- While inside the HRM core, the HRM noise by-law will be applied and followed.
- During breaks and non working hours, park heavy equipment at least 30m from a defined stream channel or flowing water (e.g., where water is flowing in the ditch, etc.) and 60m from a well head location.

3.01 Fueling and Fluid Disposal

- No fuel bulk storage stations may exceed 450 litres unless approved by Halifax Water or NSDNR.
- All Halifax Water authorized fuel storage tanks must be fully contained.
- An emergency plan must be located on site and known to all users.
- All fuel tanks must conform to the Transportation of Dangerous Goods (TDG) Regulations.
- During transport, ensure all fluid containers, including jerry cans, are leak-free and secured to avoid damage and spills.
- All fuel containers, including jerry cans, must be marked clearly identifying their contents.
- Vehicles specifically designed for delivering fuel/fluids must be escorted at all times.
- Pumping devices for all fuel tanks must have automatic shut-off valve and be attended at all times while in use; no gravity fed pumps allowed.
- Designated fueling areas must be at least 30m from a defined stream channel or flowing water (e.g., where water is flowing in the ditch, etc.) and 60m from a well head location.

- All fuel tanks must have a 10 pound 6A80BC serviceable fire extinguisher available at all times.
- All fuel stations must maintain a complete spill kit which will include a plug and dyke kit. Chainsaw fueling stations will maintain gas and oil absorbing material which will be placed under saws when refueling and oiling.
- All motorized equipment must have an appropriate sized spill kit located on board.
- Do not smoke while refueling equipment.
- Fuel equipment on bare-mineral, stable, level ground.
- Prior to beginning work, all fluid maintenance must be completed.
- Dispose of waste fluid at an approved government facility.

3.02 Maintenance and Inspections

- When performing equipment maintenance and inspections, ensure that:
  - Machinery is parked on bare-mineral, stable, level ground.
  - Parking brake is on.
  - Blade or boom is in contact with ground.
  - Machine/energy is off; hydraulics and pneumatics are off and in zero energy state.
  - Operator inspects for and repairs all fluid leaks.
  - Operator inspects all electrical components and repairs any damaged or loose parts.
- When welding:
  - Machine must be 10m from a refueling area, and parked on bare-mineral soil.
  - A 20lb serviceable 6A80BC fire extinguisher is available.
  - Fuel caps must be in place and combustibles must be cleaned up prior to welding or grinding.
  - A fire watch must be implemented, that will continue for 15 minutes after welding is complete
  - A welding mask and gloves must be worn.
- Remove flammable debris from equipment daily.
- No welding or grinding is permitted during high to extreme fire conditions.
- Machinery and tools showing above normal leaking fuels or other fluids will cease operation immediately and fluids contained. Repairs are to be made or machinery moved from watershed. Report spills as per Emergency Spill Regulations.

3.03 Floating Equipment

- Check with provincial or local authorities for weight, height, length, and timing restrictions on deliveries.
- Do not use defective tie downs to secure machinery.
- Check load security prior to entering onto a public highway as well as routinely throughout the duration of the trip.
- Check for loose debris prior to transporting.
- Be aware of all persons in the vicinity of the float when lowering; make eye contact to ensure person(s) see you and are aware of the potential danger.

4.0 Communication

- ”Active Operation” signs or similar worded signs must be posted in work area to advise people of heavy equipment operating. The signs must be posted in plain sight so as to allow for adequate warning time.
- Use private contractors channel within the operating block to maintain contact of location throughout area.
- Calling frequency depends on traffic on the road. Increase calling frequency as vehicles approach one another.
- Identify location by kilometer markers and be clear about direction. Do not use “nick names” to identify location as this could cause confusion amongst workers in area.
- Vehicles carrying flammable liquids or chemicals hazardous to water quality, and exceed the minimum TDG requirements, that do not have communication capabilities must be escorted to and from the drop off/ pickup point by a vehicle that has communication capabilities.

5.0 Gates

- Only authorized Halifax Water staff will be permitted to duplicate gate keys that fall under Halifax Water control.
- Only authorized Halifax Water staff will be permitted to issue gate keys that fall under Halifax Water control. A key issuance sheet must be completed by Halifax Water Staff and signed by both Halifax Water Staff and the party(s) receiving the key(s). A copy will be given to the receiving party(s) and the original be kept on file at Halifax Water. Once the key(s) has been returned to Halifax Water the key issuance sheet will be completed as returned, a copy will be issued to the returning party and the original will be kept on file at Halifax Water
- A master list of key holders will be kept by Halifax Water.
- A key issuance is considered written authorization. A key issuance form must be completed and kept on file with Halifax Water.
- Gates must be locked at all times unless authorized by Halifax Water.
- Authorized users must report any illegal activities or unauthorized personnel behind Halifax Water controlled gates to Halifax Water staff immediately or when within communication range.

6.0 Emergency Response and Reporting

- In the event of any emergency on watershed lands Halifax Water is to be contacted immediately as well as the emergency responders responsible.
- The Halifax Water Emergency Response Plan manual, dated December 2006, will be the guiding document for Halifax Water staff. The ERP manual can be found at Halifax Water's main office located at 450 Cowie Hill Road, Halifax.

6.01 Fire Prevention and Reporting

- In case of a fire on watershed lands, immediately contact:

HALIFAX WATER **490-6940**
(24 hour contact line))

FOREST FIRE EMERGENCY 24 HOUR LINE **1-800-565-2224**

FIRE CONTROL (Shubenacadie office) **1-902-758-2232**

- Person(s) reporting a fire must provide location, size, estimated time, name and contact information of person reporting.
- For designated watersheds, fire season is dependent on the applicable watershed regulations. For the Pockwock PWA the fire season is from **April 1st to Oct 31st o**f each year while the Lake Major and Bennery Lake PWA fire season is from **April 15th to Oct 15th** of each year. For all other watershed lands that fall outside of a designated PWA, the fire season depends on the provincial fire season for that area. **(legal requirement)**
- All operators are to be aware of where the fire equipment is stored.
- No open fires are permitted on Company lands unless otherwise authorized by Halifax Water. For all other watershed lands follow the applicable watershed regulations pertaining to fire restrictions or contact Halifax Water or your local NSDNR office.
- During fire season, smoking shall only take place on bare mineral soil; all precautions must be taken to ensure the cigarette or cigar has been extinguished.
- During fire season, all motorized equipment is required to have applicable fire fighting equipment as per the Nova Scotia Fire Protection Act. The fire plan must be on site during fire season.
- During fire season, while conducting operational activities fire indices must be checked daily and followed. A daily log must be kept.
- During high to extreme fire hazard conditions only operations conducted on bare mineral soil shall take place. Written permission to operate must first be obtained and a fire watch must be conducted daily 30 minutes after operations have ceased.
- Move equipment to mineral soil and shut off master switch at the end of each working day.
- Remove all accumulation of flammable material from equipment daily.

- No equipment shall operate within 300m of a forest or woodlands without an adequate device for arresting sparks. **(legal requirement)**
- Chainsaws must be equipped with spark arresters.
- Do not start chainsaws within 3m of a fueling area.
- Chainsaw must have a 0.5kg (1 lb) pouch fire extinguisher or 5kg (10 lb) extinguisher.

6.02 Petroleum and Chemical Spill Response and Reporting

- In the case of a petroleum or chemical spill on watershed lands, immediately contact:

HALIFAX WATER **490-6940**
(24 hour contact line))

COAST GUARD ..... **1-800 565-1633 or 426-6030**

ENVIRONMENTAL EMERGENCIES 24 HOUR LINE **426-6200**

- One hundred (100) litres (22.2 gallons) of fuel or used oil constitutes a reportable spill to government agencies. ALL-SIZED SPILLS must be reported to Halifax Water. See appendix 2 for a complete list of reportable toxins.
- Person(s) reporting a petroleum or chemical spill must provide location, estimated quantity, time, substance, if known; name and contact information of person reporting.
- Halifax Water will maintain, at all pumping station locations, a supply of oil absorbent material to be used in the event of an oil spill to create an oil boom around the intake of the pumping station and/or absorb oil on the water supply surface.
- All Halifax Water employees, Department of Natural Resources staff, and contractors working on watershed lands must report any overturned engine-equipped machines, such as trucks, skidders and tractors, to Halifax Water immediately. They must also report any foreign substance on the surface of the water supply or land that could pollute the water.
- When a petroleum or chemical spill has been reported to Halifax Water, the applicable treatment plant operator and Director of Water Services will be contacted as well as the **COAST GUARD/ENVIRONMENTAL EMERGENCIES** immediately.

7.0 Road Construction and Maintenance

7.01 Road Planning

- Applicable permits and approvals must be obtained prior to operations beginning and on site at all times.
- Where possible, use existing roads as they usually provide the best long term access. When using existing roads, reconstruct only to the extent necessary to provide adequate drainage and safety.
- Avoid areas that require large cuts and fills, in order to reduce construction costs and soil erosion.
- Plan road systems that will minimize the number, width, and length of roads in order to limit the total area disturbed and loss of productive ground.
- Where possible, locate roads on high ground and along ridges to reduce erosion and prevent sedimentation of streams. Avoid locating roads along the sides of hills with greater than 30% slope.
- Identify landings, loading areas, meeting places, turn-a-rounds and potential gravel pits during road layout.
- Plan turnouts for opposing traffic at one kilometer intervals along single lane roads and turnarounds at the ends of all roads.
- Attempt to locate roads parallel to the natural drainage system to minimize the number of watercourse and stream crossings.
- Maintain a belt of undisturbed vegetation between the road and a stream or lake to allow silt carried by runoff from the road to be collected in the undisturbed area. Vegetative widths: Slope of land <30% = 30m buffer, Slope of land >30% = 40m buffer.
- Ensure all merchantable right-of-way (ROW) wood is delivered to a mill facility.
- Where possible, avoid hilly terrain (<10% if possible), erodable soils, bedrock and shallow soils when locating roads and crossings.
- Select crossings well in advance of operations to avoid delays in receiving approvals.
- Plan crossings at right angles to prevent any redirection of the flow in the water course.
- Plan crossing at the narrowest spot possible with no braided channels or obstructions.
- Ensure all Special Management Zones (SMZs) and crossings that may require special mitigation techniques have been addressed (e.g., visual buffer or slope dependant).

7.02 Road Layout

- Road layout will be completed using a GPS hand held unit or a compass accompanied by photo and map showing a minimum:
  - Harvest boundaries
  - Special Management Zones
  - Waterways and water bodies
  - Roads
  - Property Boundaries
  - Significant areas such as wetlands, heritage sites, and wildlife values
- Ribbon layout:
  - Three (3) ribbons indicate the end of a road
  - Two (2) ribbons indicate a corner in the road or block
- Blue ribbon marked will be used to mark road centre line location as well as skid trails into or between harvest blocks that have not already roaded.
- Ensure the ribbons are tied in a manner that is clearly visible to the operator during anytime of the year.
- If an alteration to the road location is required, remove old ribbons so as not to create confusion of the correct road ribbons to follow.
- If operations do not start up within a year of completing road layout, the site is to be revisited and the lines are to be refreshed where needed. Halifax Water and NSDNR are to be notified once completed.

7.03 ROW Clearing and Road Construction

- Applicable permits and approvals must be obtained prior to operations beginning and on site at all times.
- Road construction shall only take place from **June 1 to September 30** of each year as per applicable watershed regulations (Bennery Lake, Lake Major, and Pockwock). For all other Company and Crown managed lands outside of a designated watershed where road construction is required, approval will only be granted to those situations where there is little to no risk of the water supply being affected. **(legal requirement)**
- ”Active Operation” signs or similar worded signs must be posted in work area to advise people of heavy equipment operating. The signs must be posted in plain sight so as to allow for adequate warning time.
- Cut landings and pile wood away from drainages to avoid obstructing water.
- Trees must be never be felled into a watercourse.

- No landings or wood piling areas are to be located within a SMZ, riparian area or within 30m of a watercourse.
- Ditches, water bars, off-take ditches, cross drains and settling ponds must be a minimum of 30m from any watercourse.
- Where ditches are required, construct them in a manner to divert water into the green belt.
- Cut down chicots that are closer than one treelength from the road edge.
- Do not leave lodged or spring trees.
- ROW width outside of a SMZ must not exceed 30m from standing timber to standing timber unless otherwise approved by Halifax Water or NSDNR. The exception to the rule is ROW that run through a harvest block.
- ROW width inside a SMZ or riparian zones must not exceed 20m from standing timber to standing timber unless otherwise approved by Halifax Water or NSDNR.
- No grubbing shall take place within a cultural heritage zone without the approval of Halifax Water or NSDNR.
- Post safety signs as required, such as: slow, stop, blind curve, steep hill, narrow bridge, and kilometer markers.
- Contractors working must attend a minimum of one start up meeting per year to review the requirements specific to the applicable watershed as per the contractor start up agenda.
- Slash and stumps created from ROW clearing and road construction must be used in a manner that minimizes the roadside debris (e.g., construction of roadbeds, turn-a-rounds, back filling of borrow pits) unless otherwise approved by Halifax Water or NSDNR.
- Where possible, construct roads and landings away from areas of advanced regeneration.
- Stop operations if a potential value that has not been previously identified is encountered (e.g., stream, stick nest, cabin, grave site). Immediately notify Halifax Water or NSDNR to be advised on how and where to resume operations.
- Cross drainage culverts will be a minimum diameter of 300mm (12inches).
- All watercourse crossings will be calculated using the 100 hundred year event (Q100).
- The travel surface on all forest access roads (Class-D = 3m) will be covered to a thickness of 10cm to 15cm with 5cm (2inch) gravel, free of contaminants, in order to reduce erosion and potential sedimentation from the road surface.
- Ensure a copy of the most recently approved map is on site at all times showing the location during operations. The old versions are to be destroyed.
- The construction of loop roads is not permitted without the permission of Halifax Water or NSDNR.
- The use of explosives must be authorized by Halifax Water and carried out by a certified explosives specialist.

- Once operations are completed, leave all existing roads, ditches and culverts in the same or better condition as prior to operations.

7.04 Erosion Control

- Use erosion control techniques (i.e., straw bales, filter cloth, seeding, silt fences, ditch dams, etc.) to prevent foreign material from entering the water. Install erosion control measures prior to working near streams.
- Seeding and mulching on "sensitive" areas with high sedimentation potential such as bridge approaches or cut and fill areas within 30m of streams are especially important.
- Use clean rip rap to line all bridge and culvert faces above the high water mark to protect against erosion during periods of high water. Rip rap must be free of acidic bearing slate.
- Avoid operating equipment on unstable slopes, stream banks or soft ground. Use straw, hay or clean crushed stone to stabilize banks or slopes to prevent soil from falling into stream.
- Continuously monitor and conduct routine maintenance as required on erosion and sediment control measures during and after road construction operations.
- Ensure that drainage features are fully functional prior to spring or fall runoff.
- Where erosion is anticipated on steeper sections or near culverts/bridges consider using surfacing material (gravel and rocks) to reduce erosion and potentially extend the operating season.
- Diversion ditches must be at least 30m away from a water body or watercourse. Where slope is greater than 10%, a diversion ditch is required every 30m into the green belt.
- No grubbing shall take place within 30m of any water body or watercourse to prevent sedimentation.
- Minimize grubbing within a SMZ to reduce the disturbance of the overburden unless otherwise approved by Halifax Water or NSDNR.
- Vehicle traffic should be restricted on soft roads during the wet season of the year and during heavy rains when road surface is rutting.
- Avoid skidding or forwarding on truck roads unless conditions are such that the road profile will be maintained.
- For roads with a slope of 10% or less, avoid having water run in a ditch for greater than 300m to minimize erosion.
- For roads with a slope of greater than 10%, avoid having water run in a ditch for greater then 30m to minimize erosion.
- When construction lasts more than one day, exposed soils must be stabilized at the end of each day.

7.05 Water Crossing Installation

- Applicable permits and approvals must be obtained prior to operations beginning and on site at all times.
- All watercourse crossings requiring approval for installation must be completed by person(s) who have successfully completed the NS Watercourse Alteration Certification Program, who is to remain on site to supervise the installation. Person(s) responsible for the installation must be able to provide proof of successfully completing taking the course.
- All permanent bridge and culvert installations must be completed between **June 1 and September 30** of each year. Temporary bridges can be installed year round; however, the installer must comply with the Water Course Alteration Certification Program, manufacturer instructions, and obtain approval from Nova Scotia Environment (NSE), Halifax Water and NSDNR. Exception to the rule is the emergency repair of any water course structure as a result of a wash out or failure.
- "Active Operation" signs or similar worded signs must be posted in work area to advise people of heavy equipment operating. The signs must be posted in plain sight so as to allow for adequate warning time.
- Minimize soil disturbance near streams.
- No in-water work is allowed unless approved by NSE.
- Ensure no fluids, debris or soils enter the water. Allow free flow of water at all times to allow fish passage. Temporary obstruction maybe allowed with the approval of NSE if there is no other means of water crossing installation, such as cofferdam or dam and pump option.
- No fording through water bodies or water courses of any kind is permitted unless approved by NSE.
- If a sediment control plan is required for the crossing, have the plan on site at all times.
- Ensure a copy of the most recently approved map is on site at all times showing the location during operations. The old versions are to be destroyed.
- Equipment must be clean and free of debris prior to work beginning.
- Equipment must be mechanically sound ensuring no fluid leaks of any kind prior and during water crossing installation.
- No merchantable wood may be used in a crossing without approval by Halifax Water or NSDNR.
- Where possible, build crossing at right angles to the stream to build more stable crossings and prevent changes in the water flow.
- Avoid wetlands, sensitive and unique areas where possible when choosing a water crossing.
- No beaver dams are to be removed unless approved by Halifax Water or NSDNR.
- When constructing bridge cribbing use geo-textile and clean fill to prevent sedimentation.

- Remove all leftover debris or building material from the site.
- Culvert(s) must be imbedded 20% of the culvert diameter into stream bed. **(legal requirement)**
- Ensure slope of road shoulder at the culvert is 2:1 or less to maintain stability. **(legal requirement)**
- Whenever possible use open bottom culverts or bridges for fish bearing streams. If closed bottom culverts must be used, ensure free fish passage. **(legal requirement)**
- When installing closed bottom culverts the slope gradient must not exceed 0.5%. If the slope is greater then 0.5% then an open bottom culvert or bridge must be installed to ensure fish passage and water flow. Align structure with the channel to ensure water flows freely. **(legal requirement)**
- When installing culverts, backfill with earth or gravel and pack material. For culverts greater then 600mm (24inches), pack backfill material to at least half the diameter of the culvert using a tamping machine. **(legal requirement)**
- Cover culvert with a minimum of 30cm (12 inches) of gravel leaving a 2:1 slope at each end. Culvert ends must extend a minimum of 30cm out from the end of the culvert to the toe of the finished banks. **(legal requirement)**
- When installing bridges and open bottom culverts, cribbing and footings must be 30cm back from the high water mark. Do not excavate below the normal high water mark. **(legal requirement)**
- No multiple culvert installations are permitted unless approved by NSE, Halifax Water or NSDNR.
- No chemically treated wood is allowed for the construction of water crossing structures. It is recommended that untreated hemlock, tamarack/juniper, or cedar, pre-cast concrete, corrosion resistant steel, or plastic be used.
- After construction is complete, re-vegetate disturbed soils located within 30m of water bodies, outside the travel surface.
- Regularly inspect and clean culverts when necessary to avoid washouts and ponding from occurring on the upstream side of the culvert. A routine culvert inspection and maintenance program can avoid costly repairs and reduce negative water quality impacts.
- Where possible, adjust the height of the bridge deck so that it is slightly higher than the road approaches, preventing road surface water from running onto the bridge and into the stream.
- Bridge decking (permanent/temporary) must be entirely closed with outside a minimum of 15cm x 15cm (6inch x 6inch) bumpers installed to catch vehicle and water runoff. Decking and bumpers must be kept clean to reduce negative water quality impacts.
- Ensure all end corners of the bridges are well marked with reflective bridge markers.

- Regularly inspect and maintain bridges for structural repairs and to remove any debris which may clog the opening and hinder stream flow.

7.06 Water Crossing Removal

- Applicable permits and approvals must be obtained prior to operations beginning and on site at all times.
- No in water-work is allowed unless approved by NSE.
- Ensure no fluids, debris or soils enter the water. Allow free flow of water at all times to allow fish passage. Temporary obstruction may be allowed with the approval of NSE if there is no other means of water crossing installation, such as cofferdam or dam and pump option.
- Stabilize approaches once crossing has been removed (e.g., seeding, rip rap).
- Minimize disturbance to greenbelt (riparian zone)
- Ensure construction material has been removed from site once crossings completely removed
- Machines must be cleaned and leak free prior to crossing removal.
- All crossings that are to be removed must be removed during dry conditions. During wet periods (rain, snow melt) removal will be suspended until the ground around the removal location has dried up.
- Ensure a copy of the most recently approved map is on site at all times showing the location during operations. The old versions are to be destroyed.
- Ensure short term and long term erosion measures are put in place during and after removal to maintain bank stability and prevent sedimentation.
- Safety measures must be taken to notify users of removal and to proceed with caution. Place barriers and warning signs in plane view to allow for adequate warning time.

7.07 Gravel Pits

- Applicable permits and approvals must be obtained prior to operations beginning and on site at all times.
- Pit extraction can only take place from June 1 to September 30 of each year or as approved by NSE, Halifax Water or NSDNR.
- Ensure the pit boundaries are clearly identified prior to cutting and excavating to eliminate excess exposure of bare-mineral soil.
- Remove trees within 5m of the extraction face.
- Organic overburden and trees must be piled so as to be used for site remediation once pit operations have been completed.

- The use of explosives must be authorized by NSE, Halifax Water, or NSDNR and carried out by a certified explosives specialist.
- During Gravel pit extraction, no aggregate is to be removed within 10m of the road bed edge and property boundary lines.
- There is to be no aggregate removal allowed within a SMZ or riparian zone or 30m of a watercourse or water body.
- Excavation faces must be sloped and stabilized to prevent erosion during and after extraction has been completed. Once excavation has been completed all pit faces must be sloped 3:1 to prevent erosion and reduce safety concerns.
- During extraction, the water table must remain 1.5m below the lowest extraction point to avoid the area from filling up with water.
- Drainage of the excavation area will be designed to prevent sedimentation from entering a water body or water course.

7.08 Road Upgrade and Maintenance

- Contact Halifax Water before conducting any emergency repairs on roads if water crossings are involved.
- "Active Operation" signs or similar worded signs must be posted in work area to advise people of heavy equipment operating. The signs must be posted in plain sight so as to allow for adequate warning time.
- No chemical application for the purpose of controlling vegetation is allowed unless approved by NSE, Halifax Water or NSDNR.
- Ensure no material is deposited on bridge decking or over the ends of culverts during grading operations.
- Grade road surfaces only as often as necessary to maintain a stable running surface and retain the original surface drainage.
- Avoid grading sections of road where it is not required. Grading creates a source of sediment from the newly disturbed surface. Raise the grader blade where grading is not necessary.
- While grading, bring loose material back towards the centre of the road to prevent the creation of windrows along the edge of the road that may channel runoff and erode slopes.
- Shape road to allow for proper drainage and runoff
- Wing back snow during plowing operations to minimize spring saturation and erosion of the road. Ensure the plowed road surface does not appear wider than the actual road.
- During hauling operations, road and weather conditions will be monitored to ensure proper maintenance measures are in place and being followed (eg. sanding/plowing). By doing so will minimize road repairs and lessen sediment runoff.

- Sand is the preferred winter maintenance tool; however salt may be used as a last resort, and only in areas that are considered to be a safety concern. For example, on roads with hilly terrain. Permission must first be obtained from Halifax Water or NSDNR

8.0 Forest Management Planning

- Halifax Water considers forest management planning to be an important tool in watershed management for the improvement of water quality.
- It is Halifax Water's goal to manage the forested watersheds with the support of NSDNR to have no more then 50% of the forested watershed less then 50 years of age while supporting the provincial *Environmental Goals and Sustainable Prosperity Act* 12% protected areas target.
- The maximum annual harvest area (AHA) is recommended to not exceed 1% of the forested watershed. However if market or weather conditions do not allow the 1% AHA to be reached, a maximum AHA of 2% is recommended to be harvested in the following year. It is not recommended that the maximum 2% AHA be exceeded in any one year. Exception to this rule maybe given in the event of an unplanned natural disaster such as a fire or wind storm damage. If harvesting is required for the protection of water quality, it is recommended that up to 6% of the watershed may be harvested annually for a period of no more than 3 years; after which, harvesting must return to 1% or less over the next 6 years.
- Additional to the *'Wildlife Habitat and Watercourses Protection Regulations'* Halifax Water considers forest management planning that take into consideration natural disturbance patterns, the re-establishment of the Acadian Forest, and climate change, while maintaining the highest priority in protecting water quality.
- Typical harvest blocks are not to exceed 10 hectares. Special exemption for salvage operations of wind, insect, disease, and fire damaged sites can be approved by Halifax Water or the applicable watershed advisory board where there is a threat to water quality.
- In addition to salvage operation, special block size exemption maybe given to harvest systems that improve forest stand health such as Hardwood, Selection and Shelterwood Management.
- Adhere to the harvest adjacency rule of 10 years or 2m for softwood and 3m for hardwood, whichever comes first, before considering the next harvest treatment.
- For harvest blocks exceeding the 10 hectare size limit and do not meet special block size exemption conditions or do not meet the adjacency rule, a block separation or travel corridor must be used. The corridor is meant to break up the larger block into smaller blocks less then 10 hectares. The corridors must continually run between blocks and be at least 50m wide.
- For Wildlife Tree retention, priority will be given to disease-free, long-lived, deep rooted species. Preferences in order, are;
    - American White Ash, Red Oak, Yellow Birch, Sugar Maple, Iron Wood, American Beech, White Pine, Red Pine, Eastern Hemlock, Red Spruce, Red Maple, White Birch, Black Spruce, White Spruce, Balsam Fir.
- Other values will be considered during forest management planning, in areas such as cultural heritage sites, wildlife habitat (e.g., deer wintering areas), and Species at Risk (e.g., lichens, flying squirrels, etc.).

- Identify the area to be harvested, including the location of water bodies and sensitive area such as wetlands and high erosion hazard areas (e.g., thin soils) within the harvest area.
- During forest management planning, Halifax Water must consider using harvesting techniques that do not require the use of chemicals as a post treatment to control hardwood and unwanted vegetative species as Halifax Water does not support their use. In lieu of chemicals the following practices are applied:
    - Where forest stands would best benefit from the variable retention management system, Halifax Water will promote leaving as much standing hardwood and shade-tolerant species as operationally possible. The intention is to reduce clear cut management methods within the watersheds and promote leaving as much overhead canopy as possible.
    - Where forest stands would best benefit from Hardwood, Selection, and Shelterwood management systems, Halifax Water will promote leaving shade-tolerant, long lived, deep-rooted species that leave a uniform canopy over the landscape.
- Time harvesting activities to minimize environmental impacts. For example, typically harvesting activities should occur during the drier summer months, or if needed will occur during the winter months when the ground is frozen and/or there is a snow pack.
- Consider timing restrictions around other values such as tourism season (June 15 to Oct.15 of each year).
- The width of any water course within a watershed will have a riparian zone greater or equal to the Provincial minimum standard of 20m from high water mark; however, depending on depth to water table, soil conditions, slope, etc., the riparian zone may be increased to protect the integrity of the riparian area.
- All lake shore riparian zones widths will be no less then 60m from high water mark; however, depending on depth to water table, soil conditions, slope, etc., the riparian zone may be increased to protect the integrity of the riparian area.
- Consider potential water quality impacts and risk of erosion and sedimentation in the selection of silvicultural and regeneration systems (e.g., variable retention harvest, shelterwood, hardwood selection) in order to plan forwarding routes and trails.
- Consider the additional contributions from harvesting or roads to any known existing water quality impairments or problems in watersheds of concern. For example, acid bearing slate in the Bennery Lake Watershed.
- Ensure all contracts and agreements are in place prior to operations commencing (e.g., land owner, stumpage, service agreements etc.).
- Use silvicultural practices that promote native natural species.

9.0 Forest Operations

9.01 Block Layout

- Block layout will be completed using a GPS hand held unit or a compass accompanied by photo and map showing a minimum:
  - Harvest boundaries
  - Special Management Zones
  - Waterways and water bodies
  - Roads
  - Property boundaries
  - Significant areas such as wetlands, heritage sites, and wildlife values
- Ribbon layout:
  - The tails of the ribbons indicate the inside of the operating area and will be facing the operator
  - Three (3) ribbons indicate the end of a road
  - Two (2) ribbons indicate a corner in the road or block
- Solid pink ribbon pr pink ribbon marked with "Cut Block Boundary" or "Boundary Layout" will be used to mark the harvest area boundaries during block layout. Pink ribbon with black stripes will be used to mark out buffer and significant areas (water course/ heritage zones).
- Blue ribbon marked will be used to mark skid trails into or between harvest blocks that have not already roaded.
- Orange ribbon will be used to mark sample points for forestry data collection during silvilculture or harvesting operations (e.g. stem count or volume count).
- Ensure the ribbons are tied in a manner that is clearly visible to the operator during anytime of the year.
- If an alteration to the boundary location is required, remove old ribbons so as not to create confusion of the correct boundary ribbons to follow.
- If operations do not start up within a year of completing the block layout, the site is to be revisited and the lines are to be refreshed where needed. Halifax Water and NSDNR to be notified once completed.

9.02 Harvesting

- Applicable permits and approvals must be obtained prior to operations beginning and on site at all times.

- Ensure harvest areas, all applicable leave areas, and riparian zones are flagged off as according to the *'Wildlife Habitat and Watercourses Protection Regulations'* or any applicable watershed regulations and company policies.
- Ensure a copy of the most recently approved map showing the location is on site at all times during operations. The old versions are to be destroyed.
- The harvesting machine(s) must have a copy of the most recently approved map on board showing a minimum:
  - Harvest boundaries
  - Special Management Zones
  - Water ways and water bodies
  - Roads
  - Property Boundaries
  - Significant areas such as wetlands, heritage sites, and wildlife values
- In addition to the most recently approved map, it is highly recommended that the harvesting machine have a GPS on board that reflects the approved map boundaries.
- "Active Operation" signs or similar worded signs must be posted in work area to advise people of heavy equipment operating. The signs must be posted in plain sight so as to allow for adequate warning time.
- Do not pile wood on top of culverts in order to avoid obstruction or damage.
- No cutting or other works are to take place within the designated riparian zone of any lake, river, wetland, or stream (including seasonal streams) without special approval from NSE, Halifax Water or NSDNR.
- Do not fall trees into any watercourse.
- All water bodies and watercourses must be kept free of debris generated from forest operations. No slash accumulations resulting from the operation is to be left on roads so that vehicle traffic is impeded. All ditch-lines are to be functional post harvesting.
- The Stump height BMP is as follows:
  - For trees with a diameter of 30cm or less, measured as the outside diameter at the point of cutting, the maximum stump height allowed is 30cm. For trees with a greater outside diameter than 30cm, the maximum stump height must not be greater then its' measured outside diameter. Regardless of the diameter, no tree may be felled so that its' stump height is greater then 60cm. Special exemption maybe given by Halifax Water or NSDNR for reasons such as safety; for example, the clean up of wind damaged sites.
- All merchantable timber harvested must be moved to roadside in a timely fashion for trucking purposes.

- Ensure all merchantable timber within the harvest block as identified in the forest management plan is harvested with the exception of leave areas, riparian zones and wildlife trees.
- While felling trees along a harvest boundary ensure the boundary ribbons are left intact.
- While felling trees along a property boundary ensure the boundary markers and blazes are left intact and do not fall trees into adjacent property.
- Do not fall trees over block boundary lines.
- Ensure no lodged or spring trees are left in the harvest area.
- Protect advanced growth and residuals.
- Stop operations if a potential value that has not been identified is encountered (e.g. stream, stick nest, cabin) and notify Halifax Water or NSDNR immediately. Halifax Water or NSDNR will advise on how to resume.
- Do not use roads if rutting of the road surface, sedimentation of streams or damage to culverts is likely to occur.
- If, in the opinion of Halifax Water or NSDNR, forest operations are causing excessive damage to the natural forest environment that may result in erosion or other unnatural disturbances, the operation will be ordered discontinued until the situation has been corrected.
- Cut down chicots that are closer than one tree length from the edge of the road.
- When using a chainsaw, operators must meet Occupational Health and Safety Guidelines. When operating a chainsaw, the operator must wear appropriate chainsaw safety pants, hard hat, protective eye wear, ear protection, gloves and safety boots at all times. **(legal requirement)**
- Chainsaws must be equipped with an operable chain catcher and chain break.
- When harvesting using a chainsaw, all chicots must be removed from the block for safety reasons.
- No camping, accommodation trailers or buildings are to be brought into the watershed area.
- Contractors must attend a minimum of one start up meeting per year to review the requirements specific to the applicable watershed as per the contractor start up agenda**.**
- The contractor engaged in forest operations in the watershed will be responsible for the conduct of all his employees and agents with respect to law, regulations and guidelines pertaining to activities on watershed lands.
- Any deviance on the part of the contractor or employees of the contractor from these working conditions will be immediately corrected as directed by Halifax Water.
- Leave known recognized recreational trails (i.e. hiking, walking) in as good as or better condition than found, and clear off debris.

- If the harvesting operation occurs in the vicinity of identified recreational trails (HRM) or residential areas (closer then 100m) , ensure the club and/or residents are aware of the operation and post warning signs at each end of the trail/road within 100m of the operation. The signs are to remain in place during the length of the operation until all wood is removed.
- Skidders and forwarders are to travel in the same path as the felling and processing machines to minimize site disturbance and damage to residual stems.
- No extraction trails may be located within a plantation without first obtaining permission from Halifax Water or NSDNR.
- No motorized equipment may travel through/over a watercourse unless an appropriate crossing structure is in place.
- To reduce the risk of wood being left behind, place a skid log under roadside piles. This will reduce the number of logs laying in wet/frozen conditions.
- Harvested trees must be utilized to the fullest extent; however, if form and length do not allow for ideal utilization, the minimum top diameters are defined as:
    - Minimum top diameter of 7.5cm (3inch) for Red Spruce, Black Spruce, White Spruce, Tamarack.
    - Minimum top diameter of 16cm (6inch) for Hardwood, White Pine, Red Pine.
    - Discretion must be used when measuring for top diameter as form could be a deciding factor of where the tree must be topped. Both the roadside piles and in bush tops will be inspected by Halifax Water or NSDNR to ensure quality topping practices are being conducted.

9.03 Grinding and Chipping

- Applicable permits and approvals must be obtained prior to operations beginning and on site at all times.
- No chipping or grinding of wood products is to be conducted within 60m of a watercourse.
- "Active Operation" signs or similar worded signs must be posted in work area to advise people of heavy equipment operating. The signs must be posted in plain sight so as to allow for adequate warning time.
- No stock piling of woodchips within 60m of a watercourse
- Chipping debris created from the chipping process must be cleaned off road surfaces on a regular basis so as not to impede vehicular passage.
- Once operations have been completed, chipping debris must be completely cleaned off of road surfaces and spread out to a maximum thickness of 30cm within the block boundary.

9.04 Loading and Hauling

- Applicable permits and approvals must be obtained prior to operations beginning and on site at all times.
- ”Active Operation” signs or similar worded signs must be posted in work area to advise people of heavy equipment operating. The signs must be posted in plain sight so as to allow for adequate warning time.
- Ensure all tie down cables, chains, and chip van covers are working accordingly and replace any damaged ones immediately.
- Ensure all wood is centered between the pickets for safe loading.
- Ensure the truck driver has checked both sides of the load prior to leaving the block.
- Truckers must not tie down next to another truck loading.
- Check for loose debris prior to transporting.
- Check load security prior to entering onto a public highway as well as routinely throughout the duration of the trip.
- The loader operator must thoroughly search through the snow to ensure no merchantable wood is left behind.
- If merchantable wood cannot be loaded because it is frozen to the ground, Halifax Water or NSDNR must be notified.

10.0 Silviculture

10.01 General

- Applicable permits and approvals must be obtained prior to operations beginning and on site at all times.
- All water bodies and watercourses must be kept free of debris from silviculture operations. No slash resulting from the operation is to be left on roads, and felled saplings near culvert inlets are to be removed.
- Do not use roads if rutting of the road surface, sedimentation of streams, or damage to culverts is likely to occur.
- Lunch, fueling and maintenance areas will be kept clean and all garbage removed from the watershed on a daily basis. A gas and oil absorbing material will be placed under saws when refueling and oiling. Report spills as per the Emergency Spill Regulations.
- Designated fueling areas must be at least 30m from a defined stream channel or flowing water (i.e., where water is flowing in the ditch, etc.).
- Fuel containers (Jerry cans) when transported in vehicles are to be leak-free and secured to avoid damage and spills.
- All fuel containers (Jerry cans) must be marked clearly identifying their contents.
- Machinery and tools showing above normal leaking fuels or other fluids will cease operation immediately and fluids contained. Repairs are to be made or machinery removed from watershed.
- All vehicles on the forest operation will have an appropriately sized spill kit and required fire fighting equipment on board.
- No camping, accommodation trailers or buildings are to be brought into the watershed area.
- Be aware of wildlife habitat features, such as cavity trees or nests, and protect these from disturbance during silviculture operations.
- No chemicals are allowed for herbicide, pesticide, biocide, or fungicide purposes unless otherwise approved by NSE, Halifax Water or NSDNR.
- The contractor engaged in forest operations in the watershed will be responsible for the conduct of all his employees and agents with respect to law, regulations and guidelines pertaining to activities on watershed lands.
- If forest operations are causing excessive damage to the natural forest environment that may result in erosion or other unnatural disturbances, the operation will be ordered discontinued until the situation has been corrected.
- Any deviance on the part of the contractor or employees of the contractor from these working conditions will be immediately corrected.

10.02 Regeneration Assessment

- Regeneration Assessments for initial post-harvest treatment (natural establishment/ planting) will be completed by Halifax Water or NSDNR two years after harvesting operations have been completed.
- Regeneration Assessments will be completed as per the 'Nova Scotia's *Forest Sustainability Regulations'*.

10.03 Planting

- Halifax Water prefers to promote the re-growth of native species to the harvest area through natural regeneration. Planting of native species will be used as an alternative if regeneration assessments show inadequate restocking through natural regeneration.
- Halifax Water does not promote the planting of non-native species, however, if conditions warrant, approval must be given by Halifax Water or NSDNR.
- Planting will be completed as per the *'Nova Scotia's Forest Sustainability Regulations'*.

10.04 Spacing

- Halifax Water's silviculture program includes a spacing program which targets healthy immature stands. Spacing is only conducted on stands that warrant it as per the *'Nova Scotia's Forest Sustainability Regulations'*.

10.05 Chemical Use

- As per applicable watershed regulations.
- Halifax Water does not support the use of chemicals on any watershed lands.

11.0 Recreation

- Halifax Water does not promote its lands or watersheds as open to the public for recreational activities; rather it takes the approach of "user-beware".
- Halifax Water tolerates the use of low impact recreational activities on its lands and watersheds unless otherwise posted. Low impact watershed activities include hiking, mountain biking, and cross country skiing as long as they does not impair water quality or impede on the systems in place to conduct watershed management.
- In addition to the applicable Protected Water Area regulations, no motorized vehicles are allowed on Halifax Water lands without written authorization. The written authorization must be carried on the authorized vehicle(s) at all times. A penalty may be issued to those who do not comply.
- No open fires are allowed, including camp fires, on Company lands without written permission being first obtained from Halifax Water. The written permission must be carried on the person(s) conducting the fire activity. A penalty may be issued to those who do not comply.
- There will be no cutting of wood allowed for recreational, personal or commercial purposes without the written authorization of Halifax Water or NSDNR. The written permission must be carried on the person(s) doing so. A penalty may be issued to those who do not comply.
- Hunting and fishing activities must comply with provincial and watershed regulations unless otherwise posted.
- Boating, canoeing, and kayaking must comply with provincial and watershed regulations unless otherwise posted.
- Swimming must comply with provincial and watershed regulations unless otherwise posted.

Appendix 1 – Applicable Legislation

- **Applicable Municipal By-laws that may affect Halifax Watersheds:**
  - Halifax Regional Municipality By-laws regions. Listed below are those By-Law regions that directly influence activities on Halifax Water watershed lands in addition to the Protected Water Area regulations:
    - Cole Harbour/ Westphal
    - North Preston/ Lake Major/ Lake Loon/ Cheery Brook/ East Preston
    - Lake Echo/ Porter/s Lake
    - Shubenacadie Lakes
    - St. Margaret's Bay
    - Beaver Bank/ Hammonds Plans/ Upper Sackville

    For more information please visit the website www.halifax.ca or contact (902) 490-4210.

  - East Hants Municipality By-laws for Commercial Zones:
    - East Hants – Zones within the Pockwock PWA
    - East Hants – Zones outside of the PWA, but still within the Pockwock Watershed; specifically:
      - 8.10.7 Special Requirements for the Pockwock Watershed
        a) No open storage shall be located within the Pockwock watershed area as identified on the official zoning mapping.
        b) No hazardous materials shall be stored within the Pockwock watershed area as identified on the official zoning mapping.

    For more information please visit the website www.easthants.ca or contact (902) 758-2715.

- ***Provincial Act and Regulations:***
  - *Lake Major Watershed Protected Water Area Designation and Regulations*
  - *Pockwock Lake Watershed Protected Water Area Designation and Regulations*
  - *Bennery Lake Watershed Protected Water Area Designation and Regulations*
  - *Halifax Regional Water Commission Act*
  - *Provincial Forest Protection Regulations*
  - *Wildlife Habitat and Watercourses Protection Regulations*
  - *Nova Scotia's Forest Sustainability Regulations*
  - *Emergency Spill Regulations*
  - *Used Oil Regulations*
  - *Transportation of Dangerous Goods Regulations*

The above Acts and Regulations maybe viewed on line for the most recent versions.

Appendix 2 – List of Reportable Toxins

Item No.	TDGA Class	Description of Contaminant	Amount Spilled
1.	1	Explosives	any amount
2.	2.1	Compressed gas (flammable)	100 L
3.	2.2	Compressed gas (non-corrosive, non-flammable)	100 L
4.	2.3	Compressed gas (toxic)	any amount
5.	2.4	Compressed gas (corrosive)	any amount
6.	**3**	**Flammable liquids**	**100 L**
7.	4.1	Flammable solids	25 kg
8.	4.2	Spontaneously combustible solids	25 kg
9.	4.3	Water-reactant solids	25 kg
10.	5.1	Oxidizing substances	50 L or 50 kg
11.	5.2	Organic peroxides	1 L or 1 kg
12.	6.1	Poisonous substances	5 L or 5 kg
13.	6.2	Infectious substances	any amount
14.	7	Radioactive substances	any amount
15.	8	Corrosive substances	5 L or 5 kg
16.	9.1 (in part)	Miscellaneous products or substances, excluding PCB mixtures	50 L or 50 kg
17.	9.1 (in part)	PCB mixtures of 50 or more parts per million	0.5 L or 0.5 kg
18.	.2	Environmentally hazardous substances	1 L or 1 kg
19.	9.3	Dangerous wastes	5 L or 5 kg
20.	none	Asbestos waste, as defined in the Asbestos Waste Management Regulations	50 kg
21.	**none**	**Used oil, as defined in the Used Oil Regulations**	**100 L**
22.	none	Contaminated used oil, as defined in the Used Oil Regulations	5 L
23.	none	A pesticide in concentrated form	5L or 5 kg
24.	none	A pesticide in diluted form	70 L
25.	none	Unauthorized sewage discharge into fresh water or sensitive marine water	100 L
26.	none	Ozone-depleting substances, as defined in Ozone Layer Protection Regulations	25 kg