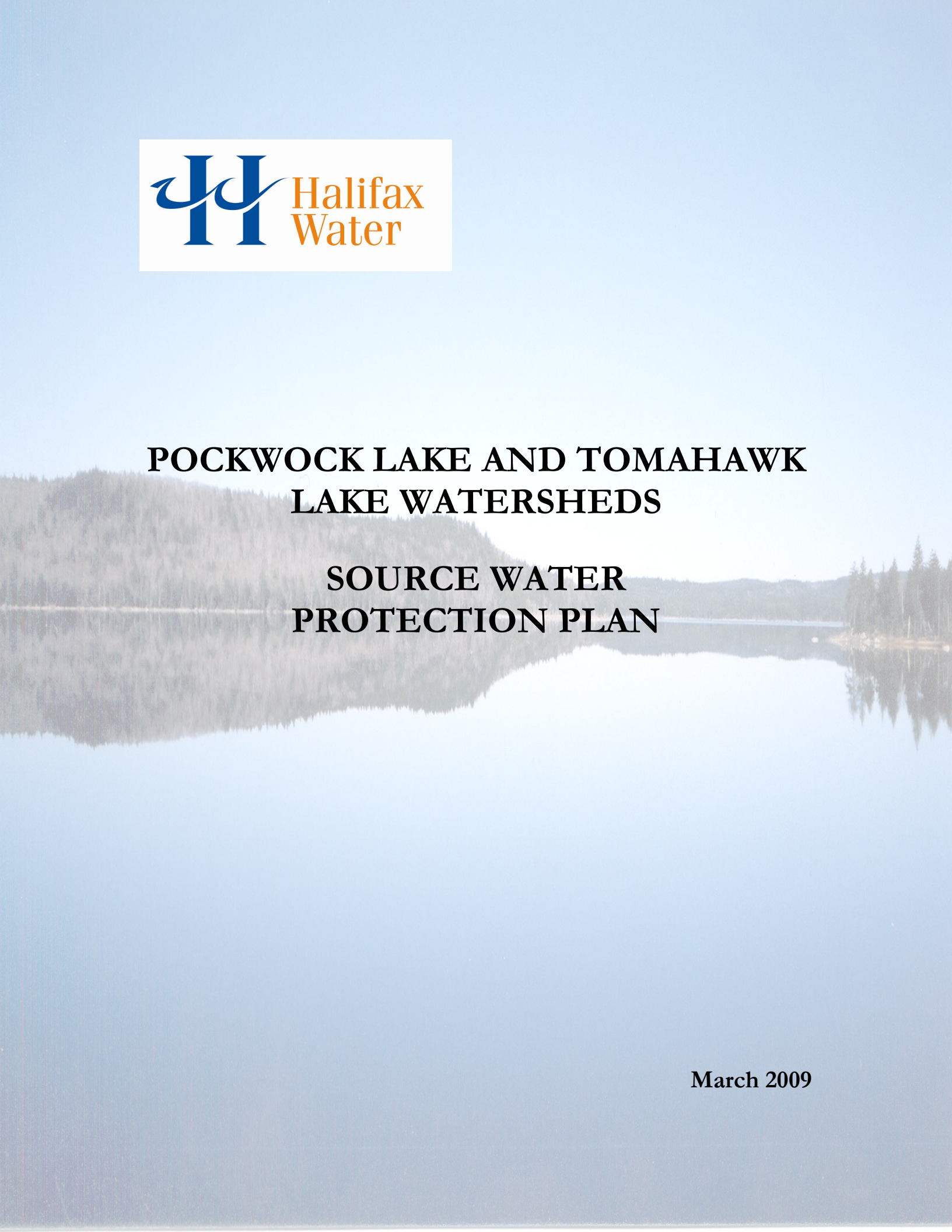

# POCKWOCK LAKE AND TOMAHAWK LAKE WATERSHEDS

# SOURCE WATER PROTECTION PLAN

March 2009

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Appendix 2: Terms of reference for Pockwock Lake Watershed Management Committee

Appendix 3: Map of Pockwock Lake Watershed

Appendix 4: Map of Tomahawk Lake Watershed

Appendix 5: Best Management Practices for the Pockwock Lake Watershed Protected Water Area, as adopted by the Management Committee

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Appendix 7: Map of Chain Lake emergency water supply

Appendix 8: Raw water sampling locations throughout the Pockwock Watershed

## 2.0 Introduction

Halifax Water is responsible for monitoring and managing all activities that may impact water quality on six distinct surface-water supplies, in order to meet the needs of customers within the urban sector of the Halifax Regional Municipality. The following document serves as the Source Water Protection Plan (SWPP) for the Pockwock Lake and Tomahawk Lake Watersheds. The SWPP outlines: the current management of the source water area; risk assessment; and the management plan and monitoring program. Pockwock Lake is the water supply for the communities of Halifax, Bedford, Sackville, Beaverbank, Timberlea and Lively. Tomahawk Lake is the future source supply.

## 3.0 Description of Pockwock Watershed Committee

The following describes the current state of the Pockwock Lake Watershed Protected Water Area regulations, the members of the Pockwock Lake Watershed Management Committee and the terms of reference.

### 3.01 Pockwock Lake Watershed Protected Water Area Regulations

The Pockwock Lake Watershed Protected Water Area was designated in 1994 by the Province of Nova Scotia for the Halifax Water Commission to supply water to customers in the metro Halifax area (see Appendix 1). The designation regulation sets requirements for Halifax Water to post signage throughout the protected watershed; it also regulates fire, vehicles, vessels, lakes and watercourses, fishing, hunting, forestry, chemical application, landfills, construction of corridors, soil erosion and sedimentation controls, and road building and maintenance. These regulations allow for the establishment of a Watershed Management Committee. Currently the portion of the Pockwock Watershed that falls outside the protected watershed area does not have the same restrictive regulations in place.

### 3.02 Members of the Management Committee

Under Subsection 105 (4) of the Environment Act. *1994-95, c. 1, s. 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 1994 Pockwock designation regulation, Part II defines the creation of such a committee in this way:

> *"…to provide advice to the Minister and the Commission with respect to the management of the Pockwock Lake Watershed with a membership made up of representatives of Nova Scotia Environment and Labour and Natural Resources and the Halifax [Regional] Water Commission."*

Prior to the 1994 regulation creation a watershed committee was established in 1975 to provide direction to the water utility before and during construction of the J.D. Kline Water Treatment Plant and up until the new regulations were put in place during. The Pockwock Watershed Management Committee meets two to three times a year, and sometimes more often, depending on activities within the watershed. Currently the committee consists of members from Halifax Water, Nova Scotia Environment (NSE) and the Nova Scotia Department of Natural Resources (NSDNR):

| | |
|---|---|
| chair/secretary | Watershed Manager, Halifax Water |
| | Director of Water Services, Halifax Water |

Superintendent of Water Quality, Halifax Water
Supervisor J. Douglas Kline Water Supply Plant, Halifax Water
(2) NSE representatives
(2) NSDNR representatives

Currently no community or municipal representatives are included in the Pockwock Watershed Management Committee.

### 3.03 Pockwock Watershed Terms of Reference

The initial terms of reference that were discussed in committee meetings in 1975 could not be located. In September of 2005, the Pockwock Watershed Management Committee drafted new terms of reference that are relevant to the current management structure (see Appendix 2).

## 4.0 Pockwock Lake and Tomahawk Lake Watersheds

The following provides a brief overview of ownership, activities, and research projects inside the Pockwock Lake and Tomahawk Lake Watershed areas.

### 4.01 Pockwock Lake Watershed

#### 4.01.01 Location and Ownership

The Pockwock Lake Watershed is located northwest of the Bedford Basin, between Mount Uniacke (Route 1) and the end of Pockwock Road (see Appendix 3). The watershed is made up of provincially protected and unprotected areas. The provincially Protected Watershed Area (PWA) contains 4,858 hectares of Crown land designated under the Environment Act (see Chapter 1 of the Act, 1994-95). The unprotected area consists of 770 hectares of land, of which Halifax Water owns 310 hectares, the Crown owns 150 hectares and 310 hectares belongs to private landowners.

The watershed contains 10 lakes, five of which are within the designated area and which constitute 93% of the total water-surface area. Most of the land within the PWA was expropriated in the mid-1970s by the province, which through the NSDNR directs forest activities and provides protection of resources with participation from Halifax Water.

Halifax Water conducts patrols outside of the designated area; however, it does not direct any activities that fall in these areas on lands not managed by Halifax Water. Halifax Water is working with the local Municipality of East Hants, the NSDNR and the NSE to make people living and working in these areas aware of the watershed.

#### 4.01.02 Forestry

The PWA is mainly forested, with a diverse structure of softwood and hardwood stands accessed by a network of forest roads and transmission-line

corridors. The dominance of red spruce stands within the protected area has supported a long history of forestry activity, even long before the expropriation of land from local forest companies and woodland owners.

Forest use inside the PWA is regulated by a 10-year renewable agreement with Elmsdale Lumber Co. Ltd., with a maximum annual harvest of 6500 cubic metres. Historically, the area has experienced a continuous but moderate degree of harvest and silviculture activity. Annual harvest plans carried out by Elmsdale Lumber, supported by frequent field checks (monitoring by the NSDNR and Halifax Water) of harvest operations, make up an acceptable forest-management tool. However, in 2003 best management practices (BMPs) were developed by Halifax Water and the Pockwock Watershed Management Committee to further aid watershed management. Halifax Water, the Management Committee and the NSDNR require that anyone carrying out forestry activities within the PWA follow the BMPs.

Halifax Water and the NSDNR jointly manage all forestry activities that take place within the PWA through a mutually agreed-upon forest-management plan. This plan is drafted using provincial guidelines and environmental regulations and is subject to special conditions that may be required by Halifax Water with regard to potential impact to water quality. For all other lands owned by Halifax Water a five year forest management plan is developed and implemented using the same guidelines and BMPs as the forest management plan developed for the Pockwock PWA.

Forestry activities in the unprotected areas have remained low to moderate. Currently Halifax Water follows BMPs for all of its lands regardless where the land is located. For all other lands that fall within the unprotected watershed there are no Halifax Water-endorsed BMPs in place.

Silviculture treatments are planned each year by the NSDNR with help from Elmsdale Lumber and Halifax Water. Elmsdale Lumber invests a required portion of its silviculture credits on Crown land in the PWA and has led silviculture activities as funded and directed by provincial and federal programs. For silviculture treatments carried out on Halifax Water-managed lands, silviculture activities are contracted out and provincial government legislation is followed.

For the PWA and lands managed by Halifax Water; natural regeneration after cutting has been enough to achieve the full stocking of the species that was harvested. However, Halifax Water supports planting as an alternative method to restocking harvested areas to acceptable levels, in those places where nature needs help.

Pre-commercial thinning treatments within the watershed have been successful in targeting the correct stands of densely stocked, naturally

regenerated red spruce (rS), balsam fir (bF), eastern white pine (ewP) and various hardwoods.

Commercial thinning activities within the PWA, and on adjacent lands managed by Halifax Water, have been less than effective due to wind-throw problems following treatment. Shallow soils on bedrock, combined with shallow-rooted trees such as spruce and fir, lead to trees with root structures that are too weak to withstand windstorms. Commercial thinning can further expose these shallow-rooted trees to damaging winds, thus not making such a treatment feasible. However, this only indicates that commercial thinning on thin soils and on areas exposed to winds has less than favourable results.

Wind disturbance following commercial thinning is a forest-management concern across the province where there is an abundance of shallow moist soils with a dominant tree cover of shallow-rooted species (spruce and fir), combined with strong coastal winds that create favourable conditions for blow down. Assessing all factors in a stand—including soil depth, soil moisture, soil texture, root structure, evidence of blow down, wind exposure, stand condition, past thinning and tree silvics—leads to a more informed decision and possibly better outcome.

#### 4.01.03 Recreation

The Pockwock PWA regulations restrict the type of recreational activities that can be carried out. Off-highway vehicles (OHVs) remain the biggest threat to the water supply; however, in 2007 Halifax Water requested a ministerial order from the NSE under the Off-Highway Vehicle's Act to further restrict OHV use inside the PWA. In July of 2008, Halifax Water received the OHV order. Unauthorized boating inside the PWA is not allowed, and to date no serious problems have been reported.

For non Halifax Water lands that fall inside the unprotected area, boating and OHVs are not restricted. For all other lands owned by Halifax Water the unauthorized use of OHVs is not allowed. Signs have been posted by Halifax Water and local community members in the area notifying these users of the Pockwock Watershed.

Swimming is not allowed inside the PWA; however, there is evidence that people often swim in the waters within the PWA. Swimming is allowed in waterways outside the PWA and is most apparent in the West Lake area.

Low-impact recreation such as hiking, mountain biking, walking and cross-country skiing is not discouraged, but Halifax Water closely monitors and educates the users of the PWA. Further to low impact recreation fishing is not allowed inside the PWA, but hunting is. Bell Park, north of West Lake on Crown land, is located outside the PWA. Signs are posted in the park pointing out that it is a walking trail only, but right now there are no signs stating that it is part of the Pockwock Watershed. Halifax Water is looking into partnering with the Bell Park Association.

### 4.01.04 Public Roads

Highway 101 separates the Pockwock PWA and the unprotected water area. Salt is used on Highway 101; however, Halifax Water monitors salt levels as part of its raw and treated water-sampling programs. As well, Highway 101 crosses two major tributaries inside the watershed: Lacey Mill Brook Inlet and West Lake Brook Outlet. The twinning of Highway 101 through the Pockwock Watershed included engineered measures to collect all highway runoff that could potentially drain to Lacey Mill Lake to the centre median and flow it through oil/water separators before it flowed to Lacey Mill Lake. The oil/water separator is monitored each year by Halifax Water and TIR.

Route 1 and the residential roads that fall inside the Pockwock Watershed are maintained in the winter using sand only. All public roads inside the watershed are maintained by the Department of Transportation of Infrastructure and Renewal (TIR). An unnamed West Lake tributary is crossed by West Lake Avenue in the north and Mill Forks Road in the south. These crossing will be monitored, and testing will be conducted at the West Lake Brook location where it crosses Highway 101.

### 4.01.05 Commercial Concerns

Inside the PWA, the only commercial concerns are the forestry activities and the J.D. Kline Water Treatment Plant, which are addressed through BMPs, provincial and company policies. Outside the PWA, Halifax Water relies heavily on Municipal, Provincial and Federal regulations to govern commercial concerns. There has been past issues with a welding shop and a non-commercial shale pit north of Highway 101. Local residents brought the concerns (improper drainage and runoff) to the Halifax Water's attention, and they were addressed. Halifax Water will keep monitoring the sites in case the issues come up again.

### 4.01.06 Chemical Application

Chemical application is a cost-effective tool used by many individuals and companies to control unwanted competing vegetative species, fungus and insects.

#### 4.01.06.1 Pockwock Provincially Protected Watershed Area

Under section 9 of the Pockwock PWA regulations no pest control product is allowed to be used within the PWA

#### 4.01.06.2 Pockwock/Tomahawk Unprotected Watershed Areas

For all watershed lands that fall outside of the PWA area, the use of chemicals for pest control purposes is controlled by municipal and provincial government regulations. Currently the Municipality of East Hants does not have by-laws in place restricting the use of chemical applications within the unprotected watershed. NSE issues permits for chemical applications within the unprotected watershed area. In January of 2008, Halifax Water requested that the NSDNR not allow

the use of any chemicals on Crown lands that fall inside the Pockwock Watershed, whether those lands were designated or not. The NSDNR approved the request, and in March Halifax Water received word that the NSDNR will no longer allow chemical applications inside the Pockwock Watershed.

#### 4.01.06.3 Halifax Water Private Lands

Halifax Water does not allow the use of any pest control chemicals on its private lands regardless whether it falls inside a provincially designated area or not.

Nova Scotia Power Inc. (NSPI) has asked in the past to use boron for wooden-pole treatment on utility lines within the Tomahawk watershed. Halifax Water objected to its use on the grounds that the poles were located on Halifax Water private lands and the fact that boron is a substance that is a threat to drinking water supplies

### 4.01.07 Water Sampling

As part of the SWP process, Halifax Water has upgraded and included the focus on source water sampling. In 2008 the August 2005 edition of the *Water Quality Sampling and Permit Compliance Manual* was revised to include a watershed sampling program. A copy of the program and its procedures is located at the Pockwock treatment plant.

### 4.01.08 Uniacke Business Park

The Uniacke Business Park is located in the northeastern portion of the Pockwock Watershed. The Westerly half of the business park lies within the Pockwock Watershed; however limited development has taken place in this area in the last few years. Halifax Water is working closely with the Municipality of East Hants to protect water quality.

### 4.01.09 West Lake Residential Area

Residential areas along the north shore of West Lake and Route 1 have been established, but no water or wastewater services are currently being offered in this area. Residential areas are always a concern, because septic tanks and furnace oil tanks may not be adequately maintained.

In addition, West Lake is used for various recreational activities such as swimming, fishing and boating, and presently there are no regulations in place to control the access and activities. The south side of West Lake and a central portion of land located on the north shore (Bell Park) are owned by the province.

### 4.01.10 Pockwock-Bowater Watershed Study

In the summer of 1999, a five-year research project called the Pockwock-Bowater Watershed Study was done in the PWA and adjoining Bowater Mersey lands. The study was led by the Nova Forest Alliance, with the active support of 10 NFA partner organizations, including Halifax Water. The

study was completed November of 2003, and the final report was published in December of 2005.

The study's primary objective was to collect data on the response of stream water (quality and quantity) from forest activities when stream buffers or riparian zones are maintained or altered. The results helped define BMPs for forest-management planning for the Pockwock and other watersheds. They could also help make changes to the province-wide management of stream buffers or reinforce existing efforts.

In addition to monitoring surface and subsurface water, the project also looked into the impact of acid precipitation on forest soils, on the water quality of small receiving streams and on soil nutrient change.

The data from this core research project provided a foundation for more comprehensive ecosystem research that includes wildlife habitat studies, nutrient-cycling effects of local climate conditions, fish-habitat characteristics of small streams, and balancing forest management and public drinking-water-supply objectives.

To learn more about the study, visit **www.novaforestalliance.com/media/documents/PBWPGeneralReport.pdf**.

#### 4.01.11 Bridge and Culvert Inventory

The Pockwock and Tomahawk watershed access road systems were well established prior to Halifax Water taking responsibility. A bridge and culvert inventory and maintenance program always existed, however no scheduled checks were conducted unless the water crossing structures were going to be used on a daily basis. This meant that many of the structures may have gone unchecked for many years or until some type of operational activity such as forestry was going to use them again. By then the structure may have already failed causing expensive repairs or unnecessary environmental damage.

In 2002 Halifax Water developed and implemented a yearly monitoring-and-maintenance program for all water crossing structures (culverts and bridges). GPS co-ordinates, structure type, dimensions, condition and effectiveness were among other details gathered. 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 gives 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.

### 4.02 Tomahawk Lake Watershed

The Tomahawk Lake Watershed (see Appendix 4) is about 1,456 hectares of forest made up of various softwood and hardwood stands. Halifax Water owns and

manages about 1,075 hectares inside the Tomahawk Watershed, including access to two lakes, Tomahawk Lake and Beaver Lake, equaling 135 hectares of surface water. The only portion of the Tomahawk Lake Watershed that Halifax Water doesn't own is south of Beaver Lake, which is referred to as the "Pockwock community lands," or the Melvin Tract Lands. Halifax Water and the community of Upper Hammonds Plains have been working hard to clean up past uncontrolled harvesting and other illegal activities that may impact raw water quality.

Tomahawk Lake is considered a future water source for the Pockwock Lake system and will be used when future customer demands exceed the current Pockwock supply. Water will be transferred from Tomahawk Lake to Pockwock Lake via a pumping station and pipeline.

Halifax Water manages the Tomahawk Lake Watershed Area as part of the current Pockwock system by following the same BMPs, forest-management regime and watershed protection practices, as well as monitoring programs that are already in place.

Currently there is no Watershed Committee to manage the Tomahawk Lake Watershed. As the need to use the Tomahawk supply grows, Halifax Water will consider how such a committee may be modified to deal with relevant community issues.

Raw water-sampling plans will be initiated in the Tomahawk Lake system prior to commissioning of this lake. This probably won't take place within the next 15 to 20 years, based on growth and consumption trends and customer demand. However, Halifax Water will be leading an annual raw water-sampling program to set a base line (see Appendix 8).

## 5.0 Risk Identification and Assessment

The following describes activities within the watersheds, potential risks, and contaminants and measures taken up until now to protect the water supply.

### 5.01 Forestry

Possible sources of contamination with forestry activities within the watersheds:

a) Release of hydrocarbons if there is a fuel or oil spill.
b) Sedimentation of streams near roads following road construction, road maintenance or following a heavy rainfall.
c) Release of herbicides into the waterways as a result of chemical application for silvicultural purposes inside the unprotected areas.
d) Negative effects resulting from the lack of BMPs, such as:
    a. incorrectly following provincial regulations such as minimum provincial-set buffers.
    b. bad choice in harvest timing on sensitive areas.
    c. incorrect sizing and installation of culverts and bridges.

BMPs (see Appendix 5) are in place for all lands managed and owned by Halifax Water, regardless whether they are in or out of the PWA, to minimize the potential of these events from taking place.

Currently for all other lands that do not fall under Halifax Water management there are no Halifax Water-endorsed BMPs. For this reason, there remains a risk, although it's a low one, of contamination through forestry activities inside the unprotected areas.

### 5.02 Recreation

The growth of the Halifax Regional Municipality and the development of nearby communities are putting additional recreational pressure on the Pockwock and Tomahawk watersheds. These watersheds are viewed by some residents of HRM and outlying areas as an ideal open area for a variety of activities that may not be allowed. At this time, walking, hiking, hunting and cross-country skiing, if all done in moderation, are considered to be low-risk activities by Halifax Water.

#### 5.02.01 Off-Highway Vehicles (OHVs)

The use of recreational vehicles such as all terrain vehicles (ATVs), trail bikes and snowmobiles can cause environmental damage that may eventually damage raw water quality, depending on the extent of damage. For example, stream damage due to too much through-travel, or if the activity directly involves the lake water, such as a machine going through ice. For this reason, these types of vehicles are considered to be a moderate to severe risk, and restricted within the protected and managed watersheds. However, these activities remain a problem throughout the watersheds.

#### 5.02.02 Swimming

Swimming is considered low risk, because swimming is not allowed in the waterways within the PWA. However, there has been evidence that people occasionally swim in Pockwock Lake. Swimming is not restricted outside the PWA.

#### 5.02.03 Boating

Boating is considered low risk, because it is restricted within the protected and managed watershed areas, but it is allowed in the unprotected watersheds. West Lake residents living directly on the lake are the main concern because there are no public boat launches.

#### 5.02.04 Fishing

The Pockwock regulations do not allow fishing on any lake or tributary within the PWA. However, fishing is not restricted in the unprotected watersheds.

If any of the above activities result in an emergency, Halifax Water's *Emergency Response Manual* outlines the steps that must be followed. A copy of the manual can be found in all Halifax Water facilities.

Signs identifying restrictions on recreational activities and contact information have been posted at the main entry points throughout the watersheds and along frequently used trails. Gates to restrict unauthorized vehicles from entering the watershed are located at main vehicle entry points. Additional barriers, normally boulders, protect those gates to limit access by OHVs, but there are several remote locations where OHVs such as ATVs and snowmobiles can access the watersheds.

Halifax Water, NSDNR employees and the OHV task force patrol the watersheds regularly by foot and in boats, OHVs and marked vehicles.

Education and awareness information found on signage, on websites and in publications have helped lower the number of illegal activities taking place within the watersheds.

### 5.03 Public Roads and Highways

A 4.6-kilometre section of the divided Highway 101, starting north of Exit 3 (Mount Uniacke) and continuing northwest, is within the natural drainage area of the Pockwock Lake system. In response to requests from Halifax Water, the TIR designed this section of Highway 101 using medians to guide and control the majority of runoff and possible spills during motor vehicle accidents into an engineered oil-and-water separator located near Lacey Mill Lake (see Appendix 3).

Route 1 forms part of the northern boundary of the Pockwock Watershed, which falls outside the PWA. The risk of any spills contaminating the watershed caused by accidents is very low, because Route 1 does not cross any major tributaries. Halifax Water will continue to monitor Route 1 and request that the TIR report any significant spills.

West Lake Avenue and Mills Fork Road South cross a tributary to West Lake. These areas are low risk to Halifax Water because they are not major transportation routes. Halifax Water will keep working with the TIR in these areas.

Salt is used by the TIR in the winter to maintain Highway 101; however, sand is used on Route 1 and the West Lake residential area. Due to the distance and large drainage area, Halifax Water feels that the risk to impair water quality is very low, and it is able to monitor and adjust the treatment process to compensate for the salt use. A sampling station is located on the south side of Highway 101, where the TIR catch basin runs into Lacey Mill Lake, as well as a sampling station at West Lake Outlet.

Standard operating procedures (SOP) can be found in Halifax Water's *Emergency Response Manual* that instructs notifying the J.D. Kline Water Supply Plant following a spill on Highway 101. A copy of the manual is located at the Pockwock Treatment Plant. Halifax Water has contacted and provided contact information to first responders responsible for the Mount Uniacke area in case of an emergency.

## 5.04 Controlled access

### 5.04.01 Treatment Plant Access

The treatment plant access road falls outside the PWA and is gated and fenced to restrict traffic to the facility. In case of any emergency that may occur on the treatment plant access road, Halifax Water's *Emergency Response Manual* will be followed (the manual can be found at the Pockwock Treatment Plant).

The controlled main access point into the water-treatment plant by way of Pockwock road is located outside the protected watershed area and is maintained during winter using small amounts of road salt. Halifax Water feels the risk of salt-water intrusion is very low; however, right now there is no facility for salt storage.

### 5.04.02 Watershed Access Roads

The main watershed access roads are controlled and maintained by both Halifax Water and the NSDNR. In case of an emergency within the watershed roads, Halifax Water's *Emergency Response Manual* will be followed by Halifax Water employees (the manual can be found at the Pockwock Treatment Plant.

During winter, there is very little activity on the protected Pockwock Watershed and Tomahawk Watershed; as a result, there are very few vehicle accidents. At the request of Halifax Water, no unauthorized salting of the access roads in these areas is allowed.

As part of the sampling program, chlorides are monitored for water-quality purposes.

## 5.05 Land Use Planning

The protected watershed is provincially owned and designated. No development may take place within the designated watershed other then water supply related development.

### 5.05.01 Municipality of East Hants

Halifax Water works closely with the Municipality of East Hants and asks that the Municipality contact Halifax Water with any emergencies that take place in, or proposals that relate to, the unprotected watershed. A procedure is in place to contact the Municipality every spring to review any items that have come up during the previous year and any new items for the future. Currently there are no representatives on the Pockwock Watershed Management Committee for the Municipality of East Hants or residential areas within the Pockwock Watershed.

a) The Uniacke Business Park is located in the northeastern portion of the Pockwock Watershed. Activity within the business park is minimal, and the industries working there are low risk. The

Municipality of East Hants can provide a list of Uniacke-based businesses.

b) An auto-salvage yard, welding shop and golf course skirt the northern boundary of the unprotected Pockwock Watershed. Halifax Water currently considers these businesses to be low risk due to their location within the watershed. Presently, Halifax Water collects raw water samples down stream from these businesses as part of its Watershed Sampling Program.

c) The north shore of West Lake is zoned residential within the unprotected Pockwock Watershed Area. Right now there are no water or wastewater services available and none planned for the near future. The lack of services poses a threat, although a low one, of fecal contamination by way of septic-field failure and infiltration. As well, many homes in the area use furnace oil and propane as a source of heat. Currently there are no Halifax Water-endorsed maintenance programs in place to ensure that septic tanks, septic fields and oil tanks are being maintained properly, other than provincial legislation and for insurance purposes.

   Other concerns for the West Lake residential area include: recreational pressure from boaters and swimmers; petroleum products that are being used in lawn mowers, boats and cars; the washing of vehicles too close to tributaries; and the use fertilizers and herbicides in people's yards.

For more information about Municipality of East Hants bylaws and zoning restrictions, visit **www.easthants.ca**.

### 5.05.02 Halifax Regional Municipality (HRM)

The portion of the Pockwock Watershed that falls inside HRM boundaries is protected under the PWA regulations. The same is not true for the Tomahawk Watershed; that entire watershed is located within HRM and is not protected under any provincial PWA. Currently the majority of the lands falling inside the Tomahawk Watershed are owned and managed by Halifax Water. These areas are managed as if they were part of the Pockwock PWA.

The community lands of Pockwock (Melvin Tract Lands) fall inside the Tomahawk Watershed, which is also zoned Protected Water Supply by HRM. The Protected Water Supply zone lists setbacks and restricts activities that may be carried out; however, these activities remain a risk, although a low one, such as agricultural, forestry and residential development. Currently no developed agricultural land and residential areas exist within the Tomahawk Watershed.

For more information about Halifax Regional Municipality bylaws and zoning restrictions, visit **www.halifax.ca**.

## 5.06 Pockwock Pumping Station

To provide power to the pumping station and the treatment facility during an electrical failure, Halifax Water has a 2,500 hp, 17Kv diesel generator on-site (inside watershed); the generator contains 400-plus litres of motor oil. Fully contained 10,000-litre and 4,000-litre fuel tanks are used at the pumping station. Halifax Water has SOPs for the operation and maintenance of the generator and for fuel transfer and storage. These procedures are also governed within the ISO 14001 *Environmental Management System Manual*, which can be found at the Pockwock Treatment Plant.

The pumping station has six high-capacity raw water pumps that draw water from Pockwock Lake to supply a maximum of 224 million litres per day to the treatment plant (normal operation is about 90 million litres per day). Each pump has 16 litres of lube oil to help the bearings work properly. This lube oil is an additional risk to the water supply if there is an accident or vandalism.

NSPI maintains a transformer at the pumping station that is located within a concrete containment system; NSPI inspects the transformer and containment every month. Rainwater flows out of the containment through a drain line into an oil/water separator, and when sensors detect a leak in the transformer storage, a valve on this drain line closes to contain any liquid that may drain out.

In the event of a spill at the Pockwock pumping station, Halifax Water's ISO 14001 *Environmental Management System Manual* and *Emergency Response Manual* outline the steps that must followed. These manuals are located at the Pockwock Treatment Plant

## 5.07 Chemicals

### 5.07.01 Watershed Chemical Application

The use of chemical pest control products being pesticides, herbicides and biocides within the protected PWA and lands owned by Halifax Water is forbidden. However, chemical use on lands that fall outside Halifax Water's control may be allowed. There are provincial permitting processes and regulations in place to control and monitor the use of such chemicals; however, the use of any chemical around water is still a risk. Currently there are no bylaws in place restricting the use of chemical application in the Municipality of East Hants.

Early in 2008, Halifax Water sent a letter of request to the NSDNR to forbid the use of chemicals on all on Crown lands that lie within the Pockwock Watershed. On Feb. 27, 2008, the NSDNR positively responded to Halifax Water's request, assuring that no chemicals for the use of vegetation control would be used inside the Pockwock Watershed. Halifax Water asks that all landowners do their part to protect the watersheds and to contact their municipal office or

Halifax Water for more information about where the watershed boundary falls. (To report the use of any chemicals, contact Halifax Water at 902-869-4304.)

NSPI has a number of main transmission lines that run through the Pockwock watershed; however NSPI does not use chemical treatment anywhere in the Pockwock watershed. The Pockwock PWA regulations prevent NSPI from using chemical treatment on the protected area while the remaining unprotected area has no main transmission lines running through it. Currently all of NSPI's main transmission lines and wooden poles that fall within the Tomahawk Watershed are located on Halifax Water private lands; therefore, Halifax Water does not allow the use of chemicals for NSPI utility-line and pole maintenance.

#### 5.07.02 Pockwock Treatment Plant Chemical Deliveries

About 20,000 litres of caustic soda are delivered monthly by tractor-trailer to the Pockwock Treatment Plant. The access is through the main gate located on the Pockwock Road which is located outside of the PWA. Other chemicals such as aluminum sulfate and hydrofluosilisic acid are delivered in bulk on a less frequent basis. These chemicals are used continually in the water treatment process. As well diesel fuel for the emergency generators is delivered as required. In the event of an emergency the ISO 14001 *Environmental Management System Manual* and *Emergency Response Manual* and procedures will be followed. Copies of these manuals are located at the Pockwock Treatment Plant.

### 5.08 Emergencies

In case of an emergency, Halifax Water's *Emergency Response Plan Manual* must be followed. A copy of the manual and emergency-contact list will be kept at the Pockwock Treatment Plant as well as any of the other Halifax Water facilities. For public reporting, signage with contact information is located throughout the watersheds.

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

#### 5.08.01 Natural Disasters

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

As part of the BMPs, when operating inside the protected watersheds during fire season, contractors must complete a yearly review of the fire regulations before startup; 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.

Forest fire reporting protocol can be found in the Pockwock Lake Watershed PWA regulations, where procedures fall under the provincial forest fire protection regulations. In addition, the NSDNR hotline (1-800-565-2224) is located on 4'x4' information signs throughout the watersheds.

In case of a fire that happens within the water-treatment plant, Halifax Water's *Emergency Response Manual* must be followed; it includes a list of numbers and is kept at the Pockwock Treatment Plant.

### 5.08.02 Aircraft Disaster

The Pockwock and Tomahawk Watersheds are located right over the Halifax Stanfield International Airport's flight path for arrivals and departures. The Canadian Armed Forces uses the same airspace as part of its training route. However, the risk of an aircraft disaster happening inside the watershed is low. Transport Canada has jurisdiction over flight routes as well as the response to an aircraft disaster. If such a disaster occurs, Halifax Water will use its own emergency-response procedures. In the case of the Armed Forces, in July of 2000 Halifax Water sent a letter asking the Armed Forces to restrict its flights over the Pockwock airspace to emergency purposes only.

In the past, there have also been issues with tourism and non-commercial flights over the watersheds; however, these non-scheduled flights have stopped at the request of Halifax Water.

### 5.08.03 Malicious Intent

Security at Halifax Water is taken very seriously; signage has been posted; fences and gates have been put up; security cameras have been installed at main operating locations; regular patrols are performed; and a water-sampling program has been developed and put in place to ensure the safety of HRM's drinking water. Halifax Water has completed an industry-developed risk assessment for its facilities and its security measures; the procedures were designed based on this assessment to reduce the probability, increase the likelihood of detection and lessen the impact of this type of event.

## 5.1 Contaminants and Risk

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

**Table 1: Summary of current activities known to take place within the Pockwock and Tomahawk Watersheds**

| 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 stream. Sedimentation of stream may occur if culvert fails and road is washed away. BMP does typically help control impact from road construction and maintenance. |
| Recreation: OHVs, boating, pedestrian activities | Fuel, sedimentation of streams, garbage | | X | Fuel in streams, stream-bank erosion and sedimentation of streams from OHV use. Boating activities in non-protected area resulting in petroleum products entering the waterways. Pedestrian activity is light impact and sometimes results in garbage left behind. |
| Public roads and highways | Automotive fluids, dangerous goods, road salt | X | | Depending on retention time, there may be direct contamination of Lacy Mill Lake or West Lake and eventual shutdown of plant. |
| Controlled access | Water-treatment chemicals, petroleum products | X | | 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, Municipality of East Hants and Halifax Regional Municipality: commercial businesses (Uniacke Business Park); residential; and agricultural development | Automotive fluids and exposure of soils. Commercial and residential chemicals used in lawn and septic care. Septic field failure, overflowing septic tanks as a result of going un-pumped, furnace oil tank failure, other petroleum products. Fecal contamination through agricultural activities. | | X | Over time there could be a buildup of fuel and oil spills as a result of large equipment and auto salvage yard practices being used. Sediment run from overexposed soils and runoff. E.coli and fecal matter could make their way into the water source, potentially increasing levels. Currently zero risk of agriculture contamination, but risk is still there because these areas do allow for agricultural activities. |
| Pockwock Pumping Station | Diesel fuel, lube oil, oil from NSPI transformer | X | | Immediate shutdown of treatment facility if direct spill to source water. |
| Chemicals: forestry, caustics, commercial, residential | Biocide, fungicide, insecticide, herbicide, diesel | X | | Forestry chemical operations outside Halifax Water protected lands. Residential and commercial use in non-protected PWA. |
| Natural disaster: | Fire, wind, insects | | X | Soil erosion, increased turbidity. |
| 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. |
| Malicious intent | Terrorism, vandalism, sabotage | X | | Total shutdown of water-treatment plant and long-term damage to the water supply. |

### 5.2 Identified Issues Prioritized

Table 2 shows the scale of problem and priority ranking of the current activities within the watersheds. Issues identified as being a priority in managing are: containment of spills at pumping station; hydrocarbon spills associated with harvesting activities; contamination from accidents occurring on Highway 101; and development in the Uniacke Business Park. These issues are followed in order by OHV use, culvert maintenance, road maintenance, silviculture activities and pedestrian recreational activities.

**Table 2: Scale of current problems and priority rank of activities within the Pockwock and Tomahawk Watersheds**

| Activity | Contamination issue | Scale of problem* | Priority rank** |
|---|---|---|---|
| Forestry operations: harvesting, silviculture, road maintenance, construction | 1) Fuel and hydraulic fluid<br>2) Sedimentation of streams | 1) 4<br>2) 3 | 1) 1<br>2) 3 |
| Recreation: OHVs, pedestrian activities, boating | 1) Fuel, sedimentation<br>2) Garbage | 1) 2<br>2) 5 | 1) 2<br>2) 5 |
| Public roads and highways | 1) Fuel, automotive fluids, dangerous goods<br>2) Road salt | 1) 5<br>2) 4 | 1) 1<br>2) 4 |
| Uniacke Business Park | 1) Fuels<br>2) Chemicals<br>3) Soil exposure<br>4) Septic field failure | 1) 5<br>2) 5<br>3) 4<br>4) 3 | 1) 1<br>2) 1<br>3) 3<br>4) 2 |
| Residential areas | 1) Septic field failure<br>2) Furnace oil tank failure<br>3) Exposed mineral soil<br>4) Chemicals | 1) 3<br>2) 3<br>3) 3<br>4) 5 | 1) 2<br>2) 2<br>3) 3<br>4) 1 |
| Agriculture activities | 1) Fecal contamination<br>2) Fuel oil spills | 1) 5<br>2) 5 | 1) 5<br>2) 5 |
| Pockwock Pumping Station | 1) Diesel, lube oil, discharge from transformer | 1) 5 | 1) 1 |
| Chemicals: | 1) Forestry<br>2) NSPI<br>3) Caustics<br>4) Residential<br>5) Diesel | 1) 4<br>2) 3<br>3) 4<br>4) 4<br>5) 4 | 1) 1<br>2) 1<br>3) 2<br>4) 1<br>5) 2 |
| Natural disaster | 1) Fire<br>2) Wind<br>3) Insect | 1) 2<br>2) 2<br>3) 5 | 1) 1<br>2) 1<br>3) 5 |
| Aircraft disaster | 1) Aircraft fluids and debris | 1) 5 | 1) 3 |
| Malicious intent | 1) Hazardous materials | 1) 4 | 1) 2 |

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

## 6.0 Management Plan

An informal management framework for the Pockwock Lake Watershed PWA designated in 1994 has been in place since the 1970s, when the Public Service Commission and provincial agencies recognized the need for an advisory committee to lead the management of the watershed area that has continued for the last 30-plus years. The Crown owns the designated area, and Halifax Water has made efforts to acquire private lands within the natural drainage area to the north of Highway 101, where land activities can affect the Pockwock Lake system.

The SWPP is reviewed each year to make sure that proper implementation is being followed. A major review is completed every five years to make necessary changes to the plan. In 2008, Halifax Water felt it was necessary to conduct a major review of the Pockwock SWPP before the scheduled five-year review, because many changes had been made from the original SWPP. The new SWPP has taken into account the unprotected areas of both the Pockwock Watershed and Tomahawk Watersheds.

### 6.1 Implementation Strategy

Halifax Water considers watershed management the first step in the multiple-barrier approach to water-quality management. The expropriation of land, resulting in public control of the watershed, by the province in the 1970s and the designation of the watershed, as a PWA, has laid the groundwork for watershed management planning for this area.

Halifax Water has set objectives for strategy implementation, including BMPs, conducting patrols and relying on enforcement from the OHV Task Force and the NSDNR, as well as a guided sampling plan. Halifax Water and the NSE have agreed to implementation timelines. Halifax Water will inform the NSE of any required changes to those timelines.

#### 6.1.01 Land Acquisition Program

Halifax Water continues to buy private lands that fall within the Pockwock and Tomahawk Watersheds. Halifax Water has found the most effective management tool is ownership. By owning the lands, Halifax Water cans control all of the activities that are conducted on them.

#### 6.1.02 Forest Management

Halifax Water will continue to manage the forested lands that fall within the Pockwock PWA and Tomahawk Watersheds. These activities will be practiced using provincial guidelines and BMPs set by the Pockwock Management Committee, with water quality the driving factor. Halifax Water has found that good forest stewardship has been an important tool in watershed management.

#### 6.1.03 Best Management Practices

In 2001, Halifax Water began to assemble BMPs to guide activities within the watersheds. (A list of the current BMPs can be found in Appendix 5.) Currently everyone working in the PWA or on Halifax Water-managed lands is required to know and sign off on the applicable BMPs, legislation and SOPs before work can start.

It is Halifax Water's goal to expand the use of BMPs for all lands that fall within the Pockwock and Tomahawk Watersheds by December of 2010.

### 6.1.04 Public Communication and Awareness

Halifax Water's communication and awareness program is an effective way to let the public know about watershed news.

Currently the program includes: posting signs throughout the protected watersheds and Halifax Water-managed lands; conducting educational seminars; and publishing newsletters, website info and advertisements in local newspapers, outdoor magazines and provincial hunting and fishing manuals. Halifax Water aims to post and maintain signage throughout the watersheds, including the unprotected areas, starting in 2008.

Halifax Water plans to contact an auto-salvage yard, welding shop and golf course located within the Municipality of East Hants, as well as the community of Pockwock, in 2008. The contact is to make people aware of how close they are to the Pockwock and Tomahawk Watersheds.

A new program being considered is a combined field trip and classroom-based curriculum aimed at teaching students in Grades 3 through 12 the importance of the Adopt-A-Watershed Program. The program is a partnership between Clean Nova Scotia and Halifax Water. The pilot project was completed during the 2007-08 school year.

Halifax Water regularly updates its website to provide important information and links to provincial programs, such as septic tank and furnace oil tank requirements.

For more information, visit **www.halifaxwater.ca**.

### 6.1.05 Watershed Committee

Pockwock Watershed Management Committee meetings will continue to guide management and activities within the immediate protected water area that may impair the source water quality. With the inclusion of the unprotected PWA in the updated SWPP, Halifax Water plans to expand the committee to include local community and municipal representatives by March of 2009.

As stated in the terms of reference, an annual report will be completed for each spring meeting for the committee to review.

Currently the Tomahawk Watershed does not have an advisory committee, because the majority of the lands fall under Halifax Water management. The lands that fall under Halifax Water management within the Tomahawk Watershed are managed as if it were already part of the Pockwock Watershed. As the need to use the Tomahawk supply draws closer, Halifax

Water will consider how the committee may be modified to deal with relevant community issues.

### 6.1.06 Regulations and Bylaws

Halifax Water plans to keep investigating new opportunities for provincial legislation and local bylaws to be strengthened or created to protect HRM's drinking water even more.

#### 6.1.06.01 Municipality of East Hants (MEH)

A spring meeting will be held by Halifax Water and MEH each April to review applicable SOPs, bylaws and Uniacke Business Park development and to update the emergency contact list.

Halifax Water will review any applicable MEH bylaws for all roads, residential areas and businesses that fall within the Pockwock Watershed.

Halifax Water plans to work with MEH to teach the residents inside the Pockwock Watershed about the legislation that is in place for proper septic-tank and oil-tank maintenance. The program aims to use the local municipal newsletter on a yearly basis starting in 2009.

#### 6.1.06.02 Halifax Regional Municipality (HRM)

Halifax Water will meet each year with HRM community development staff to review applicable SOPs, bylaws and possible development related to any relevant source water area and to update the emergency contact list.

Halifax Water plans to review any applicable HRM bylaws for all roads, residential areas and businesses that fall within the Tomahawk Watershed, as development occurs.

### 6.1.07 Enforcement

Presently Halifax Water works with the local authorities to enforce acts, regulations and bylaws that are applicable within the watersheds. Even with the co-operation of the local authorities, violations do happen. Halifax Water is currently investigating the creation of its own watershed enforcement/compliance program. Halifax Water has begun the process of reviewing and updating the regulations, thus allowing it to enforce certain aspects of the watershed regulations; however, timelines will depend on approval processes.

### 6.1.08 OHVs

Halifax Water will continue to post signs and maintain and expand patrol presence throughout the watersheds. Other goals include: improved information will be posted on the Internet on watershed restrictions; local ATV and snowmobile clubs will be contacted to educate riders; connections will be made with environmental communities that may enhance the focus

on water protection; RCMP contacts will be broadened; and the maintenance of gates and trail barriers will continue.

In 2007, Halifax Water requested an order under the Off-Highway Vehicles Act from the minister of the NSE. The order further restricts the use of OHVs inside the PWA. In late June of 2008, Halifax Water received the order. In late July of 2008, public notification went out to the Snowmobile Association of Nova Scotia, the ATV Association of Nova Scotia and *The Chronicle Herald*, with implementation in early August of 2008.

### 6.1.09 Access

Halifax Water puts up and maintains fences, gates, barriers and signs to limit the access to protected and managed watersheds. Halifax Water will continue to monitor these areas and, when required, hire private security companies to be on-site during high-traffic times. Halifax Water encourages local users to report illegal activities using the information provided on signs throughout the watersheds.

Halifax Water will look into working with landowners outside the unprotected watershed lands. Halifax Water's longer-term goal is to reach an agreement with all landowners affected by the watershed to limit access into these areas by 2013.

### 6.1.10 Department of Infrastructure and Renewal (TIR)

For all public roadways under the jurisdiction of the TIR that fall within the watershed, an annual meeting between the TIR and Halifax Water will be held each April. At the meeting, all applicable SOPs will be reviewed, a site visit to Highway 101 median oil/water separator will be planned and the emergency contact list will be updated.

### 6.1.11 First Responders

For all emergencies falling within the Pockwock and Tomahawk Watersheds, each year Halifax Water will contact the first responders responsible and provide them with contact information and a map outlining the watersheds.

### 6.1.12 Boundary Maintenance

Halifax Water currently hires licensed land surveyors to establish the legal watershed boundaries as outlined on the PWA regulations. The lines are monitored yearly and are updated by Halifax Water staff or contractors, as required. If the line is destroyed beyond recognition in a natural disaster such as fire or wind, a licensed land surveyor will be hired to reestablish the line

### 6.1.13 Pockwock Pumping and Treatment Stations

The J.D. Kline pumping station falls inside the Pockwock Watershed. 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 know of

surrounding risks and are told about the response plans and procedures that are located at the applicable treatment facility.

The J.D. Kline treatment plant and discharge holding ponds fall outside the Watershed. All discharge water produced by the treatment process flows into holding ponds where sediment settling occurs. The water from the holding ponds then flows into a natural channel where the water is carried outside of the Watershed. The water is tested daily as it leaves the pond and monthly as it flows into Little Pockwock Lake. To date Halifax Water has been working diligently with NSE to meet all provincial guidelines. The sediment produced from the settling process is then dried and trucked away to a government approved waste facility.

#### 6.1.14 Chemicals

The use of chemical herbicides and pesticides on the protected watershed and lands managed by Halifax Water will continue to be prohibited as per the Pockwock Lake Protected Watershed Area regulations and Halifax Water's mandate to protect all watersheds. Halifax Water will continue to work with the NSPI, NSDNR, NSE, municipal governments, MEH and HRM to stop the use of chemicals inside the Pockwock and Tomahawk Watersheds.

Halifax Water and NSPI will hold an annual spring meeting beginning in 2008. At the meeting, all applicable SOPs will be reviewed, the emergency contact list will be updated and scheduled utility and pole-maintenance plans within the Pockwock and Tomahawk Watersheds will be reviewed.

### 6.2 Contingency (Mitigation, Preparedness and Response)

#### 6.2.01 Forest Management

If forest activity results in a potential threat to the water supply—for example, a hydrocarbon spill—those involved will follow the BMP for spills and contact emergency phone numbers (see Appendix 6). 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 Target-Based Sampling Program outlined in subsection 7.4.04.

#### 6.2.02 OHVs

Halifax Water will continue to post signage, be involved in patrols, encourage the ATV Task Force to conduct patrols and distribute information about OHV restrictions in Pockwock and Tomahawk water supplies. If OHV use continues to increase in the watersheds, and there are detectable changes in water quality from main feeder systems during raw water sampling, then Halifax Water may have to hire contractors to conduct regular patrols. Halifax Water will also seek the provincial government's help to change regulations and stiffen penalties.

### 6.2.03 Transportation Routes

Threats to the water supply from Highway 101 have been reduced through the construction of a safer divided highway, as well as the installation of strategically placed oil/water separators. Due to the location, and the fact that Route 1 is a secondary route, no oil/water separators were put in place. The TIR and Halifax Water are prepared, as SOPs will guide contingency plans for spill containment and cleanup, which are located at the local Pockwock TIR office and Pockwock Treatment Plant.

### 6.2.04 Public Awareness

Halifax Water will continue to make the public aware of the Pockwock and Tomahawk Watersheds through signage, media, newsletters, seminars, education programs and website links.

### 6.2.05 Commercial

Through consultation with Halifax Water, MEH will consider threats to the natural Pockwock drainage area when applications for commercial development are being made.

In case of a spill, all businesses inside the Uniacke Business Park that are within the natural drainage area are to be made aware that accidental contamination must be reported immediately to MEH and first responders (RCMP, local fire department). MEH and Halifax Water are prepared, as SOPs will guide contingency plans for spill containment and cleanup. Emergency-response manuals are located at the local MEH office and all Halifax Water facilities.

### 6.2.06 Residential

Through consultation with Halifax Water; MEH and HRM will consider threats to the natural Pockwock and Tomahawk drainage when applications to new residential development are being made.

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.

### 6.2.07 Pumping Station

If an accident threatens the source water, Halifax Water ISO 14001 and corporate emergency-response plans will be used to lessen the impact to source water. A copy of the manuals will be kept at the Pockwock Treatment Plant.

### 6.2.08 Chemicals

If a chemical enters a watercourse inside the PWA, or as a result of operations on Halifax Water-protected lands, the applicable petroleum BMP and contact list must be followed (see Appendix7). If the event occurs outside the unprotected lands, the person responsible should immediately contact NSE and Halifax Water (902-490-6940). Applicable SOPs and

emergency contact numbers will be maintained and followed at all Halifax Water facilities.

#### 6.2.09 Emergencies

In case of an emergency, the Halifax Water emergency-response plan must be followed. A copy of the manual, and an up-to-date contact list and map, will be kept at all Halifax Water facilities and t local MEH and HRM first responders (RCMP, local fire department). For public reporting, signage with contact information is located throughout the watersheds. The following emergencies are considered the greatest threat to water quality:

##### 6.2.09.01 Natural Disaster

Halifax Water will continue to factor-in natural disasters in the forest-management planning process. Halifax Water will continue to practice good forest-management techniques and follow all government legislation to reduce the risk of natural disasters such as fire, wind damage, disease and insects.

##### 6.2.09.02 Aircraft Disaster

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

##### 6.2.09.03 Malicious Intent

Halifax Water will continue to post signs, build fences and gates, install security cameras at main operating locations, perform patrols and conduct routine intense water sampling to ensure the safety of HRM's drinking water. Halifax Water will continue to encourage watershed users to report any suspicious activities within the watersheds. Contact information will be put on the signage and listed on **www.halifaxwater.ca**.

### 6.3 Backup Emergency Supply

In case of an emergency (contamination, security, disaster, etc.) at the J.D. Kline Water Treatment Plant, a decision by senior management for a shutdown would need to take place within four hours in order to maintain levels in the clear well. If this happens, the distribution system could function for about 24 hours on stored water in reservoirs, depending on usage. During this time, the Chain Lake emergency water supply (see Appendix 7) would be able to supply the system for four to five days on limited use.

SOPs are in place for shutting down the J.D. Kline Water Supply Plant, public notification, customer restrictions, emergency plant start-up, etc., of which all treatment plant operators and engineering staff are fully aware. These SOPs are located at Halifax Water's main office at 450 Cowie Hill Rd. in Halifax.

Because the J.D. Kline Water Supply Plant first became operational in 1977, the Chain Lake emergency supply has only been activated eight times, and never due to emergencies occurring in watershed lands.

## 6.4 Evaluation and Updating

Members of the Pockwock Watershed Management Committee currently review events that occur within the Pockwock PWA. Beginning in 2008, the committee will also review any events that occur for the entire Pockwock Watershed. Halifax Water will continue to monitor Tomahawk Watershed events that could impair water quality. Assessments and change of action plans will be made where required for water-quality improvements.

To effectively manage the entire Pockwock Watershed, local community and municipal representatives will be considered for membership on the Pockwock Watershed Management Committee. A future Tomahawk Watershed Management Committee will be created once the Tomahawk water supply is commissioned in 15 to 20 years.

An annual report of the SWPP will be provided to the Watershed Committee in March of each year for review and comments. This report will include, but not be limited to, status on present risks, new risks that may have raised, results of the previous year's monitoring program, changes that may need to be made to the monitoring program, activities that occurred within in the watersheds and possible changes to the SWPP for continuous improvement. By having the Watershed Committee review the SWPP in March of each year, this allows Halifax Water time to submit possible changes to the SWPP to meet its obligation to NSE for the annual 90-day utility report.

Every five years, the SWPP document will be reviewed to identify any changes made to reflect ongoing watershed management. An up-to-date copy will be provided to the NSE and the Watershed Committee.

# 7.0 Monitoring Program

Halifax Water must monitor the Pockwock and Tomahawk Watersheds and report any illegal activities that may impair water quality to various government agencies for enforcement. The monitoring program consists of maintaining a presence through watershed patrols, encouraging the public reporting of any illegal or suspicious activities and conducting raw water sampling. Halifax Water will revise the monitoring program as new challenges surface.

## 7.1 Meetings

### 7.1.01 Annual Scheduled Meetings

Halifax Water will meet on an annual basis with the TIR, NSPI, HRM and MEH to exchange information about possible developments or scheduled events that could pose a threat to water quality.

### 7.1.02 Watershed Committee Meeting

The Pockwock Watershed Management Committee meetings will continue between Halifax Water, the NSDNR and the NSE. By March of 2009, the committee is hoping that an MEH representative and community representatives will attend the meetings. These improved changes to the committee will provide an opportunity for

local communities, government officials and Halifax Water employees to discuss important matters that could affect the Pockwock Watershed.

Since the Tomahawk Watershed does not currently have a watershed management committee, it is managed by Halifax Water as if it were part of the Pockwock PWA. Because Tomahawk Lake is commissioned, a watershed advisory board will be considered.

### 7.2 Patrolling

Halifax Water continues to conduct regular patrols throughout the Pockwock PWA and managed lands by foot, OHV, boat and marked vehicles, to identify activities that may be a concern. In addition, the OHV task force will continue to conduct random patrols, stopping drivers of OHVs who are illegally within the PWA and managed lands. Those who are stopped during these patrols and enforcement activities will be informed that the watershed is a protected area. Starting in 2008, Halifax Water plans to continue patrolling the watersheds and expand into the unprotected areas to make users aware of the watersheds. Halifax Water also encourages users to report any illegal activities to the NSDNR or Halifax Water using the contact information located on signs throughout the watershed.

Key locations throughout the unprotected lands have been identified and will be visually monitored. These locations include West Lake Avenue, Mills Roads and Lake Drive. If any problems are encountered, action plans will be developed to resolve them.

### 7.3 Public Reporting

Public access to the watersheds is mainly for low-impact recreational activities such as walking, hiking and mountain biking. Halifax Water keeps signage throughout the Pockwock and Tomahawk Watersheds that contains contact information for reporting any illegal activities to the NSDNR or Halifax Water.

### 7.4 Raw Water Sampling Program

In July of 2008, Halifax Water implemented its five-part Raw Water Watershed Monitoring Program for the Pockwock and Tomahawk Watersheds. Halifax Water has always had an effective raw water sampling program; however, the previous program was designed to monitor raw water quality as it reached the treatment plant, not at the source. By including monitoring of the watersheds, Halifax Water will be able to take a proactive approach in managing the water at the source. This program will be a way to measure the health of the watersheds and the quality of the water at the source.

***Note: Sampling will be conducted pending weather conditions.**

The sampling procedure will be included in the current water-quality sampling and permit-compliance program. The following explains each of the five parts:

### 7.4.01 General Source Water Monitoring

General source water monitoring is used to set baselines to measure against times of increased activities within the watershed. Results of samples may guide the investigation of whether changes are associated with land-management activities.

Dominant feeder-stream and lake-water sampling is used to determine:

**Stream Water Quality (including dissolved oxygen, turbidity, pH, temperature and electrical conductivity)**

- Oxygen dissolved in water is essential to the metabolism of all aerobic aquatic organisms and, as such, sampling can help assess the overall potential of stream and lake systems to support aquatic life (i.e., an indication of overall system health). Minimum dissolved oxygen levels are required to maintain fish and aquatic life. Further, dissolved oxygen plays a key role in the solubility of many inorganic nutrients (e.g., shifts from aerobic to anaerobic environments in regions of lakes and streams predominantly influence changes in nutrient availability). If long-term changes in oxygen-regulated nutrient availability are sustained, the productivity of an entire lake or stream can be drastically altered (Wetzel 2001). Changes in oxygen levels will trigger Halifax Water to assess the cause of the change and help relate the changes to a specific activity within the watershed.
- Turbidity is a visual property of water and implies a reduction of lack of clarity that results from the presence of suspended particles (e.g., inorganic particles originating from the erosion of soil and re-suspension of bottom sediments) (Wetzel 2001). By measuring turbidity, Halifax Water will be able to set a baseline to tell if any activities carried out in the watershed are linked to turbidity. If so then by restricting these activities or changing the time period they are performed, Halifax Water could potentially save the money it currently spends on removing suspended matter from the water at the treatment facility.
- The pH level is an indicator of acidity within an aquatic environment. The acidification of watercourses resulting from anthropogenic influences can be monitored through pH measures. Monitoring changes in acidity of the source water through pH measures will help Halifax Water determine if watershed activities are causing an acidification of source water.
- Temperature affects the growth potential of an aquatic system, as well as the dynamics of various water-quality parameters (e.g., dissolved oxygen). Monitoring the source water temperature will allow Halifax Water to determine if forest management or watershed activities are having an effect on temperature.
- Specific conductivity (or electrical conductivity) is a surrogate test for the detection of road de-icing effects. Halifax Water can monitor changes in specific conductivity to assess the effects of cold-weather treatment of roads and highways within the watershed.

- Monthly sample points will be taken at West Lake Brook Outlet (PG6), Lacy Mill Lake Culvert #2 Highway 101 (PG8), Lacy Mill Brook Pockwock Inlet (PG9), Long Gullies Pockwock Inlet (PG3), Peggy's Brook Pockwock Inlet (PG2) and Long Pond's Pockwock Inlet (PG1) (see Appendix 8). Additional monthly samples will be taken at Beaver Lake Brook Tomahawk Inlet (TG1) and Tomahawk Lake North (TG2).

**Total Suspended Sediments**

- Forest activities can increase the amount of sediment released into a stream or lake, causing an increase in the total suspended sediments (TSS) of the receiving water environment. Similar to turbidity, monitoring of TSS will help Halifax Water set a baseline to determine if any activities carried out in the watershed are linked to TSS. If so, then by restricting these activities or changing the time period they are done, Halifax Water could save money currently spent on removing suspended matter from the water at the treatment facility.
- Monthly sample points will be taken at West Lake Brook Outlet (PG6), Lacy Mill Lake Culvert #2 Highway 101 (PG8), Lacy Mill Brook Pockwock Inlet (PG9), Long Gullies Pockwock Inlet (PG3), Peggy's Brook Pockwock Inlet (PG2) and Long Pond's Pockwock Inlet (PG1) (see Appendix 8). Additional monthly samples will be taken at Beaver Lake Brook Tomahawk Inlet (TG1) and Tomahawk Lake North (TG2).

**E. coli**

- Halifax Water feels it is important to monitor the West Lake residential areas within the unprotected watershed due to the risk of septic field failure. At this time, no farmlands or livestock pastures lie within the Pockwock Watershed. By sampling now, Halifax Water will be able to set a baseline of E. coli that may or may not be present within the watershed.
- Sampling inside the PWA will help Halifax Water identify if any natural sources of E. coli could be present (e.g., from beaver activity).
- Monthly sample points will be taken at West Lake Brook Outlet (PG6), Lacy Mill Lake Culvert #2 Highway 101 (PG8), Lacy Mill Brook Pockwock Inlet (PG9), Long Gullies Pockwock Inlet (PG3), Peggy's Brook Pockwock Inlet (PG2) and Long Pond's Pockwock Inlet (PG1) (see Appendix 8). Additional monthly samples will be taken at Beaver Lake Brook Tomahawk Inlet (TG1) and Tomahawk Lake North (TG2).

**Total Phosphorus and Nitrate-Nitrogen**

- Nitrogen occurs in freshwater in numerous forms; however, the major form of nitrogen in the Pockwock Lake and Tomahawk Lake system is likely nitrate-nitrogen. Total phosphorus is a second nutrient that, together with nitrate-nitrogen, can be used to monitor nutrient loading in the freshwater system. Nutrient loading can lead

to rapid growth in an aquatic system, which is very harmful to water quality.

- Monthly sample points will be taken at West Lake Brook Outlet (PG6), Lacy Mill Lake Culvert #2 Highway 101 (PG8), Lacy Mill Brook Pockwock Inlet (PG9), Long Gullies Pockwock Inlet (PG3), Peggy's Brook Pockwock Inlet (PG2) and Long Pond's Pockwock Inlet (PG1) (see Appendix 8). Additional monthly samples will be taken at Beaver Lake Brook Tomahawk Inlet (TG1) and Tomahawk Lake North (TG2).

**Metals Scan**

- Various metals occur naturally within the earth; however, some minerals such as boron are used by individuals and companies as a chemical-control substance to treat wooden power poles and yards for fungus, ants and other insects. It is important to determine if any metals are at detectable levels within the source water system as a result of forest management and 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 should be reassessed. Testing will be done once during low-flow conditions and once during high-flow conditions. The sample points will be taken at West Lake Brook Outlet (PG6), Lacy Mill Lake Culvert #2 Highway 101 (PG8), Lacy Mill Brook Pockwock Inlet (PG9), Long Gullies Pockwock Inlet (PG3), Peggy's Brook Pockwock Inlet (PG2) and Long Pond's Pockwock Inlet (PG1) (see Appendix 8). Additional monthly samples will be taken at Beaver Lake Brook Tomahawk Inlet (TG1) and Tomahawk Lake North (TG2).

**Total Organic Carbon**

- Natural organic matter can result in taste and odour issues and can also lead to the formation of disinfection byproducts. Increased levels of organic matter will lead to increased total organic carbon levels, which could impact source water characteristics.
- Monthly sample points will be taken at West Lake Brook Outlet (PG6), Lacy Mill Lake Culvert #2 Highway 101 (PG8), Lacy Mill Brook Pockwock Inlet (PG9), Long Gullies Pockwock Inlet (PG3), Peggy's Brook Pockwock Inlet (PG2) and Long Pond's Pockwock Inlet (PG1) (see Appendix 8). Additional monthly samples will be taken at Beaver Lake Brook Tomahawk Inlet (TG1) and Tomahawk Lake North (TG2).

**In-Lake Sampling**

- A fairly comprehensive collaborative water-quality monitoring effort between the NSE and Halifax Water is underway for Pockwock Lake. This program includes data gathering at two locations in Pockwock Lake: a deep-lake station and the treatment facility's main pump house. This program will be expanded to include Tomahawk

Lake, in order to continue to build baseline data and to ensure source water protection through monitoring for changes in baseline water-quality conditions.

- Sampling will be carried out seasonally at a single deep-lake station in Pockwock Lake (PWDL1) and Tomahawk Lake (TMDL1), three times a year. The lake will be sampled once during spring (before lake turnover), once during summer and once during the fall (after lake turnover). Winter lake samples will not be collected due to safety reasons. Temperature, pH, conductivity and dissolved oxygen profiles (using a hand-held water-quality meter), as well as Secchi disk depth; will be measured in the field. Water samples will be collected for chlorophyll-a, nitrate-nitrogen, total phosphorus, fecal coli form, metal scan and total suspended sediments. A single volume-weighted sample using several discrete water samples taken from various depths will be collected as follows:
    - During periods of thermal stratification, sampling at the top, middle and bottom depths would be sufficient. During periods of thermal stratification, top, middle and bottom samples from each thermal layer (nine samples in total) will be collected and used for the composite sample.

The responsibility of the General Source Sampling Program within the watershed is the responsibility of the watershed manager. All samples taken within the treatment plant are the responsibility of the water-quality superintendent. Sampling procedures can be viewed in the *Halifax Water Sampling Manual*, which is located at the Pockwock Treatment Plant.

Depending on the findings, this may lead to more intense and more targeted sampling. Results of the sampling may guide the investigation of whether changes are associated with land-management activities.

### 7.4.02 Risk-Based Sampling

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

**Petroleum Hydrocarbons**

- Petroleum-hydrocarbon sampling is a result of vehicle traffic on Highway 101, Route 1, the West Lake residential area and the Uniacke Business Park running through the northern portion of the Pockwock Watershed. Sampling will be conducted twice a year, in March and September, during high water-flow periods. Samples will be taken at the Lacy Mill Lake Culvert #2 Highway 101 (PG8) (see Appendix 8).

**Chlorides**

- Chloride sampling is a result of de-icing on Highway 101 along the northern section of the protected part of Pockwock Watershed. All other roads, such as Route 1 and those in the Uniacke Business Park and West Lake residential areas, use sand; the use of road salt within the protected portion of Pockwock watershed is prohibited. Sampling will be done each month from November to June in the first two years; in year three and afterward, sampling will be done monthly from November to April during road-salt season. Samples will be taken at the Lacy Mill Lake Culvert #2 Highway 101 (PG8) (see Appendix 8).

### 7.4.03 Activity-Based Sampling

Activity-based sampling is scheduled based on known events such as forestry land-management activities, such as harvesting or road building, or concentrated OHV activity in the watershed. This sampling may help determine cause-and-effect relationships and short-term and long-term impacts, help change land-management activities, and provide results that may require more patrols to deter OHV activity.

**E. coli**

- Activity-based E. coli sampling is a result of removing beaver dams or septic field repair within the watersheds. Sampling will be done 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.

**Total Phosphorus and Nitrate-Nitrogen**

- Phosphate and nitrate sampling is a result of scheduled forestry activities and NSPI power-line maintenance 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., changes in dissolved oxygen). Sampling will be done daily during stream-crossing activities where there is a clear and direct pathway to the lake.

### 7.4.04 Targeted-Based Sampling

Target-based sampling is done in response to incidents or unplanned events such as fuel or environmental spills on Highway 101, major storms 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 is a result of incidents or unplanned events through forestry activities, OHVs, boating in West Lake, and road construction and maintenance on Highway 101 and Route 1. Sampling will be done 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 continue to within one kilometre of the Pockwock 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 is a result of incidents or unplanned events through septic-tank failure in West Lake and the Uniacke Business Park. Sampling will be done within 200 metres of the scene, as well as at 500-metre intervals downstream on all dominant feeder streams every hour until it reaches the lake. 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.

**Total Phosphorus and Nitrate-Nitrogen**

- Total phosphorus and nitrate-nitrogen sampling is a result of unplanned incidents or events through a chemical spill, of accidents or vandalism to forestry chemical operations outside the unprotected watershed, and from any chemical spills as a result of vehicle accidents involving carriers of this agent through the watershed. Sampling will be done daily 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.

**Turbidity**

- Turbidity sampling is a result of unplanned natural events such as a storm or fire. Sampling will continue daily until two weeks after the event has subsided. Sampling will be taken at the dominant feeder streams where the stream enters into Pockwock and Tomahawk Lakes.

### 7.4.05 Operational Raw Water Sampling

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

References

Wetzel, R.G. 2001. *Limnology. Lake and River Ecosystems*. Academic Press, New York. 1,006 pp.

## 8.0 Acknowledgements

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