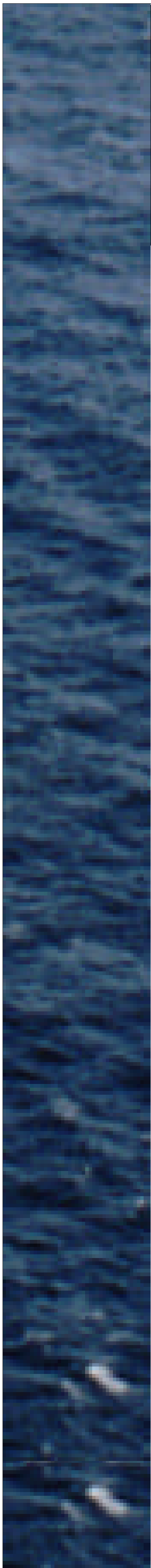
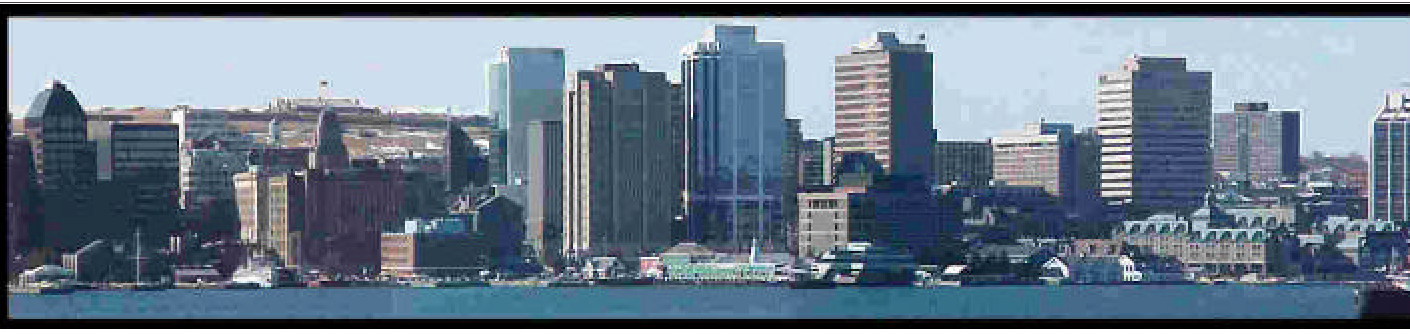
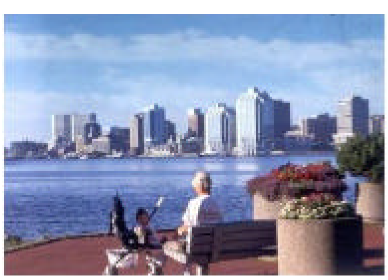


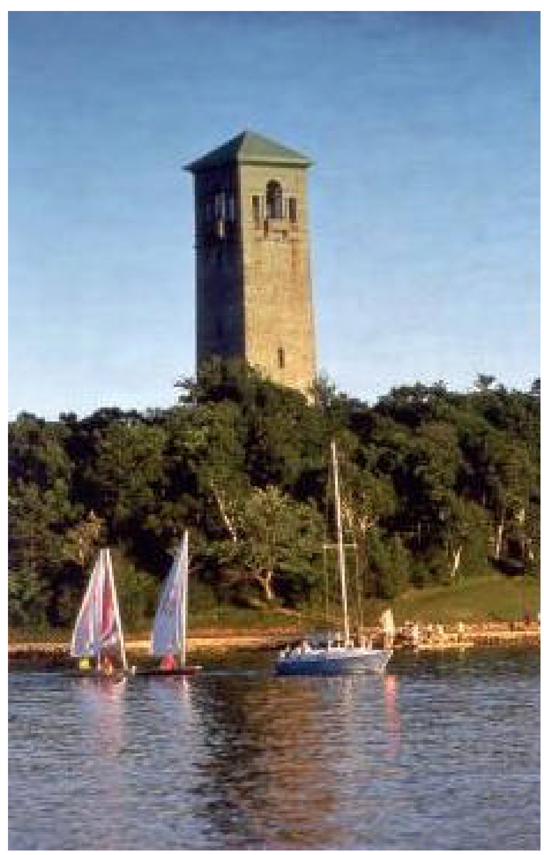


HALIFAX

REGIONAL MUNICIPALITY

# HALIFAX HARBOUR SOLUTIONS PROJECT
# ENVIRONMENTAL SCREENING





October 2001

Jacques Whitford
Environment Limited

**PROJECT NO. 13960-6027**

**REPORT TO**

**HALIFAX REGIONAL MUNICIPALITY**

**ON**

# HALIFAX HARBOUR SOLUTIONS PROJECT ENVIRONMENTAL SCREENING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**in association with**

**Coastal Oceans Associates Inc.**

**and**

**Atlantic Road and Traffic Management**


**October 2001**

| **Concordance Table - Scope of the Environmental Assessment** | |
|---|---|
| **HHSP Scope of the Environmental Assessment (July 2000)** | **HHSP Environmental Screening** |
| **A. Scope of the Project** | |
| ***Physical Works or Physical Activities*** | |
| C collection system | Section 2.7.1 |
| C combined sewer overflows | Section 2.7.1 |
| C sewage treatment plants | Section 2.7.2, Section 2.8.2 |
| C outfalls and diffusers | Section 2.7.3 |
| C onsite sludge management | Section 2.7.2, Section 2.8.2, Section 2.8.3, Section 2.9.3, Section 5.5.5.2 |
| ***Other Associated Physical Works or Physical Activities*** | |
| C offsite sludge management | Section 2.7.4, Section 2.8.3, Section 2.9.3, Section 5.5.5.2 |
| C permanent access roads, power, municipal services | Section 2.8.5, Section 5.4.5.1 |
| C temporary construction work spaces | Section 5.4.5.1 |
| ***Other Undertakings in Relation to Physical Works*** | |
| There are no other undertaking in relation to physical works | N/A |
| **B. Factors to be Considered** | |
| C The environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out; | Section 4.0, Section 5.0, Section 8.0 |
| C the significance of the above environmental effects | Section 4.0, Section 5.0 |
| C comments from the public that are received in accordance with *CEAA* and its regulations | Section 5.5, Section 9.0 |
| C measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project | Section 4.0, Section 5.0 |
| C effects of the environment on the project | Section 7.0 |

| Concordance Table - Scope of the Environmental Assessment | | |
|---|---|---|
| **HHSP Scope of the Environmental Assessment (July 2000)** | | **HHSP Environmental Screening** |
| **C. Scope of the Factors to be Considered**<br>The environmental assessment screening will: | | |
| C | include an evaluation of potential effects, including cumulative effects, for each project phase - construction, operation and decommissioning - as well as malfunctions and accidents with regard to VECs and VSCs | Section 2.10, Section 4.0, Section 5.0, Section 6.0 Section 7.0 |
| C | project related effects assessed within temporal and spatial boundaries established for the assessment | Section 4.0, Section 5.0 |
| C | focus on environmental interactions not previously addressed by the related assessment work conducted for the HHCI project and subsequent approvals | Section 3.2.1, Section 4.0, Section 5.0, Appendix B |
| C | discuss beneficial effects of the project | Section 2.11, Section 4.0, Section 5.0, Section 11.0 |
| C | address cumulative impacts by identifying past, present and reasonable foreseeable projects which might interact with the proposed project | Section 3.2.4, Section 8.0 |
| C | discuss present and future state of each VEC under scenarios with and without the proposed project | Section 4.0, Section 5.0 |
| C | describe associated initiatives such as the HRM Source Control Program which are proceeding independently of the proposed project | Section 2.6.1, Section 8.0 |
| **D. Potential Issues**<br>The summary of potential issues, from which the VECs and VSCs for the HHSP EA includes: | | |
| ***Marine Environment*** | | |
| C | fish | Section 5.1 |
| C | benthic habitat | Section 4.4 |
| C | sediment quality | Section 4.3 |
| C | marine water quality | Section 4.2 |
| ***Terrestrial Environment (Mainland South)*** | | |
| C | terrestrial habitat | Section 4.5 |
| C | species at risk | Section 4.5 |
| C | groundwater | Section 4.5 |
| C | avifauna | Section 4.5 |
| C | freshwater habitat | Section 4.5 |

| Concordance Table - Scope of the Environmental Assessment | |
|---|---|
| **HHSP Scope of the Environmental Assessment (July 2000)** | **HHSP Environmental Screening** |
| ***Socioeconomic Environment*** | |
| C commercial fishery | Section 5.1 |
| C archaeological and heritage resources | Section 5.2 |
| C land use | Section 5.3 |
| C odour | Section 4.1 |
| C noise | Section 4.1 |
| C transportation (land and marine) | Section 5.4 |

## EXECUTIVE SUMMARY

Positive effects are predicted for several valued environmental and socioeconomic components as a result of the operation of the Halifax Harbour Solutions Project (HHSP). The primary objective of the HHSP is improvement of harbour water quality; this will be achieved along with associated long-term positive effects on marine sediment quality, benthic habitat and commercial fisheries.

Aesthetic improvements from reduction in odour and visible sewage components will benefit shoreline and harbour uses (*e.g.*, land use, recreation). In addition to aesthetic improvements, sewage treatment and associated UV disinfection will greatly reduce the introduction of sewage-related human pathogens currently entering the harbour, positively affecting public health and harbour-related uses. A positive effect has also been identified for archaeological and heritage resources due to the potential for increased knowledge gained during HHSP investigations and monitoring. With respect to terrestrial resources, there will be a positive effect on groundwater resources due to the potential provision of municipal water supply in Herring Cove as an HHSP related Community Integration Fund project. Freshwater resources in Herring Cove (*i.e.*, MacIntosh Run) will also realize a positive effect from Project operation as sewage overflow events from Roach's Pond pumping station will be reduced. It is estimated that many of these positive effects will also result economic benefits related to improved opportunities for harbour related businesses and activities.

*Current Conditions*

Halifax Harbour exhibits significant effects of wastewater related pollutants entering the harbour for more than 200 years. Water quality is poor along the shorelines, sediments are contaminated, bacterial contamination is widespread, and aesthetics are poor along the Halifax and Dartmouth waterfronts due to particulates, floatables, and odour. Approximately 40 municipal outfalls serving a developed area of about 7,000 hectares and approximately 225,000 people discharge more than 150 million litres of raw sewage per day into Halifax Harbour. There are also a number of commercial, institutional, and industrial outfalls discharging directly into the harbour. As the population within this sewershed grows, the wastewater input to the harbour will continue to increase in volume. It is predicted that deleterious effects on the harbour, its ecosystem, and users, will also increase in the absence of regional sewage treatment.

*Previous Efforts*

Scientific studies identifying pollution discharges to Halifax Harbour have been conducted since the early 1900s, resulting in various proposed plans to provide sewage treatment. Although two sewage treatment plants have been built on the harbour, at Mill Cove in Bedford Basin and at Eastern Passage, approximately 80 percent of all sewage generated within the Halifax Harbour sewershed continues to enter the harbour untreated.

In 1989, the Halifax Harbour Task Force was commissioned to develop environmental quality guidelines and objectives for uses of Halifax Harbour. Halifax Harbour Cleanup Inc. (HHCI), a Crown Corporation created under a federal-provincial cooperation agreement, developed a plan to meet these water quality objectives. The HHCI plan called for a single primary treatment plant to be constructed on an artificial island in the harbour immediately north of McNabs Island. The plan was granted conditional approval by the Province of Nova Scotia in 1993 after a joint federal-provincial environmental assessment panel review. However, due to insufficient funding, the project was never implemented.

*The Halifax Harbour Solutions Project*

Despite failure to implement the HHCI project, stakeholder and public support for harbour water quality improvements remains strong. Halifax Regional Municipality (HRM) therefore currently proposes to develop a regional sewage treatment system to treat raw sewage currently entering Halifax Harbour. This system, referred to as the Halifax Harbour Solutions Project, is proposed to involve construction and operation of:

- three sewage treatment plants (STPs) (Halifax, Dartmouth, and Herring Cove);
- a sewage collection system (*i.e.*, sewers);
- combined sewer overflows (CSOs);
- outfalls and diffusers; and
- a sewage sludge management facility.

It is anticipated that this system will meet the desired water quality objectives and thus greatly reduce sewage-related pollution in the harbour.

A public-private partnership approach to Project development has been adopted by HRM, involving a combination of public and possible private financing, operation, and ownership of system elements. The primary source of funding (approximately two-thirds) for the HHSP will be derived from a pollution control surcharge applied to HRM municipal water use charges. HRM expects that the remaining one-third of funds needed to complete the full system will be required from other levels of government.

The HHSP is considered to have several improvements over the previous HHCI project. The smaller, compact STPs can be successfully integrated with existing development at the proposed Halifax, Dartmouth and Herring Cove sites. Outfalls from the three STPs will provide enhanced diffusion of treated effluent compared with the single outfall proposed for the HHCI project. UV disinfection will be used instead of chlorine, eliminating residual chlorine in the treated effluent. Effects on the marine environment, particularly benthic habitat, are relatively insignificant compared to those predicted from the construction of an artificial island for the HHCI project. It is also expected that the HHSP system can be built at a lower cost compared to the single plant proposed by HHCI.

*Public Involvement and Information*

There has been a significant public involvement and information program associated with the HHSP. HRM hosted the Halifax Harbour Solutions Symposium in 1996 to formulate general principles for moving forward with the Project. The Harbour Solutions Stakeholder Advisory Committee was subsequently formed to address technical issues which had not been fully addressed during the Symposium. This Committee produced a report which was adopted by HRM Council in 1998 with its recommendations and framework for the HHSP. As HHSP planning proceeded, and proposed STP sites were chosen, community liaison programs were initiated by HRM to provide Project information and receive community input on specific site issues. Some of these issues (*e.g.*, odour and noise control, STP building and design) have been addressed within the specifications in the request for proposals for the private sector partner, and addressed within this environmental assessment document. HRM has also undertaken a number of other initiatives to keep the general public informed about the Project and to provide the public with means of obtaining information and providing input (*e.g.*, newsletters, water bill inserts, HHSP web site, public displays). Meetings have also been held by HRM staff with specific stakeholder groups. Public involvement and information will continue throughout the life of the Project.

*Environmental Assessment Requirements*

The Canadian Environmental Assessment Agency (CEA Agency) has advised HRM that a screening level assessment of the Project pursuant to the *Canadian Environmental Assessment Act* (*CEAA*) is required. Fisheries and Oceans Canada has declared itself as a Responsible Authority for this assessment due to regulatory responsibilities under the *Fisheries Act* and the *Navigable Waters Protection Act*. Other federal authorities such as Parks Canada, Environment Canada, and Transport Canada may also have regulatory responsibility or expert knowledge relevant to the *CEAA* process. This environmental screening document is intended to satisfy these *CEAA* requirements. The Province of Nova Scotia has indicated that it does not intend to require an environmental assessment of the Project under provincial legislation.

The environmental assessment process undertaken for the HHCI project was extensive, with assessment documentation including: a two-volume environmental assessment report; two environmental assessment supplementary reports; and 24 component study reports. It is anticipated that the previous environmental assessment will reduce overall environmental assessment requirements for the HHSP. This assessment for the HHSP incorporates information from HHCI baseline studies, and relevant information from assessment documents.

This screening report focuses on environmental and socioeconomic issues of greatest concern, known as Valued Environmental Components (VECs) and Valued Socioeconomic Components (VSCs), respectively. VECs/VSCs were identified through a scoping process which included, but was not limited to: a review of the previous environmental assessment of the HHCI project; public comment; and professional judgement of the study team. The following VECs and VSCs were selected for the assessment:

- Atmospheric Resources;
- Marine Water Quality;
- Marine Sediment Quality;
- Marine Benthic Habitat;
- Terrestrial Resources;
- Commercial Fishery;
- Archaeological and Heritage Resources;
- Land Use;
- Transportation Infrastructure; and
- Public Health.

Each of the five VECs and five VSCs selected for the assessment was evaluated for potential interactions between the VEC/VSC and planned HHSP activities. Mitigative measures have been recommended to reduce or eliminate potentially adverse effects. Monitoring has been recommended where necessary to confirm impact predictions.

*Environmental Assessment Results*

Adverse residual environmental effects (*i.e.*, after all recommended mitigative measures have been applied) for all the VECs/VSCs are predicted to be non-significant for routine Project-related construction and operation activities. There may be a significant adverse effect to atmospheric resources (odour) in the unlikely event of failure of the STP odour control system. There could also be a significant adverse effect to marine water quality in the unlikely event that untreated effluent enters the Northwest Arm through the CSO at Chain Rock. However, either of these effects would be temporary and localized, and unlikely to occur due to system redundancy, contingency and emergency response planning, and operational maintenance and monitoring procedures. No significant adverse residual environmental effects from the Project are likely to result from the Project. As noted above, a number of positive Project-related effects are predicted for several VECs and VECs during the operation of the HHSP.

*Summary*

In summary, the HHSP will achieve its primary objective which is to improve water quality throughout the harbour. Water quality improvements will be particularly significant in the vicinity of current outfall discharges, and will protect sensitive areas such as Bedford Basin, as well as those used intensively for recreation such as the Northwest Arm. The improvement in water quality will also benefit a number of other associated environmental and socioeconomic components that are vital to the harbour ecosystem and quality of life in HRM. HRM's image as an environmentally and socially responsible community will improve significantly among residents and visitors. It is unlikely that these benefits will be realized without regional sewage treatment. In fact, current sewage related conditions will worsen as sewage flows increase in the future in the absence of treatment.

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# 1.0 INTRODUCTION

Halifax Regional Municipality (HRM), Nova Scotia, proposes to develop a regional sewage treatment system to treat raw sewage currently entering Halifax Harbour. This system, referred to as the Halifax Harbour Solutions Project (HHSP, the Project), is proposed to involve construction and operation of: three sewage treatment plants (STPs); a sewage collection system (*i.e.*, sewers and pumping stations); combined sewer overflows (CSOs); outfalls and diffusers; and a sewage sludge composting facility. A public-private partnership approach to Project development has been adopted by HRM, involving a combination of public and private financing, operation, and ownership of system elements. The final system configuration, design, financing and means of operation will be determined after the private sector partner (Company) and specific proposal is selected and a contract is negotiated.

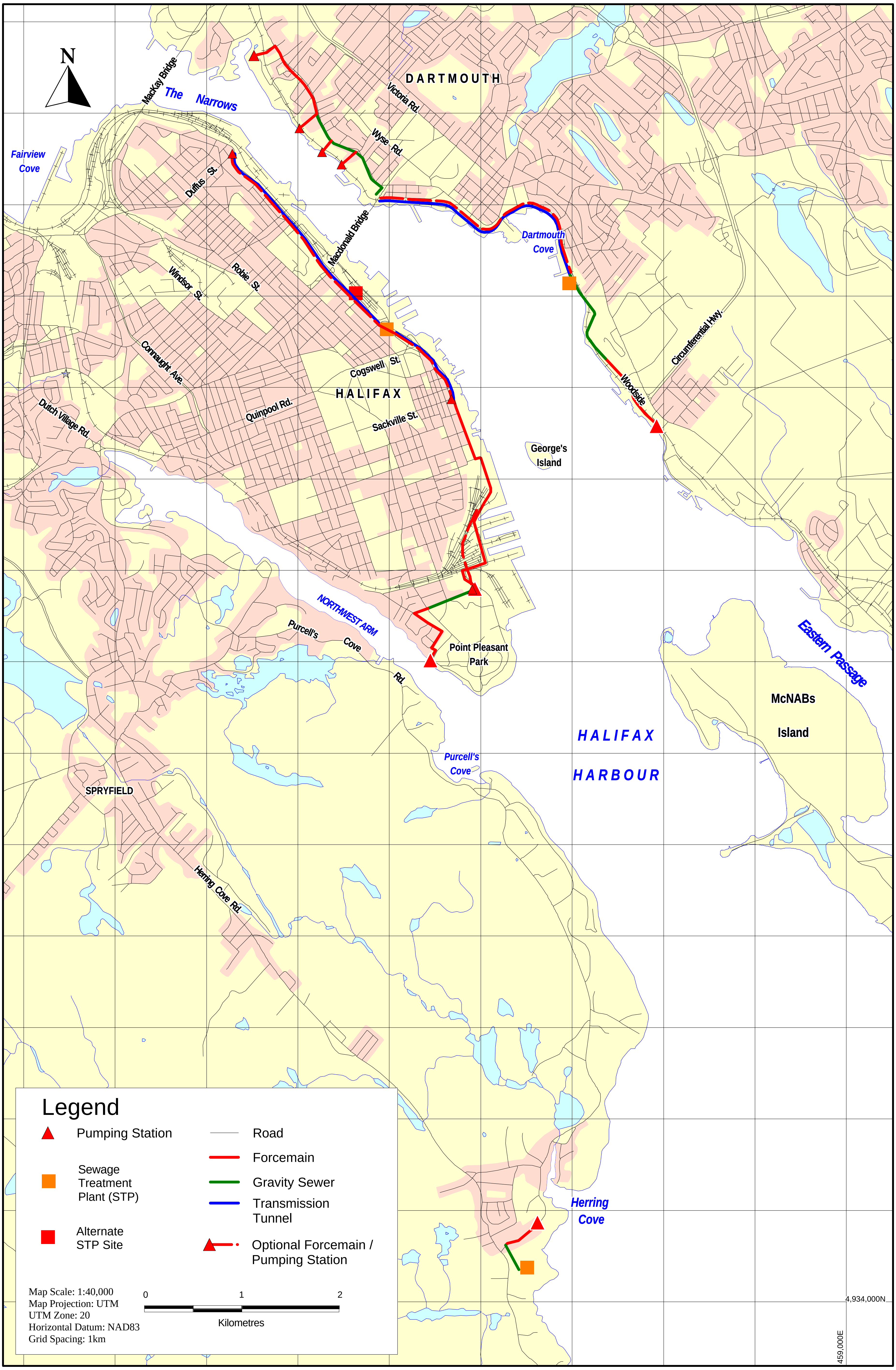
The Canadian Environmental Assessment Agency (CEA Agency) has given advice that a screening level assessment of the Project pursuant to the *Canadian Environmental Assessment Act* (*CEAA*) will be required. Fisheries and Oceans Canada has declared itself as a Responsible Authority (RA) for this assessment due to regulatory responsibilities under the *Fisheries Act* and under the *Navigable Waters Protection Act*. Other federal authorities such as Environment Canada, Parks Canada and Transport Canada may also have regulatory responsibility or expert knowledge relevant to the *CEAA* process. The Province of Nova Scotia has indicated that it does not intend to require an environmental assessment of the Project under provincial legislation.

HRM retained Jacques Whitford Environment Limited (JWEL) to prepare this Environmental Screening Report to satisfy *CEAA* requirements. Coastal Ocean Associates Inc. prepared the physical oceanography component of this assessment. Atlantic Road and Traffic Management provided the transportation component.

**Study Background and Objectives**

Discharges of raw sewage to Halifax Harbour have been a concern since the 1800s. Scientific studies identifying pollution discharges to the harbour have been conducted since the early 1900s, resulting in various proposed plans to provide sewage treatment. Although two sewage treatment plants have been built on the harbour, (Mill Cove in Bedford Basin and at Eastern Passage) approximately 80 percent of all sewage generated within the Halifax Harbour sewershed continues to enter the harbour untreated.

Approximately 40 municipal outfalls serving a developed area of about 7,000 hectares and approximately 225,000 people discharge more than approximately 150 million litres of raw sewage per day into Halifax Harbour. There are also a number of commercial, institutional, and industrial outfalls discharging into the harbour. Appendix A shows existing municipal sewer outfalls and overflows and lists known private outfalls.




**Halifax Harbour Solutions Project**

Figure 1.1
Sewage Treatment Concept Plan

HALIFAX REGIONAL MUNICIPALITY

Jacques Whitford Environment Limited

January 2001
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In 1989, the Halifax Harbour Task Force (HHTF) was commissioned to develop environmental quality guidelines and objectives for uses of Halifax Harbour. Halifax Harbour Cleanup Incorporated (HHCI), a Crown Corporation created under a federal-provincial cooperation agreement, developed a plan to meet these water quality objectives. The HHCI plan called for a single primary treatment plant to be constructed on an artificial island in the harbour immediately north of McNabs Island. The plan was granted conditional approval by the Province of Nova Scotia in 1993 after a joint federal-provincial environmental assessment panel review. However the federal/provincial/municipal funding agreement expired in 1995 and was not renewed because of the perceived high cost of the project at that time.

Despite failure to implement the HHCI project, stakeholder and public support for harbour water quality improvements continued. HRM renewed efforts by hosting a public symposium in 1996 to seek community input and develop principles for moving forward. The Harbour Solutions Advisory Committee, a broadly-based stakeholder group appointed by HRM, developed a set of recommendations to advance the project, building on the consensus results of the Halifax Harbour Solutions Symposium. Based on these recommendations and previous studies undertaken for HHCI, a Concept Plan with options was adopted by HRM (1998) to achieve advanced primary level treatment for all untreated discharges. The preferred Concept Plan included two STPs on the Halifax peninsula, one STP in Dartmouth, and one STP in the Herring Cove area. However, due to property acquisition difficulties associated with the Halifax South STP site in Spring 2001, flows from the two Halifax Peninsula STPs were proposed to be combined into one STP (formerly referred to as Halifax North) to be located south of the harbour Narrows. It is anticipated that this system will meet the desired water quality objectives and thus greatly reduce sewage related pollution in the harbour.

It is anticipated that the maximum of three relatively compact STPs can be successfully integrated into the densely developed harbourfront. It is also anticipated that outfalls from the three STPs will provide enhanced diffusion of treated effluent compared with the single outfall provided by the HHCI project. It is also expected that the HHSP system can be built at a lower cost compared with the single plant proposed by HHCI. Figure 1.1 shows the location of the proposed STPs.

The environmental assessment process of the HHCI project was extensive. Assessment documentation included: a two-volume environmental assessment report; two environmental assessment supplementary reports; and 24 component study reports. It is anticipated that the previous environmental assessment will reduce overall environmental assessment requirements for the HHSP. This assessment for the HHSP incorporates information from HHCI baseline studies, and focuses mainly on those differences between the projects that have not previously been assessed. Appendix B contains a comparison of the major project components between the HHCI project and HHSP.

# 2.0 PROJECT DESCRIPTION

## 2.1 Project Overview

The regional sewage treatment Project for Halifax Harbour is proposed to include construction and operation of three STPs (Halifax Peninsula; Dartmouth; and Herring Cove) and associated collection systems that will provide advanced primary level of treatment with UV disinfection. Initial average daily STP capacity flows for the four STPs are estimated to total 2.7 $m^3/s$, with peak flows totaling 7.04 $m^3/s$. Future (2041) average daily flows are anticipated to reach 3.31 $m^3/s$ with peak flows totalling 8.68 $m^3/s$ (HRM 2000). Each STP will have a marine outfall and diffuser for discharge of treated effluent capable of achieving an initial dilution of approximately 50:1. All STPs will include onsite sludge dewatering.

The STPs will be designed, built and may be operated by the Company while the collection systems will be built by the Company but operated by HRM. Plants and associated infrastructure would be constructed over approximately a ten-year schedule, with the timing and ultimate completion based on funding availability. The primary source of funding (approximately two-thirds) for the Project is a pollution control surcharge applied to HRM municipal water use charges. HRM is currently seeking the remaining one-third of funding required from federal and provincial levels of government. The Concept Plan estimated the capital costs for a four plant option to be $306 million ($1998) including taxes but not including land acquisition or site preparation costs. Annual operating costs were estimated to be approximately $6 million (HRM 1998).

## 2.2 Purpose and Need for Project

Halifax Harbour currently exhibits significant effects of pollutants discharged to the harbor through untreated sanitary, storm and combined sewer outfalls. Shellfish harvesting is prohibited in the harbour. Large areas of contaminated sediment exist around many of the outfalls. Water quality is poor along the shorelines, bacterial contamination is widespread, and aesthetics are poor along the Halifax/Dartmouth waterfronts due to particulates, floatables, and odour. A detailed description of the need for sewage treatment for Halifax Harbour is presented in the HHCI "Environmental Assessment Report" (Section 2.3, HHCI 1992).

Water quality objectives have been set by the HHTF (1990) for the various portions of the harbour, based on desired uses of the waters. Although two STPs currently treat a small portion of sewage entering the harbour, the majority of sewage continues to enter the harbour untreated. The purpose of the Project is to provide advanced primary level treatment with UV disinfection for the untreated municipal sewer discharges to the harbour, as well as for as many of the private outfalls as can be included. This proposed Project will produce significant environmental benefits as well as potential health and economic benefits related to improved opportunities for tourism and recreation. HRM's image among residents and visitors will also be improved with the addition of widespread sewage treatment.

## 2.3 Project Location and Scope

Based primarily on consideration of construction costs, siting constraints,and an opportunity to phase the Project in over a period of time, a four STP scenario was initially selected by HRM as the base concept. Finding suitable locations for multiple plants around a heavily developed, urbanized harbour was a challenging undertaking. However, it was anticipated that the siting of several relatively compact, enclosed STPs would be more acceptable than that of a single large STP as proposed by HHCI.

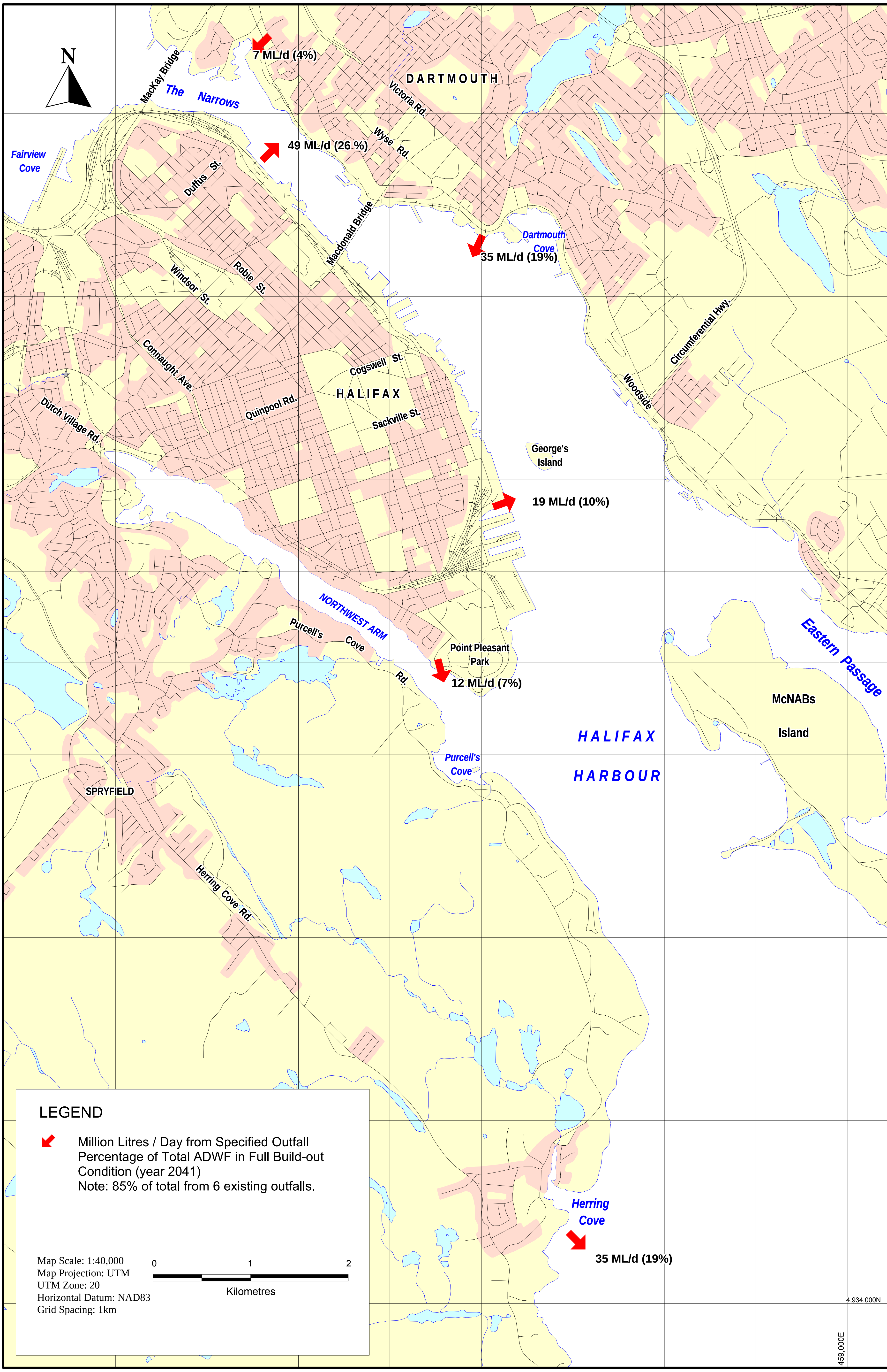
Major untreated outfalls exist along both the Halifax Peninsula and Dartmouth waterfronts from the Narrows to the harbour mouth, with an additional untreated outfall outside the harbour mouth near Herring Cove carrying sewer discharge from Mainland South Halifax. Approximately 85 percent of untreated sewage currently entering the harbour is discharged from six major outfalls. Projected flows from these outfalls (2041) are presented on Figure 2.1.

In the four STP concept, one STP was to serve Dartmouth and be located on a portion of the Coast Guard base south of the downtown Dartmouth. Two STPs would serve the Halifax Peninsula, to be located south of the harbour Narrows at Barrington and Cornwallis Streets and a second in the south end of Halifax Peninsula in the rail yard area. A fourth STP would serve Mainland South, to be located near Herring Cove. However, due to property acquisition difficulties, flows from the two Halifax Peninsula STPs were incorporated into one STP (formerly referenced as Halifax North) to be located south of the harbour Narrows. The preferred concept plan has therefore become a three STP scenario. Figures 2.2 to 2.4 indicate the proposed location of the STPs and their corresponding outfalls/diffusers.

HRM currently owns or is in the process of acquiring land for the three STP sites. An alternate location for the Halifax STP is being considered by HRM, as shown on Figure 2.2. The locations of the outfalls and diffusers indicated on the Figures are preliminary and have been based on: sufficient depth and current to achieve adequate mixing of treated effluent; proximity to the STPs; and avoidance of conflicts with navigation and anchoring. The Company is required to develop the final site plan for the outfalls and diffusers and to obtain pertinent approvals such as those required by the *Navigable Waters Protection Act*, *Fisheries Act*, *Canadian Environmental Protection Act* (Disposal at Sea).

One of the key recommendations of the Harbour Solutions Advisory Committee was to avoid discharges into the Narrows in order to protect Bedford Basin from any potential water quality degradation. Circulation patterns in the harbour tend to carry any Narrows discharge north into the Basin. For this reason, no STPs or outfalls are proposed to be located north of the MacDonald Bridge. Also recommended was that no effluent be discharged into the Northwest Arm, acknowledging a higher level of recreational use.

The collection infrastructure is proposed to consist of a combination of limited tunnelling, with the remainder of the sewage collection pipes installed in surface trenches. Some pumping with forcemains would be required, but gravity mains will be used whenever possible.




HALIFAX REGIONAL MUNICIPALITY

**Halifax Harbour Solutions Project**

Figure 2.1
Major Sewage Outfall Flows

Jacques Whitford Environment Limited

December 2000
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Map Parameters:
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Figure 2.2
Halifax STP Collection System

**Halifax Harbour Solutions Project**

## LEGEND

| | | |
|---|---|---|
| STP Site | Forcemain | Interception Location |
| Alternate STP Site | Optional Forcemain / Pumping Station | Combined Sewer Overflow |
| | Gravity Sewer | Pumping Station |
| | Tunnel | Outfall/Diffuser |

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HALIFAX
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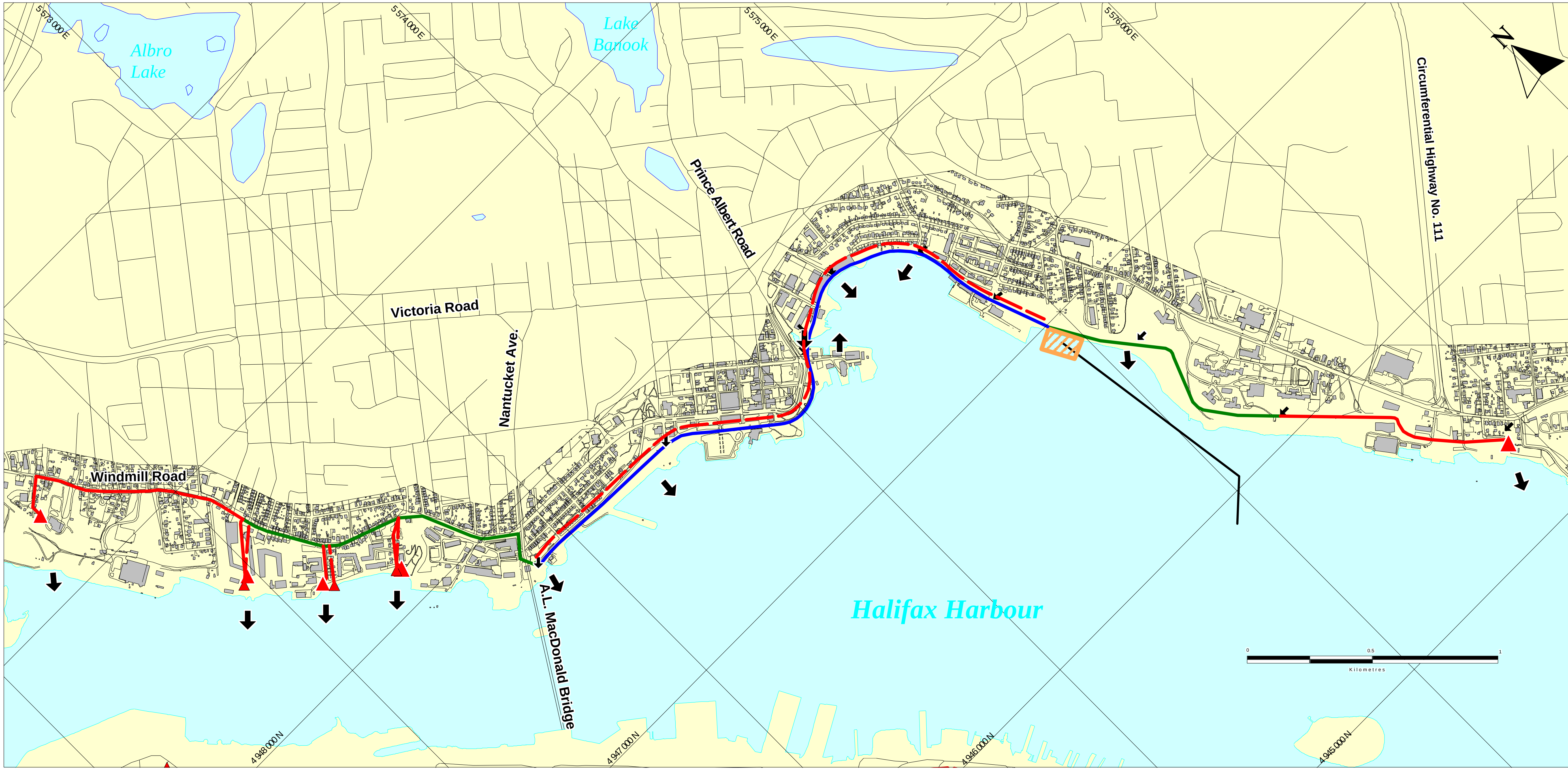


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Halifax Harbour Solutions Project;
Basemap Provided by HRM.

Figure 2.3
Dartmouth STP Collection System

**LEGEND**

- STP Site
- Forcemain
- Optional Forcemain / Pumping Station
- Gravity Sewer
- Tunnel
- Interception Location
- Combined Sewer Overflow
- Pumping Station
- Outfall/Diffuser

**Halifax Harbour Solutions Project**

HALIFAX Regional Municipality

Jacques Whitford Environment Limited

January 2001
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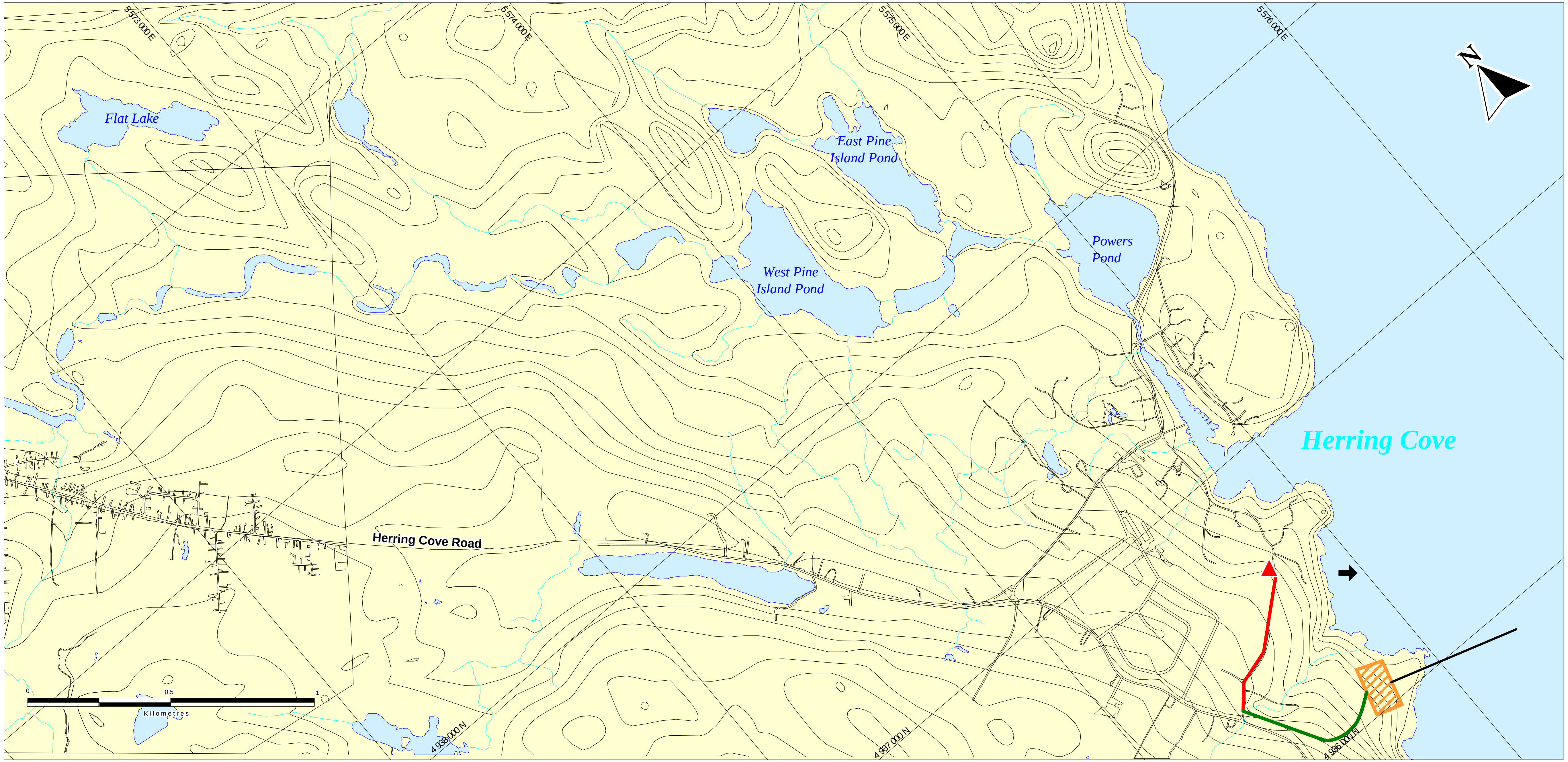


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Halifax Harbour Solutions Project;
Basemap Provided by HRM.

Figure 2.4
Herring Cove STP Collection System

**Halifax Harbour Solutions Project**

**LEGEND**

| | |
|---|---|
| STP Site | Combined Sewer Overflow |
| Forcemain | Pumping Station |
| Gravity Sewer | Outfall/Diffuser |

HALIFAX
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Jacques Whitford
Environment Limited

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At a minimum, the STPs will provide advanced primary treatment. This level of treatment includes mechanical solids separation augmented by chemical treatment to enhance removal of suspended solids. Effluent will be disinfected with ultraviolet (UV) light prior to discharge. The proposed plant design and sites will provide for the possible future addition of secondary treatment processes should this become necessary, as well as future capacity expansion if this is required.

Constraints on the size of STP sites on the Inner Harbour will require innovative multi-level design to achieve small plant footprints. The STPs will be designed to restrict odour and noise. They will also be designed and landscaped to be compatible with surrounding land uses. HRM is committed to working with communities to identify Project enhancements to help integrate the facilities into the community setting and to provide a net benefit to host communities. Accordingly, HRM has established a Community Integration Fund and initiated community consultation process for this purpose. Further information on HRM's Public Consultation program is provided in Section 9.

## 2.4 Project Schedule

The Project schedule is strongly influenced by the tendering process to select a private sector partner. HRM's tendering process has included several steps. A Request for Qualifications (RFQ) process resulted in a short list of proponents. A Request for Proposals (RFP) was prepared and released to the short list in Spring 2000. Proposal submissions were received in the Fall of 2000. It is anticipated that the selection process including negotiation of a contract with the successful proponent will be concluded in time to begin construction of the Halifax STP by late 2001.

Construction is anticipated to be conducted in two phases. Table 2.1 contains the proposed phased construction schedule for the project. This schedule may be modified for several reasons including the date of contract award, the availability of federal and provincial funding, and final configuration of the project. In the absence of federal and/or provincial funding there will be uncertainty as to which components of the Project HRM will be able to complete.

| Table 2.1 Proposed Project Construction Schedule | | |
|---|---|---|
| **Site** | **Component** | **Proposed Construction Start Date** |
| ***Phase 1*** | | |
| Halifax | C Sewage collection system<br>C STP<br>C Outfall/diffuser | Fall, 2001 |
| Dartmouth | C Sewage collection system<br>C STP<br>C Outfall/diffuser | Spring, 2003 |
| ***Phase 2*** | | |
| Herring Cove | C Sewage collection system<br>C STP<br>C Outfall/diffuser | Spring, 2007 |

It is anticipated that each STP related collection system, and outfall/diffusers will require approximately 18 to 24 months to construct.

The sewage collection systems will have a minimum design life of 60 years. The STPs, outfalls, and diffusers will be designed, constructed, and commissioned with a design life for structural components of at least 60 years, mechanical components of at least 25 years, and electrical instrumentation components of at least 15 years.

## 2.5 Regulatory and Other Requirements

The Project is subject to numerous federal, provincial, and municipal laws, regulations and guidelines. This section provides a summary of the relevant regulatory requirements. Specific information on the relevance of each is included in the respective sections of the report.

Relevant provincial legislation includes the *Environment Act* and associated regulations including, but not limited to: the *Solid Waste-Resource Management Regulations*; *Activities Designation Regulations*; *Water and Wastewater Facility Regulations*; *Dangerous Goods Management Regulations*; and *Sulphide Bearing Material Regulations*. Additional provincial legislation includes, but is not limited to: *Endangered Species Act* and *Wildlife Act*. Relevant federal legislation includes, but is not limited to: the *Migratory Birds Convention Act* and Regulations; *Canadian Environmental Protection Act* and Regulations; and *Fisheries Act*. Municipal By-Laws of direct relevance to this Project include HRM's Wastewater Discharge By-Law (By-Law No. W-101) and Noise By-Law (By-Law No. N-200).

Following release from the environmental assessment process, the Project will require various approvals, pursuant to the *Activities Designation Regulations*, including a Municipal Waste Approval and Industrial Approval. Conditions of release associated with the environmental assessment of the Project, combined with any conditions of approval associated with the provincial approvals process will also become regulatory requirements for the Project.

In addition to regulatory requirements, the successful bidding Company is responsible for adhering to the performance requirements specified in the RFP (HRM 2000a). Specific performance criteria particularly relevant to the environmental assessment include effluent and water quality standards (refer to Section 2.9.1) and noise and odour performance criteria (refer to Section 2.9.2). The RFP also references federal and provincial standards to which the Company must operate, an example of which is sludge management requirements including requirements of 40 CFR Part 503 U.S. EPA Regulations, and NSDEL requirements, such as the "Composting Facility Guidelines", and Canadian Council of Ministers of the Environment (CCME) document "Guidelines for Compost Quality" (1996 and updates).

Additional guidelines and industry standards for construction include: NSDOE "Erosion and Sediment Control Handbook for Construction Sites" (NSDOE 1998); "Province of Nova Scotia Environmental Construction Practice Specifications" (Fisheries and Oceans Canada *et al.* 1981); "Environmental Code of Good Practice for Highways and Railways" (Environment Canada 1979); and, in the case of exposure of potentially acid generating bedrock, the "Guidelines for Development on Slates in Nova Scotia" (NSDOE and Environment Canada 1991).

## 2.6 Related Projects and Project Alternatives

### 2.6.1 Related Projects

<u>Pollution Prevention Program</u>

HRM's Pollution Prevention Program, formerly referred to as the Source Control Strategy initiated in 1996, will result in important improvements in the levels of nutrients, metals, and toxins currently entering the wastewater system, and ultimately, Halifax Harbour.

The overall objectives of the Pollution Prevention Program are:

- protect the safety of the public and the health and safety of municipal staff;
- protect the physical integrity of the collection system, pumping stations and wastewater treatment plants;
- reduce potential operational problems related to the wastewater treatment process which may be caused by industrial, commercial or institutional discharges to the municipal sewer systems;

- reduce potential bio-solids management problems cause by excessive concentrations of prohibited materials; and
- reduce pollution of freshwater or marine ecosystems (in compliance with the *Fisheries Act*).

A new HRM by-law respecting discharge into public sewers (By-Law Number W-101, Wastewater Discharge By-Law) prohibits discharges of specified substances and concentrations to sanitary and combined sewers, and storm sewers. This by-law, enacted on July 21, 2001, repeals the previous wastewater by-law (W-100) which was a compendium of previous City of Halifax, City of Dartmouth, and Town of Bedford wastewater by-laws. Appendix C contains a copy of the new by-law. The new by-law is more stringent with respect to prohibited discharges, introduces compliance monitoring and reporting by the discharger, and increases the penalty for non-compliance. This by-law will be instrumental in the reduction of the discharge of toxic, hazardous or prohibited wastes into the municipal sewer systems.

The Pollution Prevention Program is now an on-going operational activity of the Halifax Regional Municipality. Regular reporting on a quarterly basis to Regional Council will identify the progress of monitoring and enforcement. HRM staff are currently developing a database of all industrial, commercial and institutional locations which will assist in the management of regulating contaminant levels in the municipal systems. This will permit existing and new development to be included in procedures for compliance monitoring and enforcement of prohibited discharges. Additionally, the development of best management practices for industrial and commercial sectors will be developed to assist these locations in achieving compliance. Educational material will also be developed for the residential sector to permit the direct participation of the public in the reduction of contamination released to our waterways. There is estimated to be approximately 5000 ICI sites to be evaluated under the program within approximately 3.5 years. A detailed phase approach to the implementation of this program is currently being developed. Compliance audits will be initiated in August, 2001.

HRM staff meet on a regular basis, possibly annually, to review the prohibitions and related chemistries of the current by-law with various stakeholders which will represent the public, private and government interests. This review process will insure that the regulatory components of the by-law reflect current operational concerns and are based on available treatment technologies to permit the objectives as previously identified to be attained.

The implementation and continued maintenance of this program is key to the success of the proposed HHSP. Although a separate entity, the pollution prevention program (*i.e.*, source control strategy) will complement the HHSP as it will increase the effectiveness of wastewater treatment and improve quality of resulting sludge for composting.

Inflow/Infiltration Reduction

HRM is also in the early planning stages of developing Inflow/Infiltration (I & I) reduction plans which will reduce the overall volume of wastewater entering the treatment system and reduce risk of overflow events. Although a separate initiative from HHSP, it will also complement the Project and increase its effectiveness.

### 2.6.2 Alternatives to the Project

Alternatives to the Project are defined by the CEA Agency as functionally different ways of achieving the same end (CEA Agency 1994). The major alternative to the project (*i.e.*, the alternative to provision of wastewater treatment) would be to continue with the status quo (null alternative). This is generally acknowledged by regulatory agencies, the general public, as well as by HRM, to be an unsatisfactory alternative, both environmentally as well as socially.

Poor aesthetics, high nutrient concentrations, harmful algal blooms, high levels of suspended solids, organic matter enrichment, and depressed oxygen levels in sediments and water are some examples of current sewage-related conditions in Halifax Harbour. The harbour water is unacceptable for shellfish consumption and primary contact recreation in most places in the Inner Harbour.

As the population serviced by the HRM sewershed grows, the wastewater inputs to the harbour will continue to increase in volume, with increasingly deleterious effects on the harbour, particularly in the absence of sewage treatment. Section 4.2 contains further discussion on the projected water quality in the absence of sewage treatment.

HRM's related pollution prevention initiatives complement the Project in that it will control discharges that cannot be effectively handled by sewage treatment systems. However, in the absence of the wastewater treatment Project, the Pollution Prevention Program and source control initiatives cannot achieve the desired water quality objectives set by the HHTF. Source control alone cannot therefore be considered a feasible alternative to the Project.

There is, therefore, no feasible alternative to the implementation of a sewage treatment system in order to achieve the basic water quality objectives of HRM.

### 2.6.3 Alternative Means of Undertaking the Project

Alternative means of carrying out the project are defined by the CEA Agency as methods of a similar technical character or methods that are functionally the same (CEA Agency 1994). A number of important guidelines or constraints were considered in order to define the major alternative means for undertaking the project. The main guidelines were provided by:

- C the General Principles from the Halifax Harbour Solutions Symposium including water use and water quality guidelines developed by the HHTF;
- C recommendations of the Halifax Harbour Solutions Advisory Committee; and
- C input from HRM staff and consultants (the Project Team).

Guidance from these sources was applied particularly during the selection of: treatment level and technology; potential site areas for STPs and outfalls; and the number and size of STPs.

Additional information regarding the evaluation of treatment technologies was obtained from the "Review of Halifax Harbour Clean-up Program" (CBCL 1996), which included a review of wastewater treatment technologies presented at the G-7 Summit in Halifax in June 1995.

**Number and Size of STPs**

The Project Team reviewed previous Halifax Harbour studies and conducted additional analyses to determine the appropriate range of numbers and sizes of STPs. An advantage of multiple plants is the opportunity to develop the overall system in phases over a longer period of time while being able to achieve incremental benefits from the portions of the system that are implemented first. One or two large plants would require larger sites for the STPs and significantly larger and more expensive collector tunnels. With six or more STPs however, the loss of economies of scale becomes a significant factor resulting in increasingly expensive overall capital and operating costs.

A three to five plant scenario was proposed based on financial, technical and siting reasons (HRM 1998). A detailed evaluation was conducted on three main alternatives, a 3, 4, and 5 plant scenario. Appendix C contains figures presenting each of these alternatives.

The four plant scenario (Alternative B) was endorsed in principle by HRM Council as the most practical. Flows on the Dartmouth side of the harbour are such that a single plant will suffice to treat the volumes; consolidation of outfalls in Dartmouth has already captured approximately 70 percent of the Dartmouth sewage in a single location. On the Halifax Peninsula side of the harbour, the concept included two STPs given the relatively higher flows compared with Dartmouth. However, it was considered feasible, however, to locate a single plant at either the Halifax North or South site. Finally, the wastewater flow from Mainland South, which discharges at Herring Cove, must be treated in the Herring Cove area, as the cost of connecting this outfall to an Inner Harbour facility is prohibitive. For these reasons, the original Concept Plan was a four-plant system, with an alternative of fewer plants. Difficulties surrounding property acquisition at the preferred Halifax South site resulted in a modification of the Concept Plan to a three plant system with a single site for Halifax Peninsula (formerly Halifax North).

**Outfall Siting**

Because of potential environmental issues associated with the discharge of treated sewage effluent, the siting of the marine outfall has played an important role in project planning. Based on a review of the oceanography and sedimentology of the Harbour, water quality objectives, as well as public and stakeholder input, the Inner Harbour was identified as the most appropriate area for marine outfalls. The Inner Harbour stretches from the north end of McNabs Island to the MacDonald Bridge. The Narrows was excluded with the objective of protecting the Bedford Basin from adverse effects that may be associated with the effluent (*e.g.*, harmful algal blooms and low oxygen events that have been a problem in Bedford Basin). The Northwest Arm was excluded because of the Harbour Solutions Advisory Committee's recommendation to maintain a higher level of water quality than other areas due to intensive recreational uses. Inner Harbour discharge was also consistent with the "containment principle" endorsed originally by the HHTF. This principal suggested that the outfall should be situated such that any potential effluent related contamination would be "contained" in previously contaminated areas, and would also be easier to monitor compared with remote discharge locations. A discharge location outside the Inner Harbour near Herring Cove was also considered necessary to service that STP. Outfall siting criteria developed by the Harbour Solutions Advisory Committee were applied in choosing candidate areas.

Optimum conditions for marine outfalls included sufficient depth (>20 m) and strong currents to promote mixing and effluent dispersion. Distances from specific areas including anchorages, beaches and aesthetically important areas were also considered. Based on these general criteria, several candidate areas for outfall discharge were identified in the Inner Harbour and Herring Cove area. These areas are presented for the main siting alternatives on the Figures in Appendix C. The Inner Harbour areas were reviewed with the Halifax Port Authority in consideration of potential conflicts with shipping and anchorages. Provisional locations for outfalls and diffusers were identified in the candidate areas (Figures 2.2 to 2.4). Detailed oceanographic modeling was conducted for these outfall locations to determine assimilate capacity of the receiving waters and potential diffuser lengths to achieve water quality objectives. Detailed information on the oceanographic modelling is presented in Section 4.2.

**Plant Siting**

Once preferred marine outfall locations were selected, the STP siting process could proceed. The following criteria was used to identify candidate sites:

- minimum of 1.2 ha - 1.5 ha in size to host the initial plant as well as to accommodate possible STP expansion to handle future flow volumes and provide secondary treatment if necessary;
- reasonably close to suitable outfall locations;
- close to high sewage flows to minimize infrastructure and pumping requirements; and
- close to sea level to reduce pumping costs.

Once potential sites were identified, a community liaison effort was initiated by HRM for each of the four affected communities surrounding the potential Dartmouth, Halifax North and South, and Herring Cove STP sites. The objective of this effort was to inform community members regarding the Project and to note issues and concerns brought forward. Coinciding with the loss of the Halifax South STP site from the Concept Plan, an alternative STP site was proposed for Halifax North (Halifax) to enable larger plant size that may be required to service the entire Halifax Peninsula. More information regarding this alternate site is contained in Section 5.3.

**Level of Sewage Treatment**

Level of treatment provided by the STP is governed by the water quality objectives for the receiving body of water. Several treatment processes were reviewed for the purposes of developing the Concept Plan, including: preliminary treatment; primary treatment; advanced primary treatment; secondary treatment; and tertiary treatment.

In determining an appropriate level of sewage treatment for the Concept Plan, two major criteria were used to evaluate alternatives: receiving water guidelines recommended by the HHTF (1990); and effluent quality limits specified by Nova Scotia Department of Environment and Labour (NSDEL) (formerly Nova Scotia Department of Environment), based on an oceanographic modelling and assimilative capacity study conducted for the HHSP related to the four proposed outfall sites (COA 2000).

Advanced primary treatment was considered to be the minimum level of treatment capable of meeting these criteria, therefore preliminary and primary treatment alternatives were ruled out. Secondary or higher levels of treatment would provide a higher quality of treatment effluent, but were not adopted in the current concept because of significantly higher capital and operating cost. There was general agreement among HRM and stakeholders that cost is a critical component of overall Project viability considering that the percieved high cost of the HHCI project was a key factor in its ultimate lack of support. Therefore the current Concept Plan assumes advanced primary treatment, with the capability of expanding to secondary treatment in the future if required.

Chlorine and UV methods to disinfect treated effluent were considered. UV technology was selected as the preferred disinfection method because of the lack of residual chemicals contained in the effluent stream compared with chlorine application.

**Collection Systems**

Alternatives considered with respect to collection systems included:

- separation or consolidation of stormwater and sewage; and
- trenching or tunnelling of the collection system.

The present Concept Plan involves construction of additional collection systems and the interception of four times Average Dry Weather Flow (ADWF), which will result in approximately 75 percent of the total annual flow being captured and conveyed to the treatment facility. Flows in excess of 4 x ADWF (primarily during storm events) will be discharged to the Harbour with the frequency of overflows at individual combined sewer overflows (CSOs) ranging from 20 to 70 events per year. CSOs will be equipped to treat overflows with screens or simple underflow baffles to remove floatables before discharge to the harbour.

The number of operating CSOs will be approximately 15-20. Potential CSO locations are indicated on Figures 2.2 to 2.4.

One alternative to the Concept Plan, with respect to stormwater/sewage separation, is to excavate existing combined collection systems and replace them with separate pipes to permit a full separation of stormwater and sewage. Universal sewer separation was not considered to be economically feasible. Although there would be less overflow events discharging partially treated sewage, contaminated surface run-off would always bypass the treatment plant and discharge into the harbour untreated. It was determined that sewer separation should be considered on an individual sewershed and/or outfall basis.

The three plant Concept Plan requires less collector system infrastructure than that which would be required for a one or two plant option. The options of trenching versus tunnelling have been evaluated to determine the most feasible environmental, engineering, and economic option. Although trenching causes more physical ground disturbance during construction, tunnelling is more costly and includes areas of construction related disturbance associated with the minehead shafts. Forcemains would have longer term operating costs and additional facilities associated with pumping compared with gravity sewers. Portions of the collection system potentially designated for tunnels, foremains and gravity sewers are described on Figures 2.2 to 2.4.

**Technologies**

The STPs will require an innovative, compact design in order to minimize land requirements and integrate successfully into the surrounding communities. Such designs may involve: inclined plate settling; stacked sedimentation tanks; reactor clarifiers with micro-sand additions; or other alternatives in order to reduce the land area requirements of the STPs.

The fundamental qualifying criteria to be considered for implementation for the HHSP is that the technology/design:

- is appropriate for the scale of the proposed project and has been applied successfully elsewhere in similar conditions on more than one occasion;
- does not create secondary problems that impact other important aspects of the treatment process; and
- is economical in both capital and operation costs when compared with other alternatives (HRM 1998).

It is assumed that the basic treatment technologies used for HHSP will meet the above criteria. In addition, the Company may propose alternative technologies/processes to achieve treatment including:

- type of grit removal (*e.g.*, aerated tanks, vortex separators);
- preliminary chemical addition;
- type of primary treatment (*e.g.*, sedimentation, flotation); and
- biosolids management (*e.g.*, digestion; sludge thickening; sludge drying; biosolids utilization).

Advanced primary treatment with UV disinfection has been applied successfully in other areas on a similar scale as Halifax and is considered to be the most economical alternative capable of meeting the desired water quality and effluent quality objectives. UV disinfection process has been accepted as a more environmentally friendly alternative to chlorination as proposed for the HHCI project.

During the G-7 Summit, held in June 1995 in Halifax, an exhibit of wastewater technologies was set up on the outfall on Upper Water Street in Halifax. The demonstration consisted of six pilot scale treatment plants supplied with combined sewage flows from the Upper Water Street outfall by a pumped system (CBCL 1996). Performance testing was conducted by NSDOE. These technologies were assessed and their application for wastewater treatment in Halifax, examined. The results of this analysis, contained in the "Review of Halifax Harbour Clean-up Program" (CBCL 1996), concluded that the technologies:

- have only been used in a limited way, on small scale installations;
- lack a proven performance record in large scale treatment plant operations;
- appear to cost more than conventional treatment systems; and
- in some cases, claim to offer smaller land requirements.

One of the technologies demonstrated at the G-7 Summit, and the main alternative technology considered during the development of the present Concept Plan was the Solar Aquatics™ system, which involves the aeration of sewage in a series of small tanks with a combined retention time of four days. This system represents an aesthetically attractive, natural-appearing process that produces a high quality effluent (equivalent to tertiary treated effluent) and is applicable to small wastewater flows. When evaluated against the prequalifying criteria however, Solar Aquatics™ technology had not previously been applied successfully at the scale proposed for HRM and would have excessive capital costs primarily with respect to land requirements (*e.g.,* facilities would require more than 30 ha of land in total compared to less than 1.5 ha required for advanced primary treatment). Sufficient land suitable to accommodate widespread treatment around the harbour using this technology is not available. This alternative was therefore not considered to be a viable alternative to treat the present existing flows.

## 2.7 Project Design and Construction

Construction activities will be conducted in accordance with best industry standards and practices and will conform to or exceed requirements of all applicable legislation, codes, standards, specifications, and guidelines including: NSDOE "Erosion and Sediment Control Handbook for Construction Sites" (NSDOE 1998); "Province of Nova Scotia Environmental Construction Practice Specifications" (Fisheries and Oceans Canada *et al.* 1981); and "Environmental Code of Good Practice for General Construction" (Environment Canada 1979).

### 2.7.1 Sewage Collection Systems

A new sewage collection system is required to intercept and collect sewage from the existing sewer system and deliver it to the STPs. Some of the existing outfalls will be consolidated in this process; others will remain as combined sewer overflows (CSOs). The normal design flow will be 4 x ADWF estimated by HRM for the year 2041 from the sewersheds of Halifax, Dartmouth, and Mainland South/Herring Cove. Excess flows will either be stored for treatment or will outfall to the Harbour through CSOs. CSOs will be equipped with screens or underflow baffles to remove floatables. The anticipated CSO at the present Chain Rock outfall site in the Northwest Arm may require some additional treatment such as disinfection in order to preserve a higher level of water quality in the Arm. Disinfection options may include chlorination/dechlorination, hydrogen peroxide, and UV radiation. The preferred method will be selected in consideration of the potential opportunities and constraints associated with each option including cost, health and safety considerations, site characteristics, design engineering, and overall space requirements. If chlorination is selected as the preferred option, the disinfected effluent will be de-chlorinated prior to release.

The collection systems will include sections of conventional gravity collector sewers, pumping stations with back-up generators, dual forcemains, and tunnel sections. The collection systems will be designed and constructed with specific entry (pick-up) points both for HRM's existing sewers and other sewers where feasible (*e.g.*, DND). Tunnels will have excess capacity which will serve to reduce overflow events. Where pumping stations and forcemains are constructed in lieu of tunnels, the system will be designed for 5 x ADWF to further reduce overflow events. The storage capacity of the system and therefore estimated number of overflow events will depend on the final design of the collector system (*i.e.*, number and size of tunnels), to be determined once the successful bidding Company has been selected. Additional storage capacity can be provided, if required, through several options. For example, if flows exceed STP capacity (initially designed for 2021 flows), the STPs can be upgraded earlier than scheduled to 2041 flow capacity to reduce the amount and frequency of overflow bypassing the STP. Another option is to increase storage capacity of wet wells of pumping stations and reduce the pumping rate to the STP. Options for reducing overflow events will be evaluated depending on the frequency and volume of the events and the system design options. Figures 2.2 to 2.4 illustrate the proposed sewage collection system routes.

Sewage trenching and installation will generally proceed along established rights-of-way (*e.g.*, roads). Work will generally include: excavation (*i.e.*, digging, ripping, blasting); sewer installation; backfilling; and repair of roads. Construction activities will be conducted in accordance with relevant standards and guidelines, including: NSDOE "Erosion and Sediment Control Handbook for construction sites" (NSDOE 1988); "Province of Nova Scotia Environmental Construction Practice Specifications" (Fisheries and Oceans Canada *et al.* 1981); and "Environmental Code of Good Practice for Highways and Railways" (Environment Canada 1979). Sewer installation or repair may cause noise, traffic delays, and restriction in access to some properties. These inconveniences will be temporary as the sewer installation proceeds, and are generally well managed through standard traffic and construction management procedures. This type of construction activity is typical for municipal infrastructure projects (*e.g.*, roads, water lines, sewers) and is generally well tolerated by the public as necessary to maintain or improve vital components of municipal services.

Tunnelling, where necessary, may be conducted using a tunnel boring machine. Blasting, if required, will be conducted in accordance with applicable regulations and guidelines. Blasting in or near watercourses will require approval from Fisheries and Oceans Canada, and shall be conducted in accordance with the Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (Wright and Hopky 1998). Blasting will also be conducted in accordance with the *General Blasting Regulations* made pursuant to the Nova Scotia *Occupational Health and Safety Act*. The Contractor performing the blasting will have a valid Blaster's Licence, obtain a blasting permit from HRM, and ensure that a pre-blast survey has been conducted as required by HRM.

### 2.7.2 Sewage Treatment Plants

Sewage treatment plants will be constructed at each of the three proposed sites shown on Figure 1.1. Existing STPs at Mill Cove (Bedford) and Eastern Passage will continue in operation. Sites have been or are in the process of being purchased by HRM for the purpose of STP construction.

A phased approach has been proposed for STP construction and operation with priorities for construction as listed below:

1. Halifax
2. Dartmouth
3. Herring Cove

Priorities have been determined by site availability, the need to address the most serious present outfall impacts, the need to provide treatment for both sides of the harbour, and options for consolidating outfalls. Project components will be phased in over approximately 10 years. HRM Council has made a commitment to move forward on a basis affordable to the community, and to raise funds for two-thirds of the total capital costs (approximately \$210 million of \$315 million). HRM is seeking the balance of funds from the federal and provincial governments. If the additional funding is not provided, the project may be scaled back accordingly.

The facilities will be designed and constructed with a life for structural elements of at least 60 years, mechanical components of 25 years, and electrical/instrumentation items of at least 15 years, with no major maintenance required in the first 15 years.

The minimum process requirements for the new sewage treatment plants will include:

- raw sewage pumping as required based on the hydraulic gradient, site elevation, and outfall conditions;
- screening;
- grit removal;
- chemical flocculation and settling followed by UV disinfection to produce an effluent meeting effluent standards consistently; and
- biosolids handling and management (each facility will include onsite dewatering of biosolids, with transport to offsite processing facilities).

The treatment plants located on the Halifax Peninsula and in Dartmouth will require innovative design in order to minimize land requirements. Designs will be used which have been proven and successfully applied in other locations, treating municipal sewage at similar flow rates. Such designs may involve inclined plate settling, stacked sedimentation tanks, reactor clarifiers with micro-sand addition, or other alternatives, in order to reduce the land area requirement of the plants (maximum 1.5 - 2 hectares, depending on number of plants and site limitations). At the treatment plant site near Herring Cove, a compact type plant or alternatively, a "conventional" advanced primary type plant may be used depending on suitability of the identified site(s). Buildings will be designed to efficiently utilize land area and as well to provide for future expansions and possible upgrades to secondary treatment. The STPs will be designed to be aesthetically attractive and visually compatible with the surrounding area and land uses. The plant facilities will be completely enclosed under negative pressure, with full odour and noise controls (refer to Section 4.1). Power and other municipal services (*e.g.*, potable water, sewer connection) will also be provided.

Construction activities associated with an STP will be typical for construction of a medium-sized industrial facility. This will include site preparation such as excavation and grading. A foundation will be installed and building components fabricated. Construction disturbance will include noise, dust and possible traffic delays. The construction of each STP will involve from 10 to 200 employees on site depending on the construction phase. Each site will attract from 15 to 20 (maximum 40) heavy trucks and 20 to 25 lighter vehicle trips per day. A new dedicated access road will be constructed to access the Dartmouth treatment plant construction site. The roadway will allow access to Pleasant Street without use of any local residential streets. The new access road will be used both during construction and operation of the Plant.

The level of disturbance at each site will depend on the phase of construction. These disturbances are typical for large scale construction projects in the Metro area and are routinely well managed through standard traffic and construction management practices. The total duration of construction for an STP is estimated to be from 18 to 24 months.

### 2.7.3 Outfall and Diffuser Design and Construction

Each STP will have a marine outfall to discharge treated sewage effluent terminating at an acceptable location in the Harbour. Outfalls will be designed hydraulically to meet present and future design flows. Outfalls will be equipped with diffusers engineered to achieve initial dilution of 50:1 or greater. Diffuser design will be dependant on receiving water assimilative capacity as determined in consultation with the appropriate regulatory authorities and may require extension or alteration over time as flows increase. Outfalls will meet all the requirements of regulatory agencies, including but not limited to: Fisheries and Oceans Canada (Habitat and Coast Guard branches); Environment Canada; and the Halifax Port Authority.

All existing municipal outfalls will be intercepted and disconnected, except for those which will continue to function as CSOs. Private outfalls will also connect into the new collector system. Where outfalls have to be routed under existing or planned future marine/wharf structures, they will be constructed as tunnels, with suitable downshafts and upshafts as required. A cut and cover method for installing outfalls at Inner Harbour locations may be used. Placement of outfalls and diffusers may require dredging, with disposal of dredging spoils. Efforts will be made to avoid areas of contaminated sediment for any dredging operations if practical. Final determination of the need for dredging will be made during the pre-design phase. If dredging is required, it is anticipated that land based disposal at an approved site will be selected since the sediments at the Inner Harbour outfall locations will likely exceed ocean disposal limits. As an alternative to the cut and cover method, outfalls may be installed by laying pipe on a bed of granular material that has been placed directly on the seafloor. The pipe would then be protected by a covering of stone and other clean material.

Outfall trenching, where required, will involve a dredge or crane on a scow, one or two dump scows, a tug and work boats. Diffusers, constructed of reinforced concrete, will likely be fabricated onshore, then taken to location by barge and placed in position on a previously prepared bed of granular material. The outfall pipe would then be covered with clean granular material.

The outfall at Herring Cove may be constructed using a tunnel with an upshaft diffuser on the seabed. The cut and cover method, proposed for the outfall pipes in the Inner Harbour, although possible for the Herring Cove location, would require drilling and blasting due to the rocky seabed. Work would include: drilling and blasting of rock and boulders; excavation of the blasted material to form a trench; positioning of the outfall pipe in place; and application of tremie concrete (concrete placed through pipes underwater) to surround the pipe, hold it in place and provide a hard wave resistant surface. The diffuser would be constructed using similar techniques. Outfall/diffuser installation will likely be conducted between April and October, with installation at each location in the main harbour requiring three to four months for completion.

### 2.7.4 Sludge Management Facility

A central sludge composting facility will be constructed to process sewage sludge for beneficial end use (refer to Section 2.8.3). The location and design of this facility to be operated by the Company is currently unknown though is likely to be located in an industrial park or other area suitable for this type of facility. The facility will be sited, designed, and operated according to the NSDOE "Composting Facility Guidelines" (March 1998) (refer to Appendix E). These Guidelines specify basic requirements to control odours and other emissions with potentially adverse effects. NSDEL will regulate this facility and likely make strict adherence to the Guidelines a condition of facility approval to construct and operate.

## 2.8 Operation and Maintenance

### 2.8.1 Commissioning

Initial testing of the STP will be carried out using clean water from the municipal water system. Only after meeting initial testing requirements will sewage be introduced to the system. Following a period of initial operation using raw sewage (approximately four weeks), the Company will conduct performance testing, with any deficiencies identified and corrective action taken immediately as necessary.

### 2.8.2 Sewage Treatment

The STPs will meet or exceed Effluent Quality Requirements while treating not less than the flow rates for "Initial Construction" as shown in Table 2.2.

**Table 2.2 Sewage Treatment Plant Capacity Flows ($m^3/s$)**

| Plant Location | Initial Construction (Based on projections to 2021) | | | Ultimate Flows | |
|---|---|---|---|---|---|
| | | | | Ultimate Capacity (2041) | Ultimate Peak Flows (2041) |
| | Avg. Daily Flow | Peak Flow | Min. Flow | Avg. Daily Flow | Peak Flow |
| Halifax | 1.55 | 3.97 | 0.29 | 1.7 | 4.37 |
| Dartmouth | 0.97 | 2.58 | 0.19 | 1.15 | 3.06 |
| Herring Cove | 0.33 | 0.88 | 0.06 | 0.61 | 1.64 |
| Total | 2.7 | 7.04 | 0.51 | 3.31 | 8.68 |

Source: HRM (2000a)
Notes:
1. Peak flow is equal to 4 x Average Dry Weather Flow (ADWF)
2. Average Daily Flow is 1.5 x ADWF
3. The ultimate capacity represents the ADWF that is expected when development of the applicable sewersheds is complete.

The HHSP plan assumes advanced primary treatment of sewage with UV disinfection. Although alternate treatment technology and processes may be proposed by the Company, operation of an advanced primary treatment facility usually includes the following processes:

1. **Screening** of raw sewage through 6 mm openings or slots produces a highly putrescible, segregated material including paper, fabric, plastic, and wood, all contaminated by human waste. The screenings will be washed to remove contaminants, prior to a sanitary landfill site for disposal.

2. **Grit removal** is accomplished in a chamber or channel in which the velocity of flow is controlled so that materials with a high specific gravity (1.2 or greater) are allowed to settle and are collected. These settled materials are sands and gravels which occur in the collection system as a consequence of street inlets, open joints, etc. The grit is collected and often washed to remove organic contamination. Grit is typically disposed of at a landfill.

3. **Settling** of the wastewater in a tank or chamber allows all remaining settleable solids to collect at the bottom of the tank and floatable materials (vegetable materials, oils and grease, small bits of plastic or wood) to collect as a scum on the top surface. The settled material drawn from the tank is a putrescible substance containing 60 percent to 80 percent organic materials, and is known as raw sludge. The floating scum material is skimmed from the surface of the tank and is generally disposed of separately or sometimes combined with the raw sludge for processing and disposal (refer to Section 2.8.3).

4. **Addition of flocculating agents** is the specific step that "advances" the process beyond conventional primary treatment (Steps 1 to 3). These agents enhance settling and also combine chemically to precipitate most of the phosphorus present in the soluble form. Advanced primary treatment also involves lower hydraulic loading rates to increase the hydraulic retention periods. The result is that in addition to a fairly high degree of phosphorus removal, fine solids and colloidal matter not removed in simple gravity settling (conventional primary treatment) are removed. Approximate removal efficiencies for conventional primary treatment of 65 percent for suspended solids (SS) and 35 percent for biochemical oxygen demand (BOD) are increased in advanced primary treatment to 75 percent SS and 50 percent BOD removal.

5. **UV Disinfection** is the final step for the proposed HHSP advanced primary treatment plants. This involves exposure to ultraviolet radiation (UV) for disinfection of human pathogens. With UV there is no potentially harmful residual product added to the effluent as with chlorine disinfection, and no hazard from accidental releases of chlorine due to a spill or fire. UV radiation has been used successfully as a disinfection method at several primary sewage treatment facilities to meet a regulatory faecal coliform limit of 200/ml (B. Topp, pers. comm, 2001). Its proposed application following advanced primary treatment (*i.e.*, increased removal of suspended solids) will produce similarly successful results. Various advanced primary treatment plants in Quebec are currently using

UV disinfection including STPs in: Laval; Beloiel; Fabreaville; La Malbaie; Beaupre; Boischatel; and Gaspe.

6. **Sludge management** is likely to be accomplished by the following processes:
   - onsite thickening or dewatering;
   - onsite alkaline stabilization;
   - offsite composting;
   - beneficial end use of composted sludge (*e.g.,* soil amendment for agricultural or non-agricultural uses, depending on quality)

### 2.8.3 Sludge and Residue Management and Disposal

At each STP, screenings, grit and biosolids will be produced. Plant design will include process equipment for biosolids collection, conveying, compaction, storage, mixing, pumping, thickening and dewatering as required. Special sludge handling trucks will be used to transport sludge from the STPs to the offsite treatment facility. The trucks will be designed to securely contain the sludge and to prevent odour emissions. The trucks will be loaded within the STP facility under controlled atmosphere and will be washed after loading and unloading.

HRM has identified certain sludge management options which are not acceptable (*i.e.*, landfilling, incineration, and ocean dumping). HRM seeks to promote beneficial use of sludge, and thus, some form of composting is considered to be the most likely option. Sludge from the treatment process will be stabilized and disposed of for beneficial use or other environmentally acceptable means in accordance with the pathogen reduction and vector - attraction reduction requirements of 40 CFR Part 503 US EPA Regulations and other regulations approved by NSDEL. Acceptable treatment and environmentally beneficial uses of sludge include composting, pasteurization, lime stabilization or pelletization to be used for purposes such as agriculture soil amendments, sod farming, mine reclamation, commercial fertilizer or silviculture.

HRM's new Wastewater Discharge By-Law (W-101) prohibits discharges of substances with certain characteristics or concentrations specified in the By-Law. Section 3(1)(f) of the By-Law contains specific provisions to prevent contamination of sludge: "No person shall discharge, into wastewater facilities, sewage or wastewater which causes or may cause or results or may result in: a restriction of the beneficial use of sludge from the municipality's wastewater facilities".

### 2.8.4 Effluent Quality Monitoring

The treated effluent will be measured in accordance with the test procedures, policies and all other requirements of NSDEL at the sampling points designated by NSDEL for each STP, and shall meet or exceed the Effluent Quality Requirements (refer to Section 2.9.1).

### 2.8.5 Operational Traffic

The operation of the STPs will generate low volumes of traffic. Estimated vehicle movements related to each Plant's operation include:

- sludge haulers, average two tractor trailers per day;
- chemical delivery vehicle, average two per week;
- lighter delivery vehicles, two per day; and
- private vehicles for employees and visitors, 12 to 15 per day.

### 2.8.6 Maintenance

Routine maintenance includes regular operations that are required to obtain smooth and continuous operation of all aspects of the facilities including, but not limited to:

- cleaning;
- lubrication;
- calibration; and
- equipment adjustment.

Predictive maintenance is the measurement of physical properties of equipment performance and a comparison with engineering standards or limits. These measurements include, but are not limited to:

- vibration testing;
- lubricant analysis for wear particles or lubricant contamination;
- infrared thermography;
- performance monitoring;
- non-destructive testing; and
- ultrasonic testing.

## 2.9 Effluents and Emissions

### 2.9.1 Effluent and Water Quality Standards

One of the key objectives of previous studies and advisory processes has been to establish environmental quality guidelines which address the multi-use nature of the harbour and the goal of sustaining the environmental integrity of biota, water and sediments. The HHTF Final Report (1990) proposed Environmental Quality Guidelines based upon water quality objectives derived from a literature review of criteria and reported levels of contaminants. They presented long-term water and sediment quality objectives.

Working with these Environmental Quality Guidelines, the HHTF adapted a water use classification scheme for Halifax Harbour (Figure 2.5). This scheme was developed in consideration of differing minimum levels of environmental quality required to support different types of water uses in a developed, mixed use harbour. This classification was based on the importance of each region of the harbour to primary user groups and the assimilative capacity of the receiving waters.

The Harbour Solutions Advisory Committee recommended one substantive change in this classification scheme, upgrading the Northwest Arm (part of the Middle Harbour) to at least an 'SB' classification, to reflect a higher level of water use objectives. This change has been accepted by HRM.

Based on a review of the initial four STP plan and oceanographic modelling conducted by HRM (COA 2000), NSDEL concluded that the following guidelines for treated effluent will be acceptable (D. Hiltz, pers. comm. 2000):

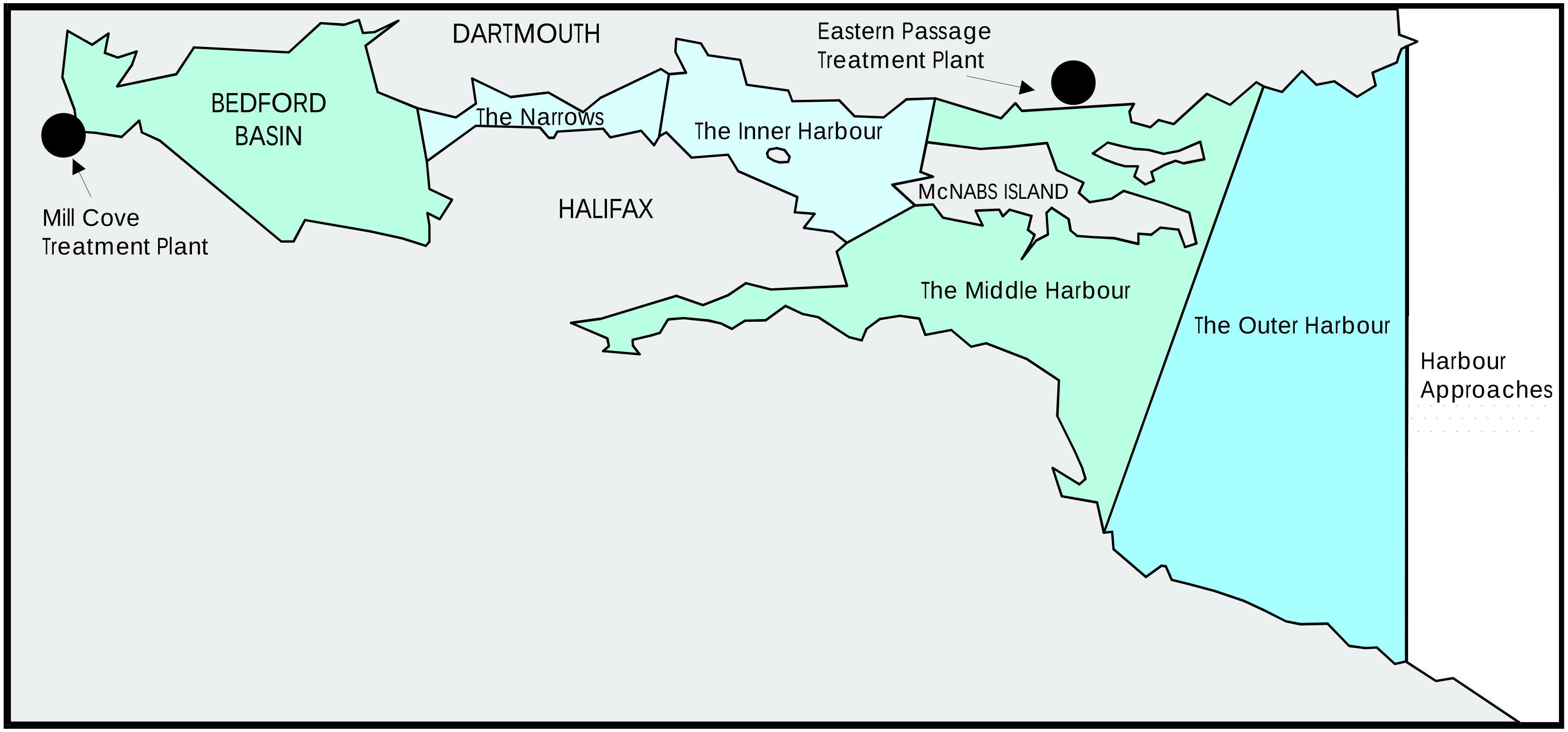
- fecal coliforms of less than 5000/100 mls, as maxima;
- $BOD_5$ 50 mg/L; and
- suspended solids of 40 mg/L.

HRM staff and consultants have concluded that these effluent quality criteria specified by NSDEL can be achieved on a consistent basis by advanced primary treatment in the current three STP concept. Environment Canada has also advised HRM that, based on the oceanographic modeling and assimilative capacity work carried out, that the proposed system is justified and will meet the water quality objectives established by the HHTF if proper design, including outfall siting, and operational maintenance system takes place (J. Kozak, pers. comm. 2000). Environment Canada also states that the acceptability of the system is predicated on the successful implementation of a source control program by HRM to reduce the input of toxics into the wastewater.

In general, given the current HHSP plan and the minimum requirement for advanced primary level treatment of sewage, it is expected that the water quality guidelines for harbour regions can be met with prudent design and siting of outfalls and diffusers. Depending on the final STP design and outfall/diffuser location, the permitted effluent quality guidelines may vary to ensure a consistent level of environmental protection. The final criteria and monitoring requirements will be specified as a condition of the operating permit administered by NSDEL.

### 2.9.2 Air Emissions/Odour/Noise

The treatment plants will be designed, constructed and operated as atmospherically controlled systems to prevent the potential occurrence of objectionable odour in the community beyond the property limits of the STP site during routine operations. Highly effective odour control systems will be used for all process areas




CLASS SA

- bathing and contact recreation
- shellfish harvesting for direct human consumption
- fish and wildlife habitat

CLASS SB

- shellfish harvesting for human consumption after depuration
- bathing and other primary contact recreational activities
- fish and wildlife habitat

CLASS SC

- boating and other secondary contact recreational activities
- industrial cooling
- good aesthetic value
- fish and wildlife habitat

Source: HHTF 1990, Updated 1998

Figure 2.5
Halifax Harbour Water Use Classification

of each plant, as well as the pumping stations. Enclosed plant design will also serve to minimize noise beyond the site boundary.

HRM has required that odour from the STPs and pumping stations will not exceed 4 ppb (over a 5 minute rolling average) at the point of air exhaust during normal operating conditions. Compliance with this limit will ensure that there are no perceptible odours at the facility property line (refer to Section 4.1).

HRM has required that facility generated noise levels at each STP property line will not exceed the following levels:

C 55 dBA $L_{eq}$ (between 2300 hours and 0700 hours);
C 60 dBA $L_{eq}$(between 1900 hours and 2300 hours); and
C 65 dBA $L_{eq}$ (between 0700 hours and 1900 hours).

Individual noise sources which are tonal in nature will not exceed 45 dBA $L_{eq}$ when measured at the applicable property line (refer to Section 4.1).

### 2.9.3 Sewage Sludge and Residue

At each STP, screenings, grit and biosolids will be produced. Screenings and grit will be washed to remove contaminants prior to landfill disposal. Biosolids will be collected at each STP site where they will be mixed, pumped, thickened, and dewatered prior to transport for offsite treatment at a central sludge composting facility (refer to Sections 2.7.4 and 2.8.3).

## 2.10 Abandonment or Replacement

Provided the land serviced by the present collection system continues in residential, commercial, or industrial use, the sewage collection systems will not be abandoned. The system is normally maintained and upgraded as necessary to provide the required service. Pipes are sized for projected population and type of development in the serviced sewersheds since there will not be an opportunity to replace or enlarge tunnels after they are commissioned. Tunnels can be accessed for routine maintenance such as cleaning. Repairs which occur as a result of corrosion or material failure can also be undertaken as necessary. These might include replacement of ladders and reinstatement of concrete lining.

The STP differs from the collection system in that it is not initially designed for ultimate capacity, rather it is designed to be expanded to ultimate capacity by addition of more treatment trains or higher levels of treatment. Sufficient land to upgrade to secondary treatment or to accomodate projected future flows will be provided at each STP site. These expansions would occur based on either hydraulic load generated in the service sewershed or by an environmental need to improve treatment level. However, once STPs are established, they are seldom abandoned because sewage is delivered to that location by the tunnels. Normal maintenance such as replacement of equipment on a periodic basis and recoating of treatment tankage will be performed. No existing STPs will be abandoned in connection with this Project.

## 2.11 Project Benefits

Investment in sewage treatment for the Halifax Harbour will provide significant social, environmental, and economic benefits. HRM's reputation as an environmentally and socially responsible community will improve among both residents and visitors. This improvement in harbour conditions and community reputation will have direct and indirect benefits for tourism and recreation, local fisheries and seafood producers, and general quality of life.

A cost-benefit analysis (CBA) was performed by GPI Atlantic (July 2000) to estimate net present value (NPV) of the investment in sewage treatment using the capital costs, operating costs, the marine nutrient cycling benefit, household willingness-to-pay, tourism revenue increase, property value increase, and the landed value of re-opened shellfisheries. The results indicate positive NPV estimates over an assumed 60 year lifecycle of the project ranging from $38.5 million to $161.5 million (discounted at 8 percent), $162.6 million to $392.3 million (discounted at 4 percent), and $645.9 million to $1, 227.8 million (no discounting). When financing costs and economic impacts (*e.g.*, labour income and spinoffs) were included in a total net benefit analysis, the total net benefit (in $1997) estimates range from a NPV of $67.7 million to $190.8 (discounted at 8 percent), to a NPV of $860.3 million to $1,442.6 million (no discounting). These values are based on 1997 dollars (GPI 2000). While it is uncertain if sewage treatment will permit reopening of shellfisheries in the harbour (closed for multiple factors), it is clear that significant economic benefits will accrue to HRM from Project implementation.

The primary objective of the project is to improve marine water quality. In addition to aesthetic improvements, sewage treatment and associated UV disinfection will greatly reduce the introduction of sewage-related human pathogens into the harbour. The bacterial limits for contact recreation (200 mg/L) are often exceeded currently in the Inner Harbour, creating health risks for swimmers and boaters. Sewage treatment and disinfection will greatly reduce these health risks and may permit additional opportunities for safe contact recreation. The Project-related implications for human health are discussed further in Section 5.5.

# 3.0 EFFECTS ASSESSMENT METHODOLOGY

## 3.1 Overview of Assessment Methodology

The environmental assessment methodology for the Project has been developed to satisfy regulatory requirements of the *Canadian Environmental Assessment Act* (*CEAA*). In particular, the assessment addresses the specific requirements for a screening level assessment pursuant to the *CEAA*.

The environmental assessment methodology used by Jacques Whitford has evolved from methods proposed by Beanlands and Duinker (1983), who stressed the importance of focusing the assessment on environmental components of greatest concern (to potentially affected parties).

In general, the environmental assessment for the Project evaluates the potential effects, including cumulative effects, of each Project phase (construction, operation, and decommissioning), as well as malfunctions and accidents, with regard to each Valued Environmental Component (VEC). VECs are components of the environment that are valued by society and upon which this assessment is focused. Figure 3.1 illustrates the standard sequence of steps followed in the assessment for each VEC. Each of these steps is described in more detail in Section 3.4. For the purpose of this assessment, VECs are divided into Valued Environmental Components (VECs; primarily biophysical) and Valued Socioeconomic Components (VSCs).

## 3.2 Issues Scoping Summary and Selection of Valued Environmental Components

It is impractical, if not impossible, for an assessment to address all of the potential environmental effects of a proposed undertaking. An important part of the assessment process therefore is the early identification of VECs and VSCs upon which the assessment could be focused for a meaningful and effective evaluation. Issues scoping is an important part of the VEC/VSC identification process. This section outlines the steps taken to identify the Project VECs and VSCs.

### 3.2.1 Issues Scoping

The issues scoping process for this assessment included public, stakeholder and regulatory agency consultation; preliminary research and field investigations; review of the Halifax Harbour Clean-up Environmental Assessment Report (HHCI 1992); and the environmental assessment study team's professional judgement.

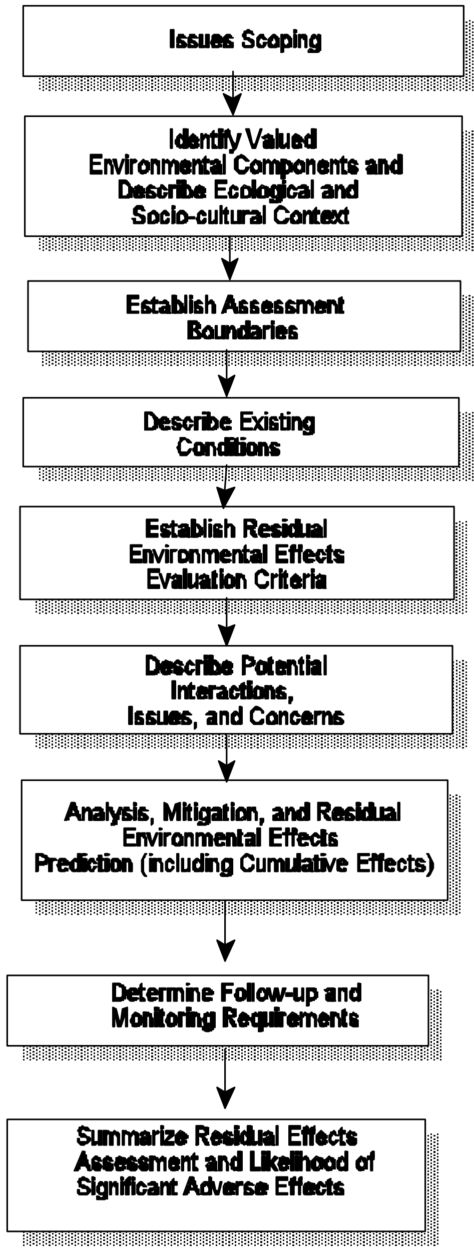



**Figure 3.1 Environmental Effects Assessment Methodology**

**Public and Stakeholder Consultation**

HRM has undertaken a variety of public and stakeholder consultations in recent years. HRM hosted the Halifax Harbour Solutions Symposium (November 8-9, 1996) which resulted in a set of General Principles that was adopted as a basis for moving forward with the project. A Harbour Solutions Advisory Committee (SAC) was subsequently formed to address technical issues which had not been fully addressed during the Symposium. The SAC comprised individuals representing different geographic areas, stakeholder groups, levels of government, academia, and the general public. The SAC produced a report which was adopted by HRM Council (April 1998) with its recommendations and framework for the HHSP.

As HHSP planning proceeded, and proposed STP sites were chosen, community liaison programs were initiated by HRM to provide Project information and receive community input on site specific issues. Some of these issues (*e.g.,* odour and noise control, STP building and design) have been addressed with specifications in the RFP for the private sector partner, and addressed in this environmental assessment through the selection of VECs/VSCs. HRM has also undertaken a number of other initiatives to keep the general public informed about the Project and provide the public with a means of obtaining information and providing input (*e.g.,* newsletters, water bill inserts, and Internet publications). Meetings have also been held by HRM staff with specific stakeholders groups. Section 9 of this report describes the public consultation process undertaken by HRM for this Project.

**Regulatory Issues and Guidelines**

Discussions were held throughout the assessment process with representatives of federal and provincial governments to: inform government officials about the Project; determine applicable regulations and permits; set water quality objectives; and, identify specific issues and concerns to be addressed in the environmental assessment. An informal regulatory meeting was held on April 26, 1999 with the CEA Agency, federal departments with a potential regulatory involvement in the assessment, and NSDEL. Additional consultations were held with regulators such as Fisheries and Oceans Canada during the baseline studies conducted for the HHSP. Several meetings were held with representatives of NSDEL, Environment Canada, and Bedford Institute of Oceanography to review oceanographic modelling results and discuss appropriate effluent quality limits. A meeting with the CEA Agency, federal regulators and expert departments was held on February 17, 2000 to review baseline studies and discuss scoping of the assessment.

Issues to be considered in the assessment and methodological approaches were also derived from Section 16 of the *CEAA* and the Responsible Authority's Guide (CEA Agency 1994).

**Halifax Harbour Solutions Baseline Technical Studies**

In addition to the HHSP Technical Report (HRM 1998) which presented the Concept Plan, the following environmental studies were undertaken to gather baseline data for the environmental assessment:

- Oceanographic Modelling and Assimilative Capacity Study (COA 2000);
- Oceanographic Modelling and Assimilative Capacity Study Three Plant Scenario (COA 2001);
- Archaeological and Heritage Resource Surveys (ADI Limited 1999; JWEL 1999a);
- Commercial Fisheries Study (JWEL 1999b);
- Marine Benthic Habitat Survey (JWEL 1999c);
- Breeding Bird Survey (Hospital Point) (JWEL 1999d);
- Wastewater Characterization Study (SNC Lavalin 1999);
- Odour and Noise Baseline Study (JWEL 2000); and
- Herring Cove Area Settlement and Servicing Strategy (LandDesign Engineering Services 2000).

The results from these studies selectively updated information contained in the HHCI environmental assessment. Information from some of these reports is summarized in relevant sections of this environmental screening. These reports are available for review on the Internet at www.region.halifax.ns.ca/harboursol/index.html or upon request to HRM.

**HHCI Research and Findings**

An extensive environmental assessment process was conducted in the early 1990s on behalf of the HHCI project. This assessment was conducted according to a terms of reference issued by a joint federal-provincial review panel. The panel held a public review, including public hearings, of the assessment documents. The assessment documentation included a two-volume environmental assessment report, two environmental assessment supplementary reports, and 24 component study reports. There reports are available for review upon request to HRM. The project was conditionally approved by NSDOE on September 3, 1993. It is anticipated that the previous environmental assessment will reduce overall environmental assessment requirements for the HHSP. Background studies conducted for the HHCI project and resulting recommendations and conditions of approval helped to identify significant issues and select VECs and VSCs for the current assessment. In order to gauge the similarities and differences between the HHCI and HHSP projects, they are compared in Appendix B. This assessment for the HHSP incorporates information from HHCI baseline studies, and focuses mainly on those differences between the projects that have not previously been assessed.

**Professional Judgement**

Professional judgement of the environmental assessment study team and HRM staff is an important component of issues scoping and VEC/VSC selection. The study team draws on their collective knowledge and experience, which includes the conduct of the recent baseline studies as well as the previous HHCI environmental assessment.

### 3.2.2 Scope of the Assessment

The scope of the project and factors to be considered in the environmental assessment were presented in the "Scope of Environmental Assessment" (HRM 2001a). This document was submitted to the federal agencies and approved as the scope of the assessment. The scope of this report, including project description components and selected VECs/VSCs is therefore based on this federally approved scoping document.

Subsequent federal agency comments on a draft version of this environmental assessment report suggested expanding the list of VECs to include migratory birds and marine mammals. Based on the lack of project interaction with marine mammals (HHCI 1992), they were neither included in the "Scope of Environmental Assessment" nor this environmental assessment report. There are no breeding mammals in the harbour (JWEL 1991b), and marine mammals were not considered a VEC for the HHCI environmental assessment (HHCI 1992).

With respect to migratory birds, they have been addressed in this assessment regarding potential interactions in Mainland South (Herring Cove). The remaining Project sites, including the inner harbour, are highly urbanized, and therefore Project interactions with migratory birds in these areas are considered to be insignificant. The artificial coastline of the central harbour is virtually devoid of water birds other than gulls (*Larus* spp.) and a few black ducks (*Anas rubripes*), although Bedford Basin and the outer harbour maintain a degree of water bird diversity (Lock 2001). HHCI (1992) examined impacts on Osprey (*Pandion haliaetus*) and Great Blue Heron (*Ardea herodias*) since these species are known to breed on McNabs and Lawlor Islands, respectively; no other migratory bird species were assessed. The HHSP will not interact with these islands or associated species since the STPs will be landbased rather than on an artificial island in the harbour as was the HHCI concept design.

### 3.2.3 Valued Environmental Components

As a result of the issues scoping exercise, the following VECs and VSCs were selected to focus the environmental assessment.

**Atmospheric Resources**

Atmospheric Resources includes air quality and the acoustic environment. Air quality is of concern because of its fundamental importance to health, and because the potential nuisance impact of odours is a known concern to the public. Noise is unwanted sound, and the elimination of noise is important to the welfare of the community. Atmospheric Resources has been selected as VEC on the basis of public concern, regulatory consultations, and professional judgement. This VEC is addressed in Section 4.1 of the report.

**Marine Water Quality**

The primary objective of the Project is to improve marine water quality. Water quality objectives have been set for the various portions of the harbour based on desired uses (*e.g.*, recreational contact, shellfish harvesting) in those areas of the harbour. Marine water quality was identified as a VEC on the basis of public concern, regulatory consultations and professional judgement. This VEC is addressed in Section 4.2 of the report.

**Marine Sediment Quality**

Organic contaminants and metal in sediments may be ingested by benthic organisms or become biologically available if re-suspended into the water column. Benthic and pelagic communities may therefore be affected by changes in the sediment or water column. Marine sediment quality was identified as a VEC on the basis of public concern, regulatory consultations and professional judgement. This VEC is addressed in Section 4.3 of the report.

**Marine Benthic Habitat**

The marine benthic community is an important component of the marine ecosystem and also in its connection to the commercial fishery. Environmental effects on the benthic fauna may affect the success of the finfish or shellfish populations in the area. The marine benthic community may be influenced by the accumulation of effluent related waste materials in ecologically sensitive and commercially important areas. It was selected as a VEC on the basis of public concern, regulatory requirements, and professional judgement. This VEC is addressed in Section 4.4 of the report.

**Terrestrial Resources**

Undisturbed terrestrial environment is extremely limited in the Project study areas. The majority of land affected by the proposed STPs is located in a highly developed urban setting. However, the site proposed for the Herring Cove STP is a forested area, relatively undeveloped. Terrestrial resources has been selected as a VEC in recognition of potential Project interactions with vegetation and wildlife at the proposed Herring

Cove STP site as well as potential interactions with groundwater and freshwater resources in the Herring Cove area. This VEC is addressed in Section 4.5 of the report.

**Commercial Fishery**

Halifax Harbour supports an active commercial fishery from which licensed Nova Scotia fishers earn their livelihood. This fishery includes lobster, groundfish and pelagics. The construction and operation of the sewage treatment facility may potentially affect the income fishermen receive from the commercial fishery in the harbour. Commercial Fishery was selected as a VSC on the basis of public concern, regulatory requirements, and professional judgement. Marine fish, although raised as a concern, has been addressed through a discussion of effects on Commercial Fishery. This VSC is addressed in Section 5.1 of the report.

**Archaeological and Heritage Resources**

Archaeological and heritage resources can be defined as those physical remains which inform us of the human use of and interaction with the physical environment. These resources may be both above and below the surface of the ground and cover the earliest prehistoric times to the relatively recent past. Archaeological and heritage resources are included as a VSC in this assessment due to public and regulatory concern, as well as professional judgement. This VSC is addressed in Section 5.2 of the report.

**Land Use**

Sewage treatment plants are industrial facilities that are proposed to be located in heavily developed, mixed use areas along the Halifax and Dartmouth waterfronts, and a rural suburban area near Herring Cove. The public, particularly in host communities, are concerned that the STPs be odour and noise free and aesthetically compatible with the surrounding land uses. Residential, industrial, commercial or institutional land uses surrounding the STPs could potentially be affected by STP construction and operation. Provincial approval requires proper siting and operation of STPs to control nuisances to surrounding land uses. Land use has therefore been included as a VSC due to public and regulatory concern, and professional judgement. This VSC is addressed in Section 5.3 of the report.

**Transportation Network**

Transportation Infrastructure is a VSC because the safe and efficient movement of persons and goods are essential to individuals and businesses within HRM. Construction and operation of the STPs, outfall/diffusers and sewer collection systems could affect various modes of transportation including road, railroad, and shipping. Transportation has been selected as a VSC on the basis of public concern and professional judgement. This VSC is addressed in Section 5.4 of the report.

**Public Health**

Protection of human health is one of the most important factors in the general well-being of a community. Sewage treatment is generally recognized as having widespread benefits to public health due to the removal of most human pathogens from the treated effluent through solids removal and disinfection. Public concern has been raised, however, with regard to potential localized adverse public health effects associated with the operation of sewage treatment facilities and the sludge composting facility. Public Health has been selected as a VSC due to public concern. This VSC is addressed in Section 5.5 of the report.

### 3.2.4 Scoping of Other Projects for Potential Cumulative Interactions

An assessment pursuant to the *CEAA* must address potential cumulative effects. The discussion of cumulative effects for this assessment is integrated into the assessment of environmental effects for each VEC and VSC such that the overall assessment of residual environmental effects includes the consideration of cumulative effects. A cumulative effects scoping exercise was conducted by the Environmental Assessment study team to identify past, present, or likely (*i.e.*, approved) future projects that might interact cumulatively with the Project. A summary of the cumulative effects assessment is included in Section 8 of this report.

## 3.3 Potential Interactions Between Project Activities and Valued Environmental Components

Tables 3.1 and 3.2 summarize the potential interactions between Project activities and the selected VECs and VSCs, respectively. The specific nature and extent of these interactions with each VEC/VSC are discussed and evaluated in the biophysical and socioeconomic effects assessments (Sections 4 and 5).

## 3.4 Presentation of Environmental Effects Assessment

This section provides an overview of the steps involved in the assessment of potential Project effects. The analysis, presented in Sections 4 and 5, will follow these steps for each VEC or VSC.

### 3.4.1 VEC/VSC Identification and Description of Ecological and Socio-cultural Context

To ensure that the assessment is holistic, the CEA Agency guidance documents (1994) require a description of the ecological and socio-cultural context for each VEC/VSC. The consideration of the current state of a VEC/VSC and any Project-related effects requires an evaluation of the relationship of each VEC/VSC with other components of the ecosystem or human systems (*e.g.*, trophic relationships). This section also describes each VEC/VSC to be assessed and the rationale for its selection.

| **Table 3.1 Potential Interactions Between Project Related Activities and Valued Environmental Components** | | | | | | |
|---|---|---|---|---|---|---|
| **Project Activities** | **Atmospheric Resources** | **Marine Water Quality** | **Sediment Quality** | **Benthic Habitat** | **Terrestrial Resources** | **Potential Effects** |
| **CONSTRUCTION** | | | | | | |
| Construction of Collector System<br>C trench excavation<br>C tunnelling<br>C blasting<br>C sewer installation<br>C pumping station/CSO construction | T | | | | T | Air, noise and dust emissions generated during construction; localized habitat disturbance in Mainland South; blasting/excavation could affect drinking water supplies in Mainland South |
| Construction of Sewage Treatment Plants (STPs)<br>C site preparation<br>C blasting/ excavation<br>C building construction | T | | | | T | Air, noise and dust emissions; localized habitat disturbance in Mainland South; blasting/excavation could affect drinking water supplies in Mainland South |
| Construction of Outfalls and Diffusers<br>C drilling/blasting<br>C dredging/ excavation<br>C pipe laying<br>C installation of diffuser | T | T | T | T | T | Air and noise emissions from construction equipment; disruption of benthic and shoreline habitat; disturbance/removal of contaminated sediments |
| Construction of Sludge Management Facility | T | | | | T | Air, noise and dust emissions; localized habitat disturbance; possible risk of sedimentation of streams if present near site |

**Table 3.1 Potential Interactions Between Project Related Activities and Valued Environmental Components**

| Project Activities | Atmospheric Resources | Marine Water Quality | Sediment Quality | Benthic Habitat | Terrestrial Resources | Potential Effects |
|---|---|---|---|---|---|---|
| **OPERATION AND MAINTENANCE** | | | | | | |
| Collector System Operation and Maintenance<br>C operation and maintenance of pumping stations and CSOs | T | | | | | Odour emissions; decreased instances of sewage overflow at Roach's Pond and MacIntosh Run in Mainland South |
| STP Operation and Maintenance<br>C treatment of raw sewage<br>C discharge of treated effluent | T | T | T | T | | Odour and noise emissions from sewage treatment facility; deposition of particulate matter and contaminants around diffusers; localized depression of dissolved oxygen and increase of nutrient loading in area of diffuser; widespread reduction of suspended solids, pathogens and BOD into the harbour |
| Sludge Handling and Management<br>C onsite sludge dewatering and stabilization<br>C operation of sludge composting facility | T | | | | T | Odour emissions; terrestrial resources interactions depend on location of facility |

**Table 3.1 Potential Interactions Between Project Related Activities and Valued Environmental Components**

| Project Activities | Atmospheric Resources | Marine Water Quality | Sediment Quality | Benthic Habitat | Terrestrial Resources | Potential Effects |
|---|---|---|---|---|---|---|
| **MALFUNCTIONS AND ACCIDENTS** | | | | | | |
| Hazardous Materials Spills<br>C spills from construction activity (*e.g.*, fuels, hydraulic fluid)<br>C spills of treatment chemicals during operation | T | T | | | T | Air emissions; soil/groundwater contamination; contaminated run-off; spill into marine environment; potential effect on terrestrial and freshwater habitat, and groundwater depending on location |
| Collector System Breaks<br>C sewer/tunnel break<br>C pumping station malfunction | T | T | T | T | T | Sewage backup; odour emissions; increased overflows at CSOs; sewer repair construction disturbance |
| Outfall/Diffuser Malfunction<br>C accidental breakage from anchor dragging<br>C clogging of diffuser | | T | T | T | | Concentrated effluent; localized depression of dissolved oxygen; localized increased sedimentation |
| Failure of Effluent Treatment<br>C power outage<br>C equipment failure | | T | T | T | | Release of partially untreated sewage to marine environment |
| Malfunction of Odour Control System<br>C equipment malfunction | T | | | | | Odour emissions |

**Table 3.2 Potential Interactions Between Project Related Activities and Valued Socioeconomic Components**

| Project Activities | Commercial Fishery | Archaeological and Heritage Resources | Land Use | Transportation | Public Health | Potential Effects |
|---|---|---|---|---|---|---|
| **CONSTRUCTION** | | | | | | |
| Construction of Collector System<br>C trench excavation<br>C tunnelling<br>C blasting<br>C sewer installation<br>C pumping station/CSO construction | | T | T | T | T | Disturbance of in-ground archaeological and heritage resources; air, noise, and dust emissions from construction equipment; interruption of vehicular and pedestrian movements |
| Construction of Sewage Treatment Plants (STPs)<br>C site preparation<br>C blasting/excavation<br>C building construction | | T | T | T | T | Disturbance of in-ground archaeological and heritage resources; dust and noise emissions; increased traffic to construction site |
| Construction of Outfalls and Diffusers<br>C drilling/blasting<br>C dredging/ excavation<br>C pipe laying<br>C installation of diffuser | T | T | | T | | Exclusion of fishery activities from construction area; disturbance to marine archaeological resources; interference with marine transportation; disturbance of fish habitat |
| Construction of New Sludge Management Facility | | T | T | T | T | Disturbance of in-ground archaeological and heritage resources; dust and noise emissions; increased traffic to construction site |

| Table 3.2 Potential Interactions Between Project Related Activities and Valued Socioeconomic Components | | | | | | |
|---|---|---|---|---|---|---|
| **Project Activities** | **Commercial Fishery** | **Archaeological and Heritage Resources** | **Land Use** | **Transportation** | **Public Health** | **Potential Effects** |
| **OPERATION AND MAINTENANCE** | | | | | | |
| Collector System Maintenance<br>C operation and maintenance of pumping stations and CSOs | | | T | T | T | Air, odour and noise emissions; maintenance-related traffic |
| STP Operation and Maintenance<br>C treatment of raw sewage<br>C discharge of treated effluent | T | | T | T | T | Air, odour and noise emissions from sewage treatment facilities; addition of treated effluent to marine waters; maintenance-related traffic; commercial fisheries gear fouling; localized sedimentation of fish habitat; widespread reduction in suspended solids and pathogens |
| Sludge Handling and Management<br>C onsite sludge dewatering and stabilization<br>C operation of sludge composting facility | | T | T | T | T | Air and odour emissions; sludge transportation; potentially contaminated compost |

**Table 3.2 Potential Interactions Between Project Related Activities and Valued Socioeconomic Components**

| Project Activities | Commercial Fishery | Archaeological and Heritage Resources | Land Use | Transportation | Public Health | Potential Effects |
|---|---|---|---|---|---|---|
| **MALFUNCTIONS AND ACCIDENTS** | | | | | | |
| Hazardous Materials Spills<br>C spills from construction activity (*e.g.,* fuels, hydraulic fluid)<br>C treatment chemicals during operation | T | T | T | | T | Soil/groundwater contamination; contaminated run-off; spill into marine environment |
| Collector System Breaks<br>C sewer/tunnel break<br>C pumping station malfunction | T | T | T | T | T | Sewage backup; odour emissions; increased overflows at CSOs; sewer repair construction disturbance |
| Outfall/Diffuser Malfunction<br>C accidental breakage from anchor dragging<br>C clogging of diffuser | T | | | | | Concentrated effluent; localized depression of dissolved oxygen; localized increased sedimentation |
| Failure of Effluent Treatment<br>C power outage<br>C equipment failure | T | | | | T | Release of partially untreated sewage to marine environment |
| Malfunction of Odour Control System<br>C equipment malfunction | | | T | | T | Odour and air emissions |

### 3.4.2 Boundaries

An important aspect of the effects assessment process is the determination of the boundaries of the assessment. Temporal and spatial boundaries encompass those periods during, and areas within which, the VECs/VSCs are likely to interact with, or be influenced by, the Project. These boundaries may extend well beyond the limits of direct disturbance (*e.g.*, migratory species whose range extends beyond the area of physical disturbance associated with the Project). Other boundaries to be considered as appropriate include administrative and technical boundaries imposed by factors such as finite resources of data, time, cost, and labour, as well as technical, political, or administrative considerations or jurisdictions.

An important temporal consideration for this assessment is that the various components of the Project are scheduled to be constructed over the next 10 years and some elements are contingent upon funding (refer to Table 2.1). Some of these VECs may change significantly over that time (*e.g.*, Land Use). It may be necessary to review aspects of the assessment pertaining to these VECs for currency as components of the Project near development.

### 3.4.3 Description of Existing Conditions

Existing conditions (*i.e.*, pre-Project) are described for each VEC/VSC. The description is restricted to a discussion of the status and characteristics of the VEC/VSC within the boundaries established for the assessment. In order to improve the focus and readability of the assessment, the description centers on aspects that are relevant to potential Project interactions; additional information is compiled as appendices and/or background studies, as necessary.

### 3.4.4 Establishment of Residual Environmental Effects Evaluation Criteria

Section 16(1)(b) of the *CEAA* specifically require that the significance of environmental effects be determined. Accepted practice in meeting this requirement involves establishing evaluation criteria for the determination of significance.

The CEA Agency (1994) lists criteria that should be taken into account in deciding whether adverse environmental effects are significant. These criteria include, among other factors:

- magnitude;
- geographic extent;
- duration and frequency;
- reversibility; and
- ecological context.

Residual environmental effects evaluation criteria which define the threshold for the significance of adverse residual effects are developed for each VEC/VSC. These ratings are generally population- or community-based, but may be based on regulatory standards or limits, where these exist for a particular VEC/VSC.

### 3.4.5 Potential Interactions, Issues, and Concerns

Potential interactions with VECs/VSCs, are described in the assessment; *i.e.*, a description of the degree to which VECs are exposed to each Project activity. Where appropriate, the assessment includes a summary of major concerns or hypotheses of relevance regarding the effect of each Project activity on the VECs/VSCs being considered. Where existing knowledge indicates that an interaction is not likely to result in an effect, certain issues may not warrant further analysis.

### 3.4.6 Analysis, Mitigation, and Residual Environmental Effects Prediction

The assessment focuses on the evaluation of potential interactions between the VECs/VSCs and the various Project activities outlined in the Project Description. A standard evaluation system has been developed to ensure that potential effects are clearly and completely evaluated. The prediction of residual effects follows three general steps, as outlined by the CEA Agency (1994):

- determining whether the environmental effects are adverse;
- determining whether the adverse environmental effects are significant; and
- determining whether the significant adverse environmental effects are likely to occur.

For the ease of the reader, the effects assessment analysis conducted for each VEC/VSC is summarized in two template matrices. The residual environmental effects assessment matrix summarizes the effects by Project activity for construction and operation phases, and describes the mitigation and analysis for each activity (Table 3.3). The modifiers used to characterize the various criteria considered in the determination of effect significance may vary for different VECs/VSCs.

**Determining whether Environmental Effects Are Adverse**

The effects evaluation for each VEC/VSC is conducted by Project phase (construction, operation, decommissioning) and for malfunctions and accidents. For each phase, the study team selects those Project activities that may result in a positive or adverse effect.

| **Table 3.3** | **Residual Environmental Effects Assessment Matrix**<br>**Valued Environmental Component: ____VEC/VSC__ (Project Phase)** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects | | | | | Residual Environmental Effect | Level of Confidence |
| | | | Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Socio-cultural and Economic Context | | |
| | | | | | | | | | |
| | | | | | | | | | |

**KEY**

**Magnitude:** 1 =Low: *e.g.*, within the normal variability of baseline conditions; 2 = Medium: *e.g.*, increase/decrease with regard to baseline but within standards and objectives; 3 =High: *e.g.*, singly or as a significant contribution in combination with other sources causing exceedances or impingement upon standards and objectives beyond the property line of the project

**Geographic Extent:** 1 = <500 m²; 2 = 500 m² -1 km²; 3 = 1-10 km²; 4 = 11-100 km²; 5 = 101-1000 km²; 6 = >1000 km²

**Duration:** 1 = < 1 month; 2 = 1-12 months; 3 = 13-36 months; 4 = 37-72 months; 5 = > 72 months

**Frequency:** 1 = < 11 events/year; 2 = 11-50 events/year; 3 = 51-100 events/year; 4 = 101-200 events/year; 5 = >200events/year; 6 = continuous

**Reversibility:** R = Reversible; I = Irreversible

**Ecological/Socio-cultural and Economic Context:** 1 = Pristine area or area not adversely affected by human activity; 2 = Evidence of adverse effects.

**Residual Environmental Effect Rating:** S = Significant Adverse Environmental Effect; N = Non-significant Adverse Environmental Effect; P = Positive Environmental Effect

**Confidence:** 1 = Low level of Confidence; 2 = Medium level of Confidence; 3 = High level of Confidence

To determine if there are adverse effects, the study team considers a number of factors, including those recommended in the CEA Agency guidance documents (1994):

- negative effects on the health of biota;
- loss of rare or endangered species;
- reductions in biological diversity;
- loss of critical/productive habitat;
- fragmentation of habitat or interruption of movement corridors and migration routes;
- transformation of natural landscapes;
- discharge of persistent and/or toxic chemicals;
- toxicity effects on human health;
- reductions in the capacity of renewable resources to meet the needs of present and future generations; and
- loss of current use of lands and resources for traditional purposes by Aboriginal persons.

Where adverse or positive effects are identified, the Project activity and the effects are listed in the matrix.

**Determining Whether the Adverse Environmental Effects Are Significant**

*Analysis and Residual Environmental Effects Prediction*

The analysis evaluates the interactions between Project activities and the VEC/VSC and determines the significance of any residual adverse environmental effects (*i.e*., effects that may persist after all mitigation strategies have been implemented). The study team evaluates possible residual environmental effects according to the evaluation criteria established for the VEC/VSC. These effects are assigned a rating of significant adverse, non-significant adverse, or positive. The team's evaluation includes consideration of specific mitigation strategies and the residual environmental effects evaluation criteria mentioned above. Supporting discussion in the text highlights particularly important relationships or data identified in the matrix.

To comply with the requirements of Section 16(1)(a) of the *CEAA*, cumulative environmental effects of past, present, and likely future projects are considered. The concept of cumulative environmental effects also recognizes that the environmental effects of different human activities can combine and interact with each other to cause cumulative effects that may be different in nature or extent from the effects of individual activities. Cumulative effects assessment has been undertaken in this screening based on projects scoped (Refer to Section 8.0) and assessed for each VEC/VSC (Sections 4 and 5). The residual environmental effects prediction in the assessment incorporates cumulative effects.

*Level Of Confidence*

The significance of the residual environmental effects of the Project on a VEC/VSC is evaluated based on review of relevant literature, consultation with experts, and professional judgement. In some instances, limitations in the available data make effect predictions difficult. Ratings are therefore provided to indicate the level of confidence with which the study team makes each prediction.

*Overall Residual Effects Rating by Phase*

After completing the assessment of specific Project activities, the study team evaluates the residual effects by Project phase. This overall rating considers all residual adverse effects, including cumulative effects.

**Determining Whether the Significant Residual Adverse Environmental Effects Are Likely to Occur**

The CEA Agency (1994) has provided criteria for determining the likelihood of significant residual adverse environmental effects include:

- probability of occurrence; and
- scientific uncertainty.

Where possible, the assessment can apply statistical methods to determine the likelihood of significant residual effects. Where such methods are not feasible, a qualitative approach based on non-statistical analyses or professional judgement is used.

### 3.4.7 Follow-up and Monitoring

Section 16(2)(c) of the *CEAA* require consideration of the need for, and requirements of, any follow-up studies. These are evaluated for each VEC/VSC. Requirements for follow-up and monitoring are linked to the sensitivity of a VEC/VSC to both Project-related and cumulative environmental effects. The likelihood and importance of such effects, as well as the level of confidence associated with the adverse residual effects rating, are also taken into consideration.

### 3.4.8 Summary of Residual Effects Assessment

This section summarizes the adverse environmental effects on each VEC/VSC by Project phase, as well as adverse environmental effects that might result from malfunctions or accidents. It also addresses the likelihood of all predicted significant adverse effects. The likelihood of a significant adverse environmental effect is based on scientific knowledge with reference to statistical significance, quantitative risk assessment, or professional judgement.

# 4.0 ENVIRONMENTAL EFFECTS ASSESSMENT

## 4.1 Atmospheric Resources

Atmospheric resources includes air quality and the acoustic environment. Air quality is of concern because of its fundamental importance to health, and because the potential nuisance impact of odours is a known concern of the public and of HRM. Section 5.5, Public Health, addresses the very low risk associated with the trace amounts of volatile organic compounds released to the atmosphere in sewage and through sewage treatment. This section deals primarily with those compounds which are capable of producing malodorous conditions.

Noise is unwanted sound; the minimization of noise is important to the welfare of the receiving community. Adverse levels of noise can cause problems ranging from simple nuisance through sleep disturbance and communication interference. The adequate protection of the acoustic environment is an important component of advanced municipal planning and development.

Additional information on this VEC can be found in the "Odour and Noise Baseline Study" (JWEL 2000) conducted for the HHSP. The following documents prepared for the HHCI project are also relevant to this VEC: "Environmental Assessment Report", Sections 4.8, 4.9, and 6.6 (HHCI 1992); "Noise Environment" (JWEL 1991a); "Odour" (JWEL 1992); and "Air Quality in the Environs of Halifax Harbour" (JWEL and Porter Dillon 1991).

### 4.1.1 Boundaries

The spatial boundaries for the assessment of air quality are not constrained by physical boundaries that apply to other components of the environment. The movement of air is determined by the large scale weather patterns and modified locally by topographic influences, such as coastlines, and modified in the microscale by building wakes and other aerodynamic barriers. An important spatial consideration for the assessment of air quality is the requirement that there be no detectable project-related odour outside of the STP property.

Spatial boundaries for the assessment of noise have been developed considering that noise is transmitted most effectively in a "line-of-sight". Interruption of line of sight reduces noise perceptibly. Noise decreases with distance, such that the listener will perceive a decrease of approximately half the volume when the separation is increased by a factor of about three. The spatial boundaries for this project regarding noise are established by strict control requirements at adjacent properties.

With regard to temporal boundaries for the assessment, dust is primarily a concern during the construction phase, with odour as the main concern during the operations phase of the project. Odour is a concern at all times of day, and odour criteria are the same at all times. The assessment of noise impacts will consider the construction and operation phases of the project, and takes into account the varying noise guidelines by time of day. Seasonal factors are also an issue for both odour and noise; when people are more likely to spend time outdoors, potential exposure is increased.

### 4.1.2 Description of Existing Conditions

#### 4.1.2.1 Odour

In order to investigate current levels of odour in the vicinity of the proposed STP sites, a background monitoring program was designed and carried out during the summer months of 2000.

The objectives of the odour monitoring program were:

- to measure current odour levels all representative times of the day;
- to determine if there are local sources of odour at the sites; and
- to identify the odour sources in order to be able to isolate any future odour contribution from STPs.

The "Odour and Noise Baseline Study" (JWEL 2000) presents the program methodology, and the results of the study; these are summarized below.

The characteristic odours of STPs, when there is an odour problem, are total reduced sulphur (TRS) compounds. The predominant member of the TRS group is hydrogen sulphide ($H_2S$), known for its "rotten egg" smell. Other compounds are associated with odours, however the TRS substances are the dominant odourants at STPs. TRS levels can be measured directly with high sensitivity analyzers, such as those used by HRM at two existing STPs. For this study, the equivalent analyzer (JER 631-X) was used for the TRS baseline measurement program. This instrumental method offered the potential for the operator to attempt to track odours to their source, and to quantify source levels of contaminants. The scientist operating the equipment also recorded pertinent sensory observations. Other odour measurement techniques, such as odour panels, are more difficult to implement since they rely upon integrated samples which must be transported to laboratories for analysis.

The HRM limit for TRS production at the HHSP STPs is 4 ppb at source which is considered the exhaust point of the air scrubber system.

The results of the odour measurement program are summarized in Table 4.1 and the following sections. The results presented in this Report for the Halifax site are represented as "Halifax North" in the "Odour and Noise Baseline Study" (JWEL 2000).

| Table 4.1 Average Total Reduced Sulphur (TRS) Concentrations | | | |
|---|---|---|---|
| | Average [ppb] | Maximum [ppb] | Minimum [ppb] |
| Halifax | 3 | 5 | 0 |
| Dartmouth | 2 | 5 | 0 |
| Herring Cove | 1 | 3 | 0 |
| HRM Limit[1] | 4 | | |
| Source: JWEL 2000 | | | |
| [1] The HRM limit as specified in the RFP Amendment No. 8 (HRM 2001b) measured at the exhaust point of the air scrubber system. | | | |

The TRS levels measured at each site are relatively uniform and low; comments are provided in the text below.

**Halifax**

Very little odour was noted at this site apart from the exhaust gases of vehicles on Barrington Street.

**Dartmouth**

The Dartmouth site had very low levels of odourous compounds. The general perceptible odour was sea air. It was noted in conversation with one resident that there was, from time to time, objectionable odour from sewage on the shoreline during low tide.

**Herring Cove**

There were very few likely sources of odour in the village of Herring Cove, due to the residential nature of the area. Some odours of the sea are more pronounced in the vicinity of the wharf area, but nothing out of the character for a rural fishing village.

**Summary of Existing Odour Levels**

The baseline monitoring program results show that the four candidate sites for the STPs have very little existing sources of odour. There are no known problems, that would cause a cumulative adverse impact after construction of STPs, or that would likely be mistaken for the impact of the new STPs.

#### 4.1.2.2 Noise

In order to investigate current levels of noise in the vicinity of the candidate sites for STPs, a background monitoring program was designed and carried out simultaneously with the odour monitoring study described in Section 4.1.2.1 during the summer months of 2000.

The main objectives of the noise program were:

- C to measure current noise levels at representative times of the day;
- C to determine if there are local sources of noise during any part of the day that might cause existing noise levels to be of concern; and
- C to identify the sources contributing to the local noise level in order to enable isolation of any future noise contribution from future STPs.

The "Odour and Noise Baseline Study" (JWEL 2000) presents the program methodology and study results; these are summarized below.

Sound pressure levels are measured in decibels on the A-weighted scale (dBA) which accounts for the varying sensitivity of the human ear over the audio spectrum. The quantity most often referenced in regulations is the $L_{eq}$, or the power-averaged level of noise over some interval. Intervals of one-hour are commonly used, but fail to reflect the contribution of short-term noises. In this program, $L_{eq}$ was measured on 1 minute intervals, and one hour $L_{eq}$ values are computed from the 1 minute values. In addition, L10 and L90 measurements were made. These are the sound pressure levels exceeded 10 and 90 percent of the time respectively, and are used to characterize the variability of the noise levels. In addition to the meter used for the baseline data, a second meter was used by the field personnel to investigate individual sources that might be observed. The meters used in the work were a Bruel and Kjaer Model 2236, a Quest 1900 and a Quest Micro 15.

The average noise readings are presented in Table 4.2. Individual measurements have been aggregated to determine the baseline noise level for the three daytime periods as specified in the NSDOE "Guideline for Environmental Noise Measurement and Assessment" (NSDOE 1989) which is also a performance requirement of the HHSP STPs as expressed in the RFP (HRM 2000a).

**Table 4.2 Average Noise Measurements at Proposed STP Sites**

| Site | Noise Levels in dBA | | |
|---|---|---|---|
| | **2300 to 0700** | **1900 to 2300** | **0700 to 1900** |
| Halifax | 59.7 | 61 | 63.1 |
| Dartmouth | 47.5 | 53.1 | 53.0 |
| Herring Cove | 39.2 | 39.5 | 44.8 |
| Noise Guideline[1] | **55** | **60** | **65** |

Source: JWEL 2000

[1] NSDOE *Guideline for Environmental Noise Measurement and Assessment* (1989) is specified as a project performance requirement by HRM in the RFP.

The noise levels are shown in greater detail by time of day in Tables 4.3 through 4.6.

**Table 4.3 Noise Measurements at the Halifax Site, Upper Water Street**

| Date | Day | Start time | End time | $L_{eq}$ [dBA] |
|---|---|---|---|---|
| 30/06/2000 | Friday | 9:17 | 9:46 | 62.5 |
| 04/07/2000 | Tuesday | 12:36 | 12:50 | 62.6 |
| 05/07/2000 | Wednesday | 15:06 | 15:40 | 64.4 |
| 07/07/2000 | Friday | 18:17 | 18:49 | 62.3 |
| 19/07/2000 | Wednesday | 21:23 | 21:53 | 61.0 |
| 21/07/2000 | Friday | 3:40 | 4:13 | 57.7 |
| 24/07/2000 | Monday | 0:20 | 0:43 | 61.3 |
| 25/07/2000 | Tuesday | 6:15 | 6:45 | 60.1 |

**Table 4.4 Noise Measurements at the Dartmouth Site, Boundary Street**

| Date | Day | Start time | End time | $L_{eq}$ [dBA] |
|---|---|---|---|---|
| 30/06/2000 | Friday | 8:28 | 8:57 | 48.2 |
| 04/07/2000 | Tuesday | 11:34 | 12:05 | 54.6 |
| 05/07/2000 | Wednesday | 14:20 | 14:51 | 53.3 |
| 07/07/2000 | Friday | 17:26 | 17:56 | 53.6 |
| 19/07/2000 | Wednesday | 20:21 | 21:05 | 53.1 |
| 21/07/2000 | Friday | 2:30 | 2:55 | 46.6 |
| 23/07/2000 | Sunday | 23:39 | 0:09 | 48.8 |
| 25/07/2000 | Tuesday | 5:30 | 6:00 | 46.6 |

**Table 4.5 Noise Measurements at Herring Cove, Ocean View Drive**

| Date | Day | Start time | End time | $L_{eq}$ [dBA] |
|---|---|---|---|---|
| 30/06/2000[1] | Friday | 0.541666667 | 0.5604167 | 42.4 |
| 04/07/2000 | Tuesday | 16:06 | 16:36 | 48.0 |
| 05/07/2000 | Wednesday | 18:02 | 18:33 | 44.8 |
| 07/07/2000 | Friday | 20:48 | 21:18 | 39.5 |
| 20/07/2000 | Thursday | 0:20 | 0:54 | 35.1 |
| 21/07/2000 | Friday | 6:13 | 6:59 | 42.3 |
| 24/07/2000 | Monday | 3:30 | 4:01 | 31.3 |
| 25/07/2000 | Tuesday | 9:45 | 10:17 | 39.7 |

Sampling for this date was conducted near the Fiber Optic Cable Plant.

The nature of the noise level at each site is quite different, and the characteristics and individual sources are described below.

**Halifax**

The noise regime at this site is dominated by traffic on Barrington Street. At all times of the day and night, the traffic is virtually the only identifiable source of noise. The provincial Noise Guideline is exceeded for daytime.

**Dartmouth**

Noise levels at the Dartmouth site consist of background noises from the Coast Guard facility and some traffic noise from urban streets. The residential area has no distinct sources of noise. Sounds from the Coast Guard include idling marine vessel engines, occasional service vehicles and maintenance equipment. Minor noise contributions at this site come from ships in Halifax Harbour and other industrial facilities north of the Coast Guard property. The rail line between the residential area and the Coast Guard site is inactive and does not contribute to the acoustic environment.

**Herring Cove**

This village is very quiet during most of the day, with the majority of noise originating from traffic on the main coastal road (Herring Cove Road).

**Summary of Existing Noise Levels**

Ambient noise levels vary among the sites, but all are within the provincial Noise Guideline except for Halifax which exceeds the Guideline for evening. This site has the overall highest levels of noise.

### 4.1.3 Residual Environmental Effects Evaluation Criteria

**Odour**

Odour is very difficult to regulate for a number of reasons. In the case of sewage odours, it is possible to use the TRS readings as a measure of odour potential, but it must be recognized that there may be other substances present that lend additional characteristics to the overall odour. Odour panels are sometimes used to quantify the intensity of an odour, but are not useful for tracing sources in the field, and are useless if there is no perceptible odour. An odour panel is composed of six or more persons with "normal" sensory perception who smell samples that have been diluted with clean air. The level of dilution at which the odour is just perceptible to 50 percent of the panel is regarded quantitatively as an "odour unit". With care and strict adherence to protocols, the odour panel is a valuable means of characterizing odours, and in relating human responses to instrumental responses.

TRS meters can record odour causing compounds in dilutions of parts per billion (ppb). In terms of human responses, the detection level of TRS compounds is typically low parts per billion. The Ontario Ministry of Environment (OME) conducted extensive odour panel testing on a wider range of substances (Nagy 1989). Hydrogen sulphide, the major part of TRS in air near STPs has a 50 percent detection level of about 5.5 $\mu g/m^3$, or about 4 ppb. There is a variability in the normal population, and the detection level for the most sensitive 5 percent of the population is about 1.5 ppb, whereas the upper 5 percent level is about 20 ppb. Some texts report detection levels of $H_2S$ the human nose at the sub-ppb level, but the OME results suggest that this would be by a fraction of 1 percent of the population. Therefore, based on the work conducted for OME, one odour unit (*i.e.*, 50 percent detection limit) is defined here as 4 ppb. HRM has adopted this as a performance criteria for HHSP STPs and pumping stations as measured at source (*e.g.*, air scrubber exhaust) to ensure that no odours are perceptible offsite.

The same OME study attempted to determine levels at which the population would complain, and would be annoyed. The 50 percent complaint level is about 14 ppb, and the annoyance level, 180 ppb. These levels are not as well defined, mathematically, showing the variability attributable to subjective response. Sensitization, or identification of the source lowers the critical level of complaint or annoyance. If a citizen detects an odour from a source that has been a problem, or that is suspected of causing personal harm, they are much more likely to complain and become annoyed. The approach adopted in Ontario was to use the 50 percent detection level as a standard, that is, one odour unit per cubic meter, measured on a 10 minute basis. Because of the variability of the population, this implies that half of the population would detect the odour, about 20 percent might complain, and 5 percent might be annoyed.

The design criteria specified in the RFP Addendum #8 stipulates that “the concentration of Total Reduced Sulphur (TRS) compounds in air discharged from the Facility shall not exceed 5.5 µg/m3, or 4 ppb, as measured at points of discharge from each of the Sewage Treatment Plant’s exhaust stack(s).” The RFP addendum also required the use of monitoring equipment on the air discharges, including recording equipment to ensure that this criterion is met. The measurement at the air exhaust is required on a continuous basis with the odour limit not exceeded in any five minute rolling average. The RFP requires that there be “no detectable odours offsite *i.e.* beyond property boundary”. The odour stipulations for STPs also apply to pumping stations and CSOs.

Quantitative limits for $H_2S$ concentrations in ambient air in some Canadian provinces are presented in Table 4.6.

**Table 4.6 Canadian Hydrogen Sulphide ($H_2S$) Limits**

| Province | Pollutant | 1 hr (µg/m3) | 24 hr (µg/m3) |
|---|---|---|---|
| P.E.I. | $H_2S$ | 15 | 5 |
| NB | $H_2S$ | 15 | 5 |
| NS | $H_2S$– Max tolerable | 42 | 8 |
| NS | $H_2S$ – Max desirable | 14 | 4 |
| NF | $H_2S$ – Acceptable level | 28 | |
| QE | $H_2S$ | 28 (10 ppb) | |
| ON | $H_2S$ | 30 | |
| AB | $H_2S$ | 14 | 4 |
| HHSP STP Limit at source | $H_2S$ | 5.5 (4 ppb) | |

On the basis of the odour detection research presentation and the OME report, the HRM limit is relatively strict and protective of the public. The HRM limit is also considered relatively stringent when compared with $H_2S$ limits for ambient air in other provinces.

A **significant** adverse residual environmental effect would be defined as one that results in a persistent exceedance of the HRM performance criteria (*i.e.*, 4 ppb over a 5 minute rolling average) at the point of air exhaust during normal operating conditions resulting in perceptible odours at the facility property line.

A **positive** effect would be defined in one that results in a net reduction in total odour generation.

**Noise**

The performance criteria for the HHSP STPs as specified in the RFP is :

The noise level at the Sewage Treatment Plant property line shall not exceed:

C 55 dBA Leq (between 2300 hours and 0700 hours);
C 60 dBA Leq (between 1900 hours and 2300 hours); and
C 65 dBA Leq (between 0700 hours and 1900 hours).

Individual noise sources which are tonal in nature shall not exceed 45 dBA Leq when measured at the Sewage Treatment Plant property line (HRM 2000a).

The noise criteria corresponds to those in the NSDOE Noise Guidelines.

A **significant** adverse environmental effect with respect to noise may be defined by any of the following:

- C a noticeable change in noise level (approximately 5 dBA) which results in exceedance of the NSDOE Guideline levels;
- C a noticeable change in noise level (approximately 5 dBA) above existing noise levels in areas where the Guideline levels are already exceeded; or
- C a change in noise level of approximately 10 dBA above existing noise levels in areas where the Guideline levels are not exceeded.

A **positive** effect occurs when Project-related activities result in a reduction in ambient noise level.

### 4.1.4 Potential Interactions, Issues, and Concerns

**Air Quality**

During the construction phase, the air quality in the vicinity of the construction sites will be subject to some adverse effects from site preparation, materials delivery and construction equipment. Dust generation will be the most obvious effect, but some odour from diesel powered equipment will be present close to, and within the site.

During operation of the facilities, the major concern with respect to air quality is the potential emission of odour from the system processes during both routine operations as well as during upset conditions. The potential risk of volatile organic compounds is discussed in Section 5.5.

Sewage related odours are widely detected along the harbour shoreline and throughout the harbour, particularly near existing outfalls. It is anticipated that the HHSP will greatly reduce this odour and thus provide a benefit for those who use the harbour and shoreline.

**Noise**

During the construction phase, there will be noise associated with movement of construction equipment, excavation including potential blasting, and trucks delivering material to the site.

During operation, potential noise sources include internal equipment in the plant (*e.g.,* pumps, fans, ventilation exhausts) plus worker passenger vehicles and truck movements (*e.g.,* back up signal).

### 4.1.5 Analysis, Mitigation, and Residual Environmental Effects Prediction

#### 4.1.5.1 Construction

**Air Quality**

Construction generated dust and equipment emissions will be similar in magnitude and effect to any one of several relatively large scale building construction projects that have occured recently in Halifax (*e.g.*, Bishops Landing). Dust will be composed of generally inert mineral materials, generated primarily from overburden materials and construction materials. Some material will be tracked off-site by construction vehicles, and may become airborne due to passing traffic. Dust will also be generated during excavation, tunneling and blasting activities.

Assuming standard dust control practices (*e.g.,* water application) are implemented as required, there is not likely be a significant impact on air quality. In addition to water application during dry conditions, these standard practices may also include: regular cleaning of the paved road surfaces of material tracked out of the construction site; using tarpaulins on temporary storage piles of materials with high dust potential; and application of chemical dust suppressants such as calcium chloride in the unpaved area of the construction zone. Dust control and monitoring will generally be the responsibility of the site construction supervisor. The supervisor will respond to any complaints related to dust or other air emissions in a timely and effective manner.

In summary, construction related air emissions may cause temporary, localized effects in areas surrounding construction sites. These effects are similar to those associated with other large scale construction projects in the Metro area, and are generally well managed and well tolerated by the public. Provided standard dust control measures are employed, significant effects on air quality during construction are not likely to occur.

**Noise**

Construction noise has the potential to adversely affect the areas adjacent to construction sites, and mitigation is required, at least in terms of construction scheduling, to avoid unacceptable effects.

As a general guide, the noise levels of various types of equipment are shown in Table 4.7.

| **Table 4.7 Construction Equipment Noise Level Summary** | | |
|---|---|---|
| **Equipment Type** | **$L_{eq}$(dBA) at 15 metres** | **Comments** |
| Backhoe | 59 – 82 | Levels indicate range of idling to various operating tasks. |
| Bulldozer | 68 – 99.1 | Levels indicate range of idling to various operating tasks. |
| Compactor | 81 – 91 | Road preparation. |
| Compressor | 67 – 82 | Levels indicate range of idling to full operation. |
| Concrete batch plant | 95 | Loading Truck. |
| Concrete mixer | 67 – 68 | |
| Concrete truck | 69 – 79 | |
| Crane | 75 – 78 | |
| Forklift | 81 | |
| Front-end loader | 73 – 90 | Levels indicate range of various operating tasks. |
| Excavator | 85 | |
| Grader | 67 – 95 | Levels indicate range of idling to various operating tasks. |
| Hydraulic Hammer | 99 – 105 | |
| Self-propelled roller | 71 – 86 | Levels indicate range of various operating tasks. |
| Scraper | 72 – 91 | Levels indicate range of idling to various operating tasks. |
| Hand tamper | 85 – 88 | |
| Trenchers | 81 – 85 | |
| Source: Kessler *et al*. (1978) | | |

All heavy construction work will be carried out in the day (07:00 to 19:00). Lighter construction and material deliveries may be carried out during evening hours (19:00 to 23:00). The HRM Noise By-law (No. N-200), provides for the prohibition of construction activities during the following time periods:

- before 7:00AM on Monday, Tuesday, Wednesday, Thursday, and Friday;
- after 9:30 PM on Monday, Tuesday, Wednesday, Thursday, and Friday;
- before 8:00 AM on Saturday, and after 7:00 PM on Saturday;
- at all times on a Sunday, Statutory Holiday, or Remembrance Day.

Assuming construction activity will adhere to the HRM noise by-law, there is not likely to be a significant impact related to noise generation during construction. There will be audible, recognizable sounds of construction activity during the appropriate times of day, however any excursion of the noise beyond the significance criteria levels should be infrequent, and of short duration.

Other issues related to construction traffic are discussed in Section 5.4. As with other potential adverse effects generated by construction activities, noise generation during construction will be temporary and localized. Noise generation, if limited to the appropriate time of day as specified in the By-Law No. N-200 is not likely to cause significant adverse effects.

Table 4.8 summarizes the residual environmental effects analysis for the construction phase.

#### 4.1.5.2 Operation

**Air Quality**

HRM recognizes the high degree of public concern regarding potential odour generation at STPs. In order to ensure that the STPs are publicly acceptable, and even a net benefit to host communities, HRM has developed stringent odour control requirements. During STP operation, plant ventilation air is exhausted to the atmosphere through odour control equipment designed to meet the stringent requirements HRM specified in the RFP. It is assumed that this equipment will use highly effective proven technology with multiple stages. Negative pressure will be maintained inside the STP. Sludge transfer will be carefully controlled to prevent release of odour. A continuous odour monitoring system will also be provided.

Assuming that the limit of 4 ppb of TRS is not exceeded at the STP discharge points, adverse effects from STP odour generation on surrounding communities is unlikely. The limit of 4 ppb is equivalent to the 50 percent human detection limit (one odour unit) at the discharge point; the detection of potential odour causing compounds is even less likely as the distance from the STP increases. The odour control requirements for STPs also apply to other potentially odour generating components of the project infrastructure (*i.e.*, pumping stations and CSOs).

It is possible that some odour may be generated in the very unlikely event of a failure of the odour control system along with its back up systems. Such an event would be temporary with relatively localized effects. Refer to Section 6 for additional information regarding potential effects associated with equipment malfunction. In summary, given the stringent HRM odour control requirements and systems proposed for the HHSP and continuous monitoring, significant adverse effects from odour are unlikely.

The operation of the STPs and CSOs will eliminate the direct discharge of untreated sewage to the harbour. This will greatly reduce or eliminate the odours that have been widely reported (*e.g.*, along the Dartmouth and Halifax waterfronts). This reduction of sewage-related odour will be a positive effect of the Project.

**Noise**

The operation of STPs will result in some mechanical noise from ventilation fans, pumps, and other miscellaneous equipment. Tonal noise components will be less than 45 dBA. In general, noise from STP operations may be perceptible at the property line, however this noise is not expected to create significant adverse effects. The Halifax STP would not contribute significantly to the existing exceedence in the evening related to traffic noise from Barrington Street. At Herring Cove, depending upon the final site selection, the plant may be the dominant noise source at its property line, though the HRM performance criteria require that the provincial guidelines are not exceeded.

Back-up signals from trucks servicing the STP sites are likely to be the most readily discernable noise event offsite during the operational period. These signals are a safety requirement and are therefore unavoidable. However, STP site planners should attempt to route onsite traffic in a forward moving pattern as much as possible, and position loading/unloading areas away from potentially sensitive noise receptors. Routine onsite truck traffic should also be restricted to day time hours. These measures should reduce these effects to acceptable levels. In summary, significant adverse effects from noise during the operational phase are unlikely.

Table 4.9 summarizes the residual environmental effects analysis for the operations phase.

### 4.1.6 Follow-up and Monitoring

**Air Quality**

The odour levels of the STPs, pumping stations, and CSOs will be tested during commissioning and compared to the HRM performance criteria; remedial action will be taken as necessary. Continuous monitoring for TRS will be conducted during operation to ensure that odours are not leaving the site boundaries. As stated in RFP Addendum #8:

> *An odour monitoring and recording system including sensors, measuring and recording devices shall be installed at all sewage treatment plants. All sensors and measuring equipment shall be suitable for the intended operation with appropriate sensitivity and accuracy for the low concentrations that will be measured and monitored include data in SCADA system with capability for real time monitoring of results by HRM.*

Measurements in the STP air discharge points will be on a continuous basis. The information will be logged, and accessible by the public in the event of community complaints. In addition to TRS monitoring at the air exhaust, the STP operators will take note of any other type of odour that may be generated by the STP (*e.g.*, scrubber solution). Logging of any community complaints and resolution will also be undertaken by the operator and reported to HRM on a regular basis.

**Noise**

The noise levels of the STPs must be tested during plant commissioning and compared to the HRM performance criteria; remedial action must be taken if necessary. Routine noise monitoring will also be taken to ensure ongoing compliance with criteria. The noise monitoring program should include provisions to log and respond to community concerns. It is also recommended that acoustic and vibration monitoring be used as part of a routine maintenance program in order to ensure early detection of problems that would lead to noisy equipment operation.

#### 4.1.7 Summary of Residual Environmental Effects Assessment

Air quality and noise effects from construction activities will be temporary and localized, and are typical of urban construction projects in Halifax. Dust generation will be effectively mitigated through standard practices, while noise effects will be limited by adherence to HRM noise by-law restrictions.

Operational noise from STPs will be perceptible at the site boundaries, but these effects are not likely to be significant. Appropriate equipment and facility design will further reduce any adverse effects from noise. Effective odour control during the operational phase is a critical project component that will be addressed through: process design (*i.e.*, negative building pressure, enclosed systems, highly effective air scrubbers); performance criteria to ensure no detectable offsite odours; and continuous monitoring. Offsite odour effects should not occur except in the very unlikely event of a major system malfunction. In summary, significant adverse environmental effects on atmospheric resources (air quality, acoustic environment) as a result of Project construction and operation are unlikely. There will likely be a positive effect on air quality during Project operation due to reduction of sewage-related odour along the Halifax and Dartmouth waterfronts.

**Table 4.8 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Atmospheric Resources (Construction)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects | | | | | Residual Environmental Effect | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Socio-cultural and Economic Context | | |
| Construction of STPs and collector system | C Dust generation and construction vehicle exhaust (A) | C Standard dust control procedures | 1 | 1 | 3 / 6 | R | 2 | N | 3 |
| | C Noise from construction activities and vehicle movements (A) | C Time of day and day of week restrictions on construction activities | 1 | 2 | 3 / 5 | R | 2 | N | 3 |

**KEY**

**Magnitude:** 1 =Low: *e.g.,* within the normal variability of baseline conditions; 2 = Medium: *e.g.,* increase/decrease with regard to baseline but within standards and objectives; 3 =High: *e.g.,* singly or as a significant contribution in combination with other sources causing exceedances or impingement upon standards and objectives beyond the property line of the project
**Geographic Extent:** 1 = <500 m²; 2 = 500 m² -1 km²; 3 = 1-10 km²; 4 = 11-100 km²; 5 = 101-1000 km²; 6 = >1000 km²
**Duration:** 1 = < 1 month; 2 = 1-12 months; 3 = 13-36 months; 4 = 37-72 months; 5 = > 72 months
**Frequency:** 1 = < 11 events/year; 2 = 11-50 events/year; 3 = 51-100 events/year; 4 = 101-200 events/year; 5 = >200events/year; 6 = continuous
**Reversibility:** R = Reversible; I = Irreversible
**Ecological/Socio-cultural and Economic Context:** 1 = Pristine area or area not adversely affected by human activity; 2 = Evidence of adverse effects.
**Residual Environmental Effect Rating:** S = Significant Adverse Environmental Effect; N = Non-significant Adverse Environmental Effect; P = Positive Environmental Effect
**Confidence:** 1 = Low level of Confidence; 2 = Medium level of Confidence; 3 = High level of Confidence

**Table 4.9 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Atmospheric Resources (Operations)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects: Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Socio-cultural and Economic Context | Residual Environmental Effect | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| Collector system operations | C Noise from pumping station equipment and vehicle movements (A) | C Pumping station design and equipment will consider acoustic effects<br>C Time of day and day of week restrictions on vehicle movements | 1 | 1 | 1 / 1 | R | 2 | N | 2 |
| | C Air discharge potentially resulting in odours to communities (A) | C Enclosed pumping station and CSO facilities<br>C Odour control equipment at pumping stations<br>C Stringent HRM performance requirements to ensure no offsite odour | 1 | 1 | 5 / 6 | R | 2 | N | 2 |

**Table 4.9 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Atmospheric Resources (Operations)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects | | | | | Residual Environmental Effect | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Socio-cultural and Economic Context | | |
| STP operations | C Air discharge potentially resulting in odours to communities (A) | C Highly effective odour control equipment<br>C Enclosed facilities, negative air pressure in STPs<br>C Sludge transfer controls<br>C Stringent HRM performance requirements to ensure no offsite odour<br>C Continuous monitoring at air discharge | 1 | 1 | 1 / 1 | R | 2 | N | 2 |
| | C Noise from STP equipment operation and vehicle movements (A) | C STP design to consider acoustic effects in equipment selection and site layout<br>C Time of day and day of week restrictions on truck movements | 1 | 1 | 5 / 6 | R | 2 | N | 2 |
| STP operations (cont'd) | C Sewage treatment resulting in reduction of odour on harbour and shoreline (P) | C No mitigation required | 2 | 4 | 5 / 6 | R | 2 | P | 2 |

| **Table 4.9** | **Residual Environmental Effects Assessment Matrix<br>Valued Environmental Component: Atmospheric Resources (Operations)** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects | | | | | Residual Environmental Effect | Level of Confidence |
| | | | Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Socio-cultural and Economic Context | | |

Refer to Table 4.8 for Key.

## 4.2 Marine Water Quality

Marine water quality in Halifax Harbour is a VEC because it is intrinsically linked to a number of other key ecological and socioeconomic components such as: fish and benthic habitat, sediment quality, harbour fisheries; and land and harbour use. Harbour water is the primary receptor of untreated sewage discharges and the consequent adverse effects on these related VECs and VSCs. Water quality issues of concern related to sewage discharges include increases in biological oxygen demand (BOD), suspended solids (SS), pathogens, metals, and other contaminants. Harbour ecosystems and uses are currently adversely affected, in part, by poor water quality due to untreated sewage discharge. Sewage treatment can successfully reduce many of the sewage related problems in the harbour today.

Other VECs and VSCs discussed in this report linked to marine water quality include: Section 4.3, Marine Sediment Quality; Section 4.4, Marine Benthic Habitat; Section 5.1, Commercial Fishery; and Section 5.5, Public Health.

Additional information on this VEC can be found in “Oceanographic Modeling and Assimilative Capacity Three Plant Scenario” (COA 2001); and “Wastewater Characterization Study” (SNC Lavalin 1999). The following documents prepared for the HHCI project are also relevant to this VEC: “Environmental Assessment Report”, Sections 3.2.1, 3.2.2, and 6.8 (HHCI 1992); “Marine Water and Sediment Quality” (Land and Sea Environmental Consultants Ltd. 1991); “Water Quality Modeling in Halifax Harbour” (ASA Consulting Limited 1991); and “Physical Oceanography” (MacLaren Plansearch Ltd. 1991a).

### 4.2.1 Boundaries

Treatment and discharge of sewage effluent through marine diffusers will alter the marine water quality throughout the harbour. Spatial boundaries for the assessment of marine water quality include those marine areas north of Hartlen Point which have been included in hydrodynamic and water quality models for detailed assessment. These include areas defined earlier by the Halifax Harbour Task Force (HHTF) as Outer Harbour, Middle Harbour, Inner Harbour, Narrows and Bedford Basin (Figure 4.1). Temporal boundaries of these models include “present”conditions as defined by 1991 discharge rates and distribution, and “future” conditions as defined by projected 2041 discharge rates and distribution. Temporal boundaries for the assessment consider that sewage flows constantly year round with the major variation corresponding with peak flows caused by storm runoff in the combined storm/sanitary sewer system. Temporal boundaries also consider, for the most part, a full project build out and do not consider incremental change in water quality as STPs are phased in over a 10 year period.

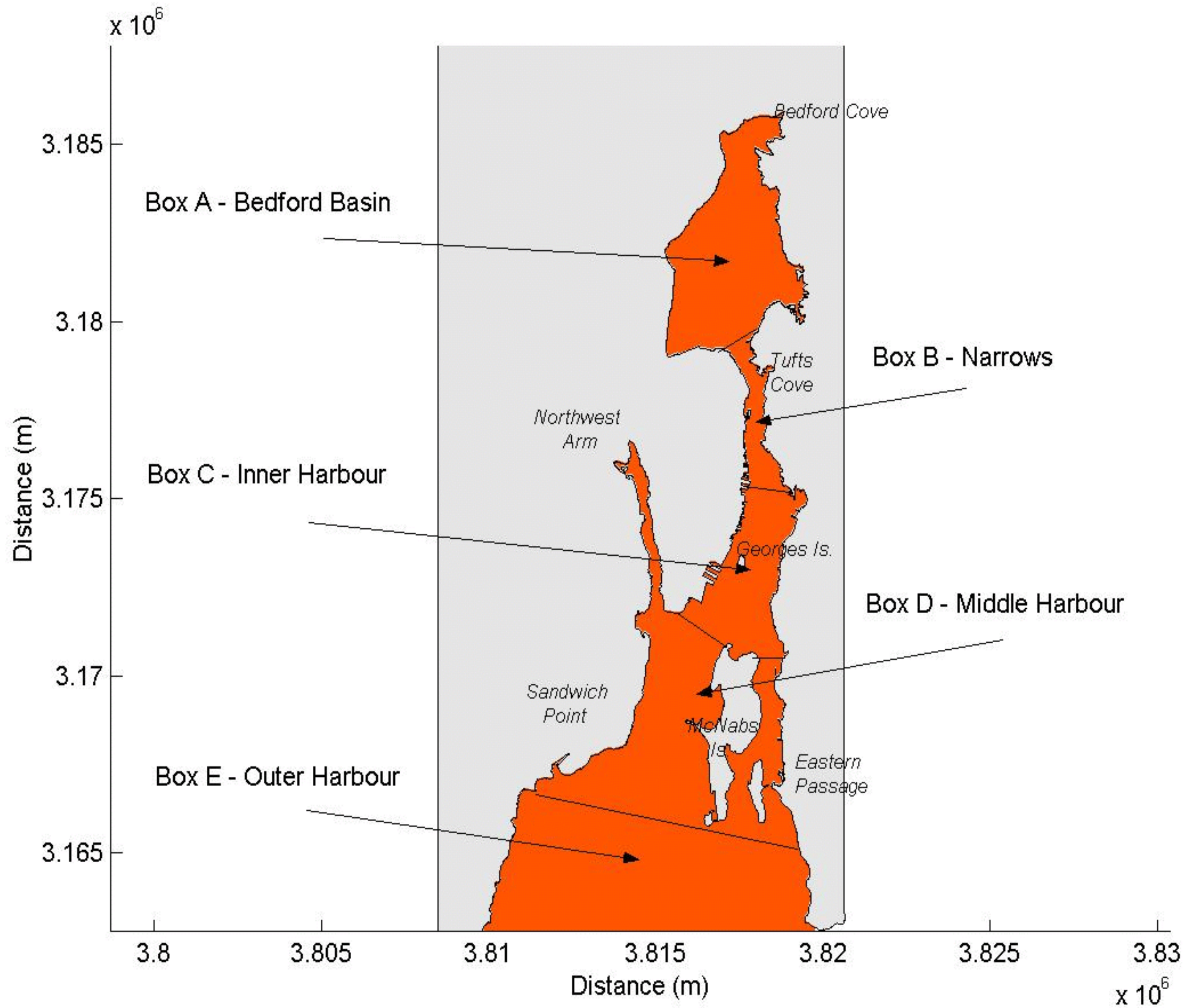



**Figure 4.1 Spatial Domain of Water Quality Models**

### 4.2.2 Description of Existing and No-Project Future Conditions

This section includes a discussion of both existing conditions related to marine water quality as well as projected future conditions in absence of the Project. Sewage loads to Halifax Harbour are projected to continue to rise due to development within the harbour sewershed as shown in Table 4.10. Future conditions were assessed based on projected loads and patterns that reflect: 1) a continuation of discharge of raw effluent; and 2) the proposed treatment and relocation of discharges to four new outfalls. For both present and future cases, the assessment of water quality has been based on models of water circulation developed from historical hydrographic data (Jordan 1972) and current patterns observed using an Acoustic Doppler Current Profiler (ADCP) deployed off Sandwich Point over a month-long period in 1989 (ASA 1990).

Table 4.10 shows that projected loads for average dry weather conditions double over the period 1991-2041. It is therefore important to consider, along with existing conditions, the projected decrease in water quality which will occur in the harbour if the Project is not undertaken. In this section, general aspects of the existing oceanography and water quality, along with model results representing existing conditions (1991) and future untreated conditions (2041), are described.

**Table 4.10 Present and Future Sewage Flows**

| Proposed STP Locations | 1991 | | | 2011 | | | 2041 | | |
|---|---|---|---|---|---|---|---|---|---|
| | ADWF ($m^3/s$) | PWWF ($m^3/s$) | % | ADWF ($m^3/s$) | PWWF ($m^3/s$) | % | ADWF ($m^3/s$) | PWWF ($m^3/s$) | % |
| Halifax | 0.677 | 2.708 | 61% | 0.928 | 3.712 | 60% | 1.081 | 4.324 | 50% |
| Dartmouth | 0.352 | 1.408 | 32% | 0.489 | 1.956 | 32% | 0.668 | 2.672 | 31% |
| Herring Cove | 0.082 | 0.328 | 7% | 0.127 | 0.508 | 8% | 0.409 | 1.636 | 19% |
| TOTAL | 1.111 | 4.444 | 100% | 1.544 | 6.176 | 100% | 2.158 | 8.632 | 100% |

Key: ADWF - average dry weather flow; PWWF - peak wet weather flow
Source: HRM 2000a

**Oceanographic Conditions**

Halifax Harbour is a deep tidal estuary which includes a fjordal basin at its head. The following describes the main oceanographic processes which effect sewage dispersion in the Harbour: estuarine circulation; coastal circulation; fjordal circulation; and tides.

*Estuarine circulation*

Freshwater from the Sackville River (plus other freshwater contributions along the shoreline including sewage) tends to flush the harbour by spreading out near the surface while entraining seawater from below. This sets up an "estuarine circulation" which carries sewage effluent seaward in a surface layer to be replaced by seawater flowing landward in a deeper layer. The strength of the estuarine circulation in the harbour depends on the amount of freshwater discharge from Sackville River and from sewage discharge and runoff. Based on the mean salinity distribution in the harbour (Petrie 1990) we can estimate that the estuarine exchange ranges from about 20 million cubic metres per day in the Narrows to about 30 million cubic metres per day in the channel off Sandwich Point. This mean estuarine circulation is 200 to 300 times larger than the average sewage flow of about 0.1 million cubic metres per day (1991 ADWF) and thus plays an important role in diluting the sewage discharged to the harbour.

*Coastal circulation*

The predicted estuarine circulation rate based on the average distribution of salinity in the harbour corresponds well to directly measured average rates at Sandwich Point of about 30 million cubic metres per day. However, the direct field measurements of current off Sandwich Point have shown that harbour waters respond to wind and shelf processes in addition to the freshwater water input. Current data were collected over a 60 day period in 1989 and a 30 day period in 1991 and show that the rate of turnover is highly variable resulting in a standard deviation in the mean of +/-60 million cubic metres per day. The data showed that the estuarine circulation often reverses with surface waters traveling landward and bottom waters traveling seaward for periods of days at a time. Modeling showed that these enhanced "normal" and "reversed" events were similar to the process of coastal upwelling and downwelling and tended to augment exchange with the coastal ocean and help promote good water quality in the harbour (ASA 1990). However, on occasion, reversals can be expected to hold surface waters in the harbour or move them landward toward Bedford Basin. This may “trap” the sewage in Bedford Basin and temporarily reduce water quality, especially in summer, during periods of low river flow.

Coastal circulation also includes flow past the mouth of the harbour. Coastal currents in the Outer Harbour have been shown to be variable and only a small amount of sewage discharged/advected seaward of Sandwich Point will enter/re-enter the harbour.

*Fjordal circulation*

Estuarine and coastal circulation described above usually apply to the upper layers of the harbour. Circulation and exchange in the deeper waters of Bedford Basin are comparatively weak. This is because the exchange of deep water in Bedford Basin is inhibited by the shallow sill in the Narrows. Exchange of this water with the rest of the harbour is limited to vertical turbulence and occasional turnover presumably associated with particularly strong upwelling of dense water along the coast. For these reasons, the deep fjordal waters in Bedford Basin are renewed less often than the rest of the harbour.

*Tide*s

Exchange, due to the variable estuarine and coastal circulation patterns described above, is augmented by the persistent effect of the tides. Near the mouth of the harbour, a fraction of the material advected seaward on the ebb tide will mix with coastal waters and not return on the flood. A fraction of this new water will mix with water further in the harbour during the next tidal cycle, etc., eventually resulting in the complete exchange of harbour water. Tidal exchange is greatest near the mouth of the harbour and weakest at the head of the harbour in Bedford Basin.

**Existing Water Quality Issues**

Discharge of raw sewage effluent into Halifax Harbour has affected the levels of marine water quality parameters including dissolved oxygen, nutrients, pathogens, metals and suspended solids. Dissolved oxygen (DO) levels are lowered near outfalls and over larger areas directly due to the BOD of the effluent and indirectly to algal production and detrital decay associated with nutrients (primarily nitrogen (N) and phosphorus (P)) in the discharge. This additional oxygen demand augments the natural tendency for the deeper "fjordal" water in Bedford Basin to become anoxic. Pathogenic agents are present throughout the harbour as evidenced by high levels of the "indicator" fecal coliform (FC) bacteria. FC levels exceed guidelines for recreational water quality (*i.e.*, human contact) near outfalls and throughout the central region of the harbour. Sewage effluent also elevates the concentration of suspended solids (SS) in the harbour. In addition, domestic and industrial effluent can contribute to the concentration of metals in harbour waters and sediments. Together, DO, FC, SS, metals, and nutrients, constitute a set of parameters which collectively represent the status of marine water quality in the harbour. The collection, treatment and redistribution of sewage effluent will modify the levels and distribution of these parameters and thereby affect the quality of marine waters in the harbour. These water quality parameters are discussed in further detail below.

*Pathogens*

Levels of FC bacteria have been measured at various locations, depth and times over past decades. These measurements are representative of the risk of pathogens in sewage effluent and in the marine environment. In general, levels exceed the human contact guideline of 200 bacteria/100 mL (Health and Welfare Canada 1992) throughout the Inner Harbour and Narrows and in the vicinity of all existing outfalls including those at the mouth of Northwest Arm and Herring Cove. The effects of sewage related pathogens are more fully discussed in Section 5.5.

*Nutrients and harmful algal blooms*

Coastal waters receive domestic, industrial and agricultural waste frequently rich in nutrients. It is believed that human activities have increased and altered the relative availability of nutrients in coastal waters (abundant in sewage), in ways that favour toxic forms and more severe and longer lasting outbreaks of harmful algae blooms (HABs).

Algae blooms in Halifax Harbour normally include a spring bloom of diatoms and a summer bloom of dinoflagellates and other types of algae (Loucks 1998). These blooms are supported, in part, by the nutrient input (specifically nitrogen and phosphorus) associated with sewage discharge. HABs are becoming more common in many areas on the eastern seaboard of North America. For example, the Bedford Basin bloom of July - August 1990 provided the first diarrhetic shellfish poisoning (DSP) HAB identification in eastern Canada. The collapse of an algae bloom can lead to eutrophication and associated oxygen depletion severe enough to kill fish and other marine life. This was the case in Bedford Basin in August 1993 when a concentrated algal bloom pushed the ecosystem temporarily to a state of eutrophication resulting in a fish kill. There is anecdotal evidence of distressed fish in other years as well.

*Suspended sediments*

Present SS concentrations are low (1.2 mg/L) (Petrie and Yeats 1990), typical of coastal waters, except in the immediate vicinity of existing outfalls.

*Metals*

Present suspended metals are generally low and within regulatory guidelines except in the immediate vicinity of outfalls.

*Oxygen*

DO levels are high, except in Bedford Basin deep water where fjordal flushing is low, in the immediate vicinity of outfalls, and possibly during algal blooms as discussed above.

**Comparison of Existing Conditions and No-Project Future Conditions**

The distribution of untreated sewage effluent and associated FC bacteria have been modeled (ASA 1990; COA 2000). Sewage effluent is a “conservative” tracer for sewage in that its presence is altered only by the physical forces in the harbour (*e.g.*, tides and currents) and it provides an absolute indication of the movement of sewage in the harbour. FC bacteria are an example of a “non-conservative” tracer for sewage in that bacteria are affected by biological processes (*i.e.*, die off) in addition to physical transport.

A two layer model was used to simulate effluent dispersion in the upper layer of the harbour. Model runs were conducted for entrainment of the discharge into the surface layer at 18 outfall locations along the coastline based on 1991 and 2041 flows representing present and future conditions. Model flows were based on average dry weather flows (ADWF) presented in Table 4.11; ADWFs were used to be consistent with previous modeling efforts, and are generally representative of mid-to-late summer conditions during which water quality is typically the poorest. Storm conditions, which generally produce greater and more dilute flows, have not been modeled. Model methodology and results are presented in greater detail in "Oceanographic Modelling and Assimilative Capacity Study Three Plant Scenario" (COA 2001).

**Table 4.11 1991 and Projected 2041 Average Dry Weather Flows (ADWF)**

| Outfall Location | 1991 ADWF ($m^3/s$) | 2041 ADWF ($m^3/s$) |
|---|---|---|
| ***Halifax*** | | |
| Duffus Street | 0.289 | 0.562 |
| Young Street | 0.017 | 0.028 |
| North Street | 0.015 | 0.015 |
| Upper Water Street | 0.026 | 0.031 |
| Duke Street | 0.01 | 0.012 |
| Sackville Street/Bell Road | 0.055 | 0.065 |
| Terminal Road | 0.002 | 0.002 |
| Pier A | 0.132 | 0.224 |
| Chain Rock | 0.135 | 0.142 |
| ***Dartmouth*** | | |
| Tuft's Cove | 0.059 | 0.086 |
| Jamieson Street | 0.046 | 0.062 |
| Lyle Street/Best Street | 0.012 | 0.015 |
| North Street/Park Avenue | 0.011 | 0.018 |
| Peace Pavilion | 0.195 | 0.405 |
| Tupper Street | 0.003 | 0.003 |
| Cuisack Street | 0.01 | 0.011 |
| Melva Street | 0.015 | 0.069 |
| ***Herring Cove*** | | |
| Roaches Head | 0.082 | 0.409 |
| Source: HRM 2000a | | |

*Existing and (no-Project) future effluent concentration*s

Model predictions of the levels of effluent which occur in the harbour for present (1991) and future (2041) (no-Project) conditions are presented in Figure 4.2. A contour on Figure 4.2 shows the level at which sewage derived SS are expected to reach 10 percent of background SS concentrations. The level of 10 percent of background at which the sewage component of SS in the water column represents an acceptable fraction of natural levels.

Figure 4.2 shows that the area affected by effluent under present conditions is centered on the Inner Harbour and Narrows. The model predicts that, if untreated, the future effluent distribution will extend over a much larger area of the harbour and average concentrations will be significantly higher. Modeled SS concentrations exceed 10 percent of present background levels primarily in the Inner Harbour and at the mouth of Northwest Arm for present flows. The area affected is predicted to extend south beyond Herring Cove and north into Bedford Basin for future flows in the absence of the Project.

*Existing and (no-Project) future FC concentrations*

Modeled levels of FC bacteria in the harbour for present (1991) and future (2041) (no-Project) conditions are presented in Figure 4.3. FC concentrations shown are the maximum levels which occurred at each model cell over the entire 28 day model simulation. A contour on the figure shows the area in which the human contact guideline level (200 FC/100 mL) is exceeded.

Figure 4.3 shows that present FC bacteria (and by inference pathogen) levels are high in the Inner Harbour and Narrows. The area in which the contact guideline is occasionally exceeded extends to the south of Point Pleasant Shoal and into the mouth of Northwest Arm. The area of exceedence at Herring Cove is relatively small based on present loads.

The predicted future (no-Project) flows will cause FC levels to be much higher in the central part of the harbour and in the area of Herring Cove. However, while levels will be higher, the area affected in the central region of the Harbour will not be much larger than it is for the present flows. In contrast, the large increase in future flows from Herring Cove causes a large increase in both the levels there and the size of the area affected.

**Summary of Relevant Water Quality Guidelines**

Halifax Harbour is a "coastal inlet" subject to flushing from tides, oceanographic turbulence and layered flows including an estuarine component and a coastal (upwelling/downwelling) component. Therefore, the appropriate designation for this system under the "Nova Scotia Standards and Guidelines Manual for the Collection, Treatment and Disposal of Sanitary Sewage" (NSDOE 1992) is "open coastal". The generic provincial guideline for open coastal effluent discharge is 5000/30/30 for bacteria (FC per 100 mL)/SS

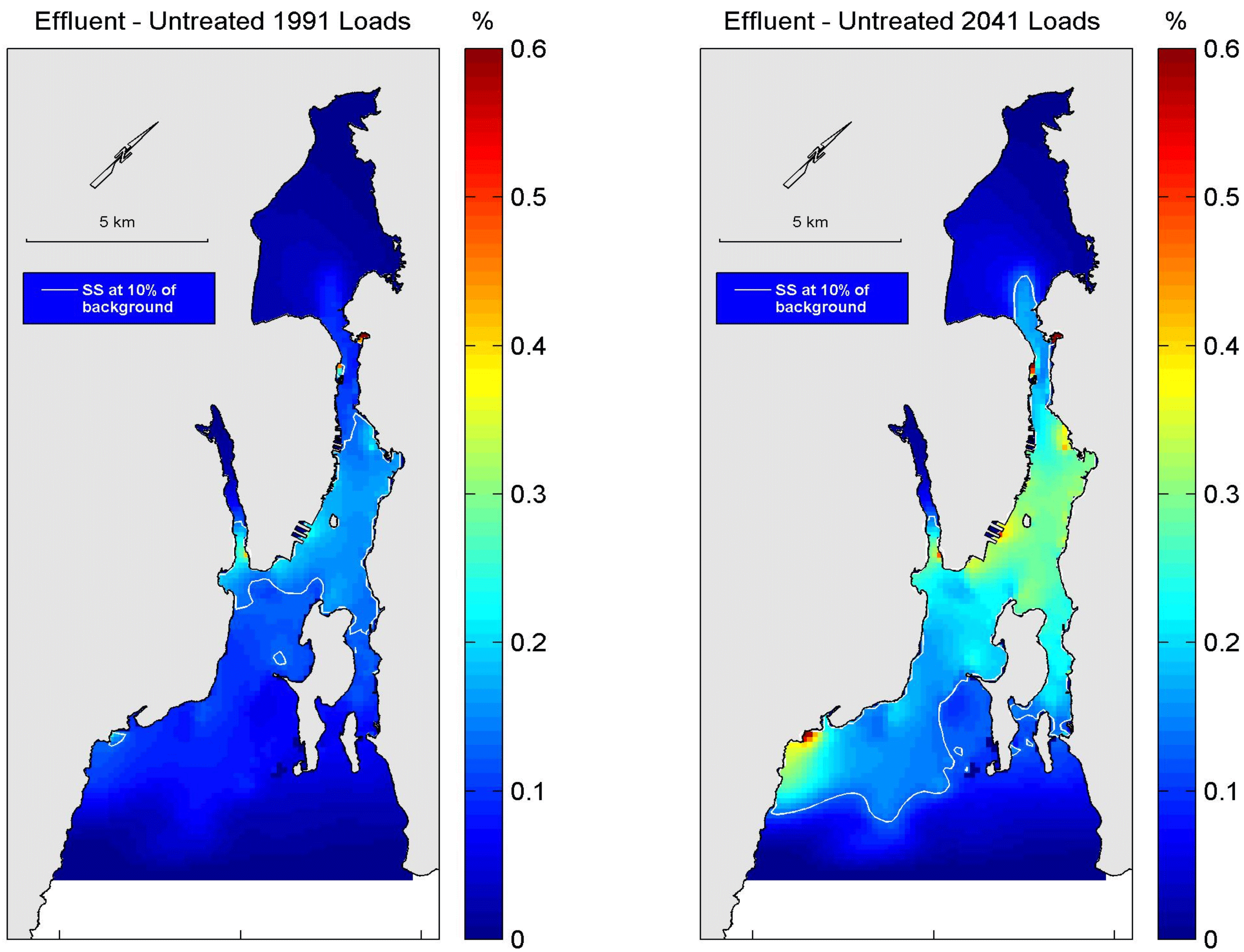



**Figure 4.2 Modeled Sewage Effluent Concentrations - Present and Future (untreated) Flows**

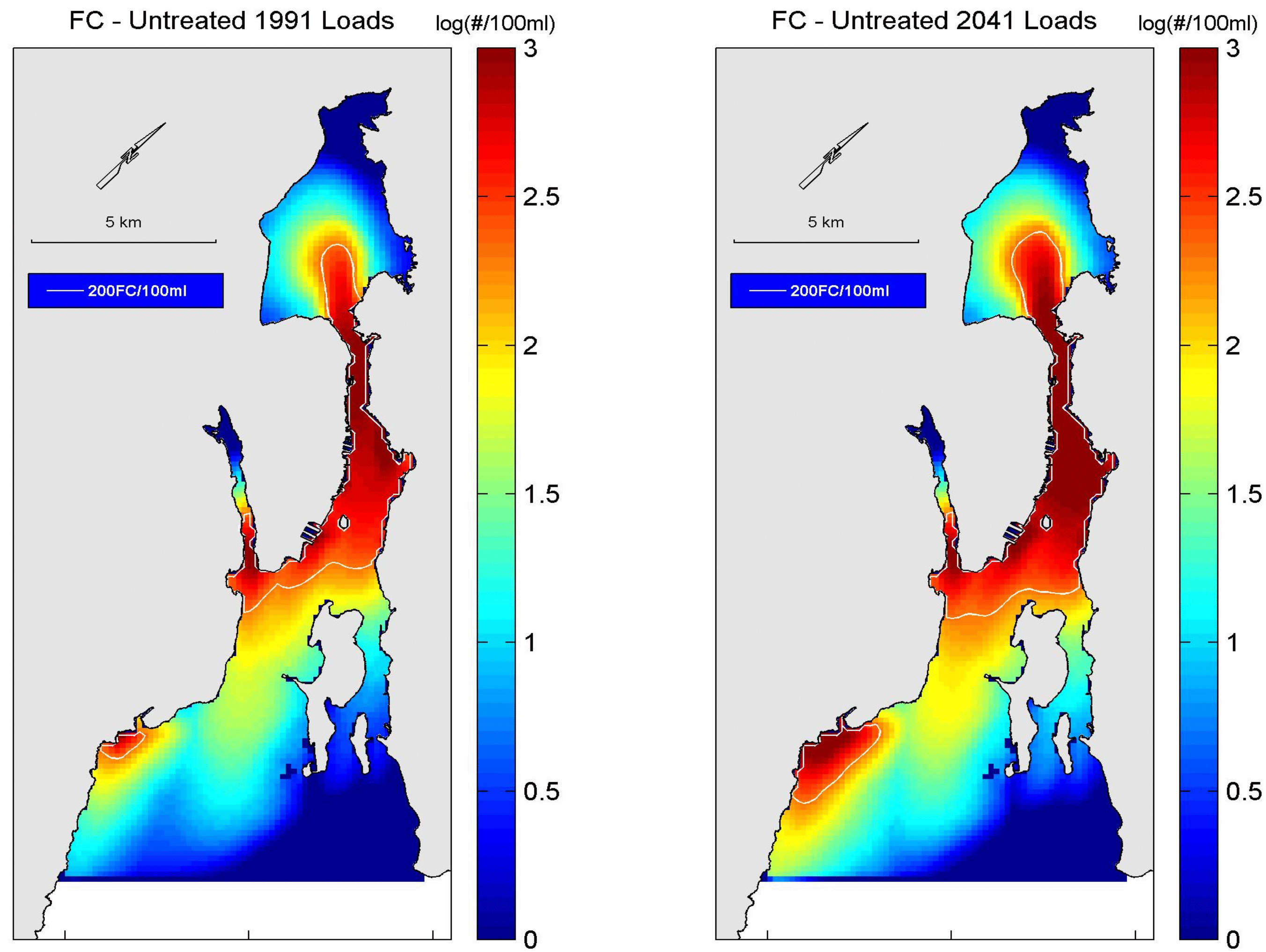



**Figure 4.3 Modeled FC Bacteria Concentrations - Present and Future (untreated) Flows**

(mg/L)/BOD (mg/L). Variance from these levels is permitted if warranted based on the results of a detailed receiving water study which provides information on dilution zones based on a site specific analyses of oceanographic processes.

Coastal Ocean Associates conducted treated and untreated sewage effluent modeling for the HHSP in 2000 and 2001. The results of this work are summarized in this section with full details provided in "Oceanographic Modeling and Assimilative Capacity Study Three Plant Scenario" (COA 2001). Based on oceanographic modeling conducted by HRM in 2000 (COA 2000), NSDEL has accepted an effluent quality limit of 5000/40/50 for FC/SS/BOD respectively, for the initial four plant scenario. These limits were the basis for the modeling of the treated effluent scenarios presented in this section. It is anticipated that the three plant scenario with advanced primary treatment with UV disinfection can consistently meet these effluent quality requirements. The allowable levels for FC bacteria is consistent with the generic provincial guidelines, while the allowable BOD and SS levels are higher than the generic guidelines. However, this variance is not considered a concern since the effluent is to be discharged through engineered diffusers which will provide a high initial dilution (50:1). The diffuser locations have been selected for areas with sufficient depth and currents to further promote dispersion.

Other potential water quality guidelines were identified in an extensive review conducted by the Halifax Harbour Task Force (HHTF 1990). These applied to dissolved oxygen, bacteria (FC), suspended solids, metals and organic chemicals. The Task Force approached the problem of setting objectives by first assigning classifications to broad zones or boxes within the Harbour. The lowest classification, SC, was assigned to the area of the Inner Harbour and the Narrows which are dominated by commercial usage. While providing for industrial usage and some oxygen depletion, water quality criteria for the SC zone is intended to provide for safe boating and other secondary recreational activities, good fish and wildlife habitat, and aesthetic values. A SB classification was assigned in the area of the Middle Harbour to a line just south of McNabs Island. Bacteria levels in this area were to meet swimming guidelines (200 #/100 mL). Waters south of this area were to be maintained relatively pristine with a SA classification. This use classification system was endorsed at the Halifax Harbour Symposium in 1996 and again, with minor modifications (to upgrade the Northwest arm to SB), in a report by the Solutions Advisory Committee (SAC 1998) (refer to Figure 2.5 and Section 2.8.1). The Halifax Harbour Task Force (HHTF) also recommended a marine diffuser to manage potential near field effects from the discharge.

Modeling has shown that all of the HHTF water quality criteria are met just outside the initial diffuser mixing zone with the exception of SS. The HHTF criterion for SS was that the effluent should not increase local marine levels by more than 10 percent. This requirement for SS is difficult to meet due to naturally low background levels of SS in the harbour. Based on field data and box modeling, the estimated background level of SS is 1.2 mg/L (Petrie and Yeats 1990). Untreated effluent presently has an SS concentration of 90 mg/L (SNC Lavalin 1999) while the modeled limit for advanced primary treated effluent has a SS concentration of 40 mg/L. Thus, in order to reduce SS levels to 10 percent of background, the untreated effluent and treated effluent must be diluted to 0.13 percent and 0.3 percent corresponding to dilutions of 770:1 and 330:1, respectively. These dilutions are difficult to achieve within the harbour, and for this reason, the HHTF criteria for SS will not be met everywhere throughout the harbour, even for a treated effluent.

### 4.2.3 Residual Environmental Effects Evaluation Criteria

A **significant** adverse effect is one that results in the degradation of marine water quality by causing one or more water quality parameters to exceed limits associated with the water use classification system adopted by the Halifax Harbour Task Force.

A **positive** effect is one that results in the improvement of marine water quality parameters such that the water use classification system objectives are met or closer to being achieved.

### 4.2.4 Potential Interactions, Issues, and Concerns

Potential effects on marine water quality during the project construction phase will be generally limited to installation of the marine outfalls and diffusers. The outfall pipe may be installed by trenching or bottom lay methods which would involve disturbance of marine sediments. At the Inner Harbour locations, these sediments are likely to contain relatively high levels of hydrocarbons, metals, and other contaminants (see Section 4.3) that could become entrained in the water column. If dredging of sediments is required at the Inner Harbour locations, it is assumed that ocean disposal of the dredged material will not be permitted due to the high level of contaminants; approved land disposal would therefore be required.

Project operation will involve the large scale treatment of sewage in HRM and discharge of treated effluent to the marine environment. Potential effects on marine water quality during the operational phase include reductions in SS, metals, BOD, and pathogens, resulting in an overall improvement in marine water quality, and satisfying the fundamental project objectives. There is a concern regarding potential localized adverse effects on water quality resulting from the consolidation of treated sewage discharge into three outfalls compared with the many outfalls currently in use. There is also a concern regarding routine overflows of partially treated sewage from CSOs during storm events.

### 4.2.5 Analysis, Mitigation, and Residual Environmental Effects Prediction

#### 4.2.5.1 Construction

Marine water quality may be temporarily affected during the installation of outfalls and diffusers on the harbour bottom. Trenching or bottom laying of the pipe will disturb the sediments causing the suspended sediments to enter the benthic boundary layer. Once in this layer, they will tend to be advected by tides and mean currents before eventually resettling. Typical settling speeds for fine materials are expected to be in the order of 1 mm/s so that particles raised to near the surface from a depth of 20 m (the maximum depth of construction activities) could remain in the water column for up to several hours. Assuming a typical harbour current of 10 cm/s, such particles would be dispersed over a distance of up to 2 km. If dredging of sediment is required, dredge spoils will be tested in accordance with the Canadian General Standards Board (CGSB) Provisional Standard No. 164-G-IMP, Leachate Extraction Procedure (1987). If the leachate contains contaminant concentrations in excess of the criteria outlined in the *Transportation of Dangerous Goods* (TDG) Regulations, then the material would be considered a hazardous waste that should be disposed of at a hazardous waste management facility permitted by an appropriate regulatory agency. If contaminant concentrations are less than the TDG criteria, the material would not be considered hazardous and will be disposed in an approved land disposal facility, therefore large quantities of sediment will not be redistributed in the water through ocean dumping. It is not anticipated that marine water quality will be appreciably affected by Project construction given the relatively localized degree of sediment disturbance, substantial sediment dispersion, and temporary nature of the construction. The Company will consult with Environment Canada to determine requirements of a disposal at sea permit under *CEPA* (*Ocean Dumping Regulations*) once construction details are known. No mitigative measures are recommended. Further information on potential effects of construction on sediment quality and the benthic environment are presented in Sections 4.3 and 4.4 respectively.

Table 4.12 summarizes the residual environmental effects analysis for the construction phase.

#### 4.2.5.2 Operation

The primary objective of the Project is to improve marine water quality, and thus also improve other VECs and VSCs directly linked to water quality. The Project represents a remarkable improvement in water quality in relation to existing conditions and, perhaps more importantly, in relation to conditions that will be created by future development and population increases. By 2041 total effluent discharge rates are predicted to double compared with baseline 1991 levels. Despite this, the load of suspended sediments will be kept relatively constant while bacteria and pathogens levels will be drastically reduced. Although not modeled explicitly, the contribution of sewage related floatables will also be significantly reduced or eliminated.

The distribution of the effluent will be greatly improved by moving discharges into deeper water and away from sensitive areas represented by the Northwest Arm and Bedford Basin. Marine diffusers will provide for significant initial dilution.

These improvements will be realized on an incremental basis as the STPs are phased in and become operational over a ten year period. This improvement is demonstrated in model output comparing future flows with and without the Project.

Figures 4.4 and 4.5 present the results of model simulations of future (2041) effluent concentration and FC levels both with and without the Project. Key conclusions regarding the information provided in the model output are presented below.

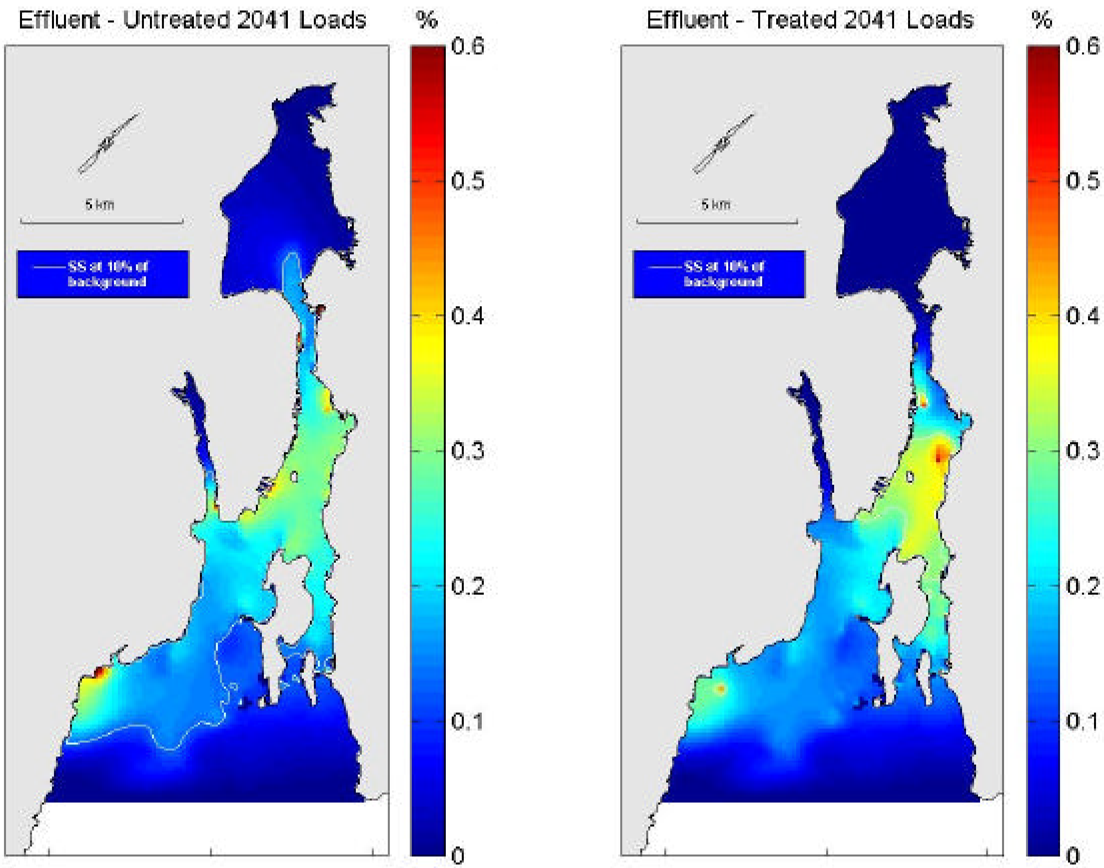



**Figure 4.4 Modeled Effluent Concentrations - Future Untreated and Treated Flows**

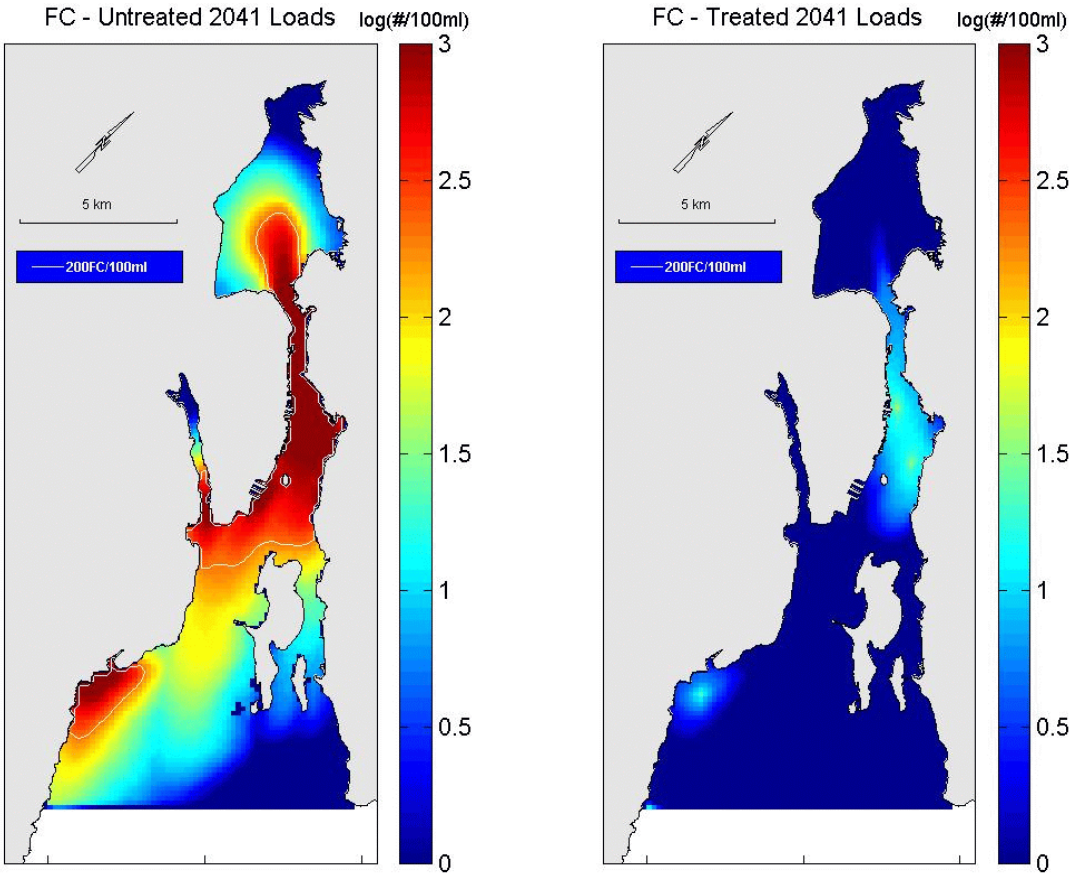



**Figure 4.5 Modeled FC Bacteria Concentrations - Future Untreated and Treated Flows**

**Comparison of Future Treated and No-Project Loads (Effluent Concentration)**

A comparison of treated and no-Project loads of effluent concentration projected for 2041 (Figure 4.4) suggest the following conclusions.

- Overall, the treated effluent is more centralized to the Inner Harbour region consistent with HHTF classification objectives.
- Effluent levels at the mouth of Northwest Arm are reduced significantly, consistent with its classification upgrade to SB.
- Effluent discharged at the Herring Cove site is more disperse due to being further offshore compared with current discharge point.
- Less effluent enters Bedford Basin with treatment. Thus, the relatively sensitive Basin region will be subject to less stress from effluent volumes in addition to benefitting from improved effluent quality.
- Overall effluent quality is improved as indicated by the SS contour representing 10 percent of background values.

**Comparison of Future Treated and No-Project Loads (FC Distribution)**

A comparison of treated and no-Project loads of FC projected for 2041 (Figure 4.5) suggest the following conclusions.

- Overall FC levels, and by inference pathogens, are greatly reduced by treatment; this is one of the primary purposes of the Project.
- FC levels from STP-treated effluent will not exceed the human contact guideline level anywhere in the Harbour outside a near-field mixing zone around each diffuser. Storm overflows will continue to result in occasional exceedences of the human contact level from time to time near CSOs.

Marine water quality may be adversely affected in highly localized areas associated with the near-field mixing zone of the outfall diffusers. These adverse effects will be minimized as a result of the use of engineered diffusers and the selection of outfall locations. The diffusers will be designed to provide an initial dilution of 50:1 for the treated effluent. Effluent dispersion will be further facilitated by the careful selection of outfall and diffuser locations. As described in Section 2.5.2, the proposed locations were selected within areas chosen for sufficient depth and currents to promote dispersion and to avoid sensitive areas (*e.g.,* Narrows/Bedford Basin, Northwest Arm). It is anticipated that any localized adverse effects on water quality will not conflict with guidelines in the water use classification system.

The HHCI project, which received environmental approval following a full environmental assessment and Panel Review, proposed consolidation to a single discharge. The present HHSP plan will achieve greater dispersion levels and reduced localized effects by comparison. While overflows will not be fully treated, Project design will fully treat at least 4 x ADWF.

Occasional storm overflows will occur at CSOs during times when the sewer flows exceed four times ADWF. Most CSOs will be located in the Inner Harbour at or near current untreated outfalls. Preliminary treatment (*e.g.,* screening) will be provided at the CSOs to remove some solids. The partially treated effluent discharged at CSOs will be diluted by the high storm water flows. These discharges will not conflict with the guidelines in the water use classification system for the Inner Harbour CSOs. Future overflows into the Northwest Arm in the vicinity of Chain Rock will occasionally exceed the water use guideline for contact recreation (SB) at that location. It is therefore recommended that the CSO near Chain Rock incorporate additional treatment, particularly disinfection, to meet the specified water use criteria for the Northwest Arm. The feasibility of different disinfection technologies (*e.g.,* UV, sodium hypochlorite) at that CSO will be investigated; it is not anticipated that chlorine gas will be used.

In summary, Project operation will provide widespread water quality improvements throughout the harbour in areas currently adversely affected by the discharge of untreated sewage. This improvement will permit the uses described in the water use classification system, including the upgrade for the Northwest Arm (assuming additional treatment at the Chain Rock CSO). Sensitive areas of the harbour (*i.e.,* Bedford Basin and the Northwest Arm) will be protected. Localized adverse effects will be minimized through the use of engineered diffusers and proper diffuser location.

Table 4.13 summarizes the residual environmental effects analysis for the operations phase.

### 4.2.6 Follow-up and Monitoring

The primary purpose of the HHSP is to improve marine water quality. Verification of oceanographic modeling results and projected treatment efficiencies may be undertaken through environmental effects and compliance monitoring, respectively. It is anticipated that regulatory agencies will assist HRM and its proponents to evaluate the need for follow-up studies and monitoring.

### 4.2.7 Summary of Residual Environmental Effects Assessment

In summary, it is anticipated that the Project will provide major improvements to marine water quality of the Halifax Harbour. The Project will therefore have a positive effect on this VEC.

**Table 4.12 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Marine Water Quality (Construction)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects: Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Social-cultural and Economic Context | Residual Environmental Effects Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| Marine outfall/diffuser installation (trenching or bottom lay) | C Resuspension of contaminated sediments (A) | C No mitigation required | 1 | 3 | 2 / 1 | R | 2 | N | 3 |

**KEY**

**Magnitude:** 1 = Low: *e.g.,* a minor change in water quality parameters, within natural variation; 2 = Medium: *e.g.,* a moderate change in water quality parameters, temporarily outside range of natural variability; 3 = High: *e.g.,* a large change in water quality parameters , outside the range of natural variation
**Geographic Extent:** 1 = <500 m²; 2 = 500 m² -1 km²; 3 = 1-10 km²; 4 = 11-100 km²; 5 = 101-1000 km²; 6 = >1000 km²
**Duration:** 1 = < 1 month; 2 = 1-12 months; 3 = 13-36 months; 4 = 37-72 months; 5 = > 72 months
**Frequency:** 1 = < 11 events/year; 2 = 11-50 events/year; 3 = 51-100 events/year; 4 = 101-200 events/year; 5 = >200events/year; 6 = continuous
**Reversibility:** R = Reversible; I = Irreversible
**Ecological/Socio-cultural and Economic Context:** 1 = Pristine area or area not adversely affected by human activity; 2 = Evidence of adverse effects.
**Residual Environmental Effect Rating:** S = Significant Adverse Environmental Effect; N = Non-significant Adverse Environmental Effect; P = Positive Environmental Effect
**Confidence:** 1 = Low level of Confidence; 2 = Medium level of Confidence; 3 = High level of Confidence

**Table 4.13 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Marine Water Quality (Operations)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects | | | | | Residual Environmental Effects Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Social-cultural and Economic Context | | |
| Collector system operation | C Localized reduction in water quality during storm overflow events (A) | C No mitigation required | 3 | 4 | 5 / 6 | R | 2 | P | 3 |
| STP operation | C Localized reduction in water quality in immediate vicinity of diffuser (A) | C Engineered diffusers<br>C Location of diffusers to promote dispersion | 1 | 1 | 5 / 6 | R | 2 | N | 3 |
| | C Discharge of treated sewage effluent (P) | C No mitigation required | 3 | 4 | 5 / 6 | R | 2 | P | 3 |

Refer to Table 4.12 for Key.

## 4.3 Marine Sediment Quality

Marine sediment in most areas of the Inner Harbour exhibit high concentrations of organics and metals due to its long history as an industrial port and receptor of untreated sewage discharges. The mobility of constituents between marine sediments and the overlying water column results in a relationship between these two media. Organic contaminants and metals in sediments may be ingested by benthic organisms or become biologically available if re-suspended into the water column. Therefore benthic and pelagic communities may be affected by changes in the sediment or water column. Sewage discharges may affect sedimentation in the harbour in terms of both quality and quantity of the sediment to be deposited, and the patterns of sediment distribution and deposition.

Additional information on this VEC can be found in "Marine Benthic Habitat and Sediment Characterisation at Each Diffuser Site"(JWEL 1999c), a component study conducted for the HHSP. The following documents prepared for the HHCI project are also relevant to this VEC: "Environmental Assessment Report", Sections 3.2.2 and 6.9 (HHCI 1992); and Marine Water and Sediment Quality (Land & Sea Environmental Consultants Ltd. 1991).

### 4.3.1 Boundaries

The spatial boundary for the assessment of sediment quality is the zone of influence of the deposition of sewage related material on the sea floor as determined by oceanographic modeling. The temporal boundaries of the assessment of sediment quality are continuous and year round as is the discharge of sewage effluent.

### 4.3.2 Description of Existing Conditions

A baseline study, "Marine Benthic Habitat and Sediment Characterisation at Each Diffuser Site" (JWEL 1999c) was conducted in August 1999. The methodology and results of the study are summarized in this section.

To characterize the sediment chemistry near the outfall/diffuser locations and potential depositional areas, sediment grab samples were collected in August 1999. Using a 0.1 $m^2$ Van Veen grab, three grab samples were collected from the Hospital Point area (Herring Cove). The grab samples were taken at the approximate outfall/diffuser location, at a point 100 m north and 100 m south of the outfall/diffuser. For the Halifax and Dartmouth locations, Figures F.1 and F.2 (Appendix F) show the geotechnical borehole locations from which surficial samples (from cores) were collected.

From the Van Veen samples and cores, a 250 mL sample was composited of material from the top 5 cm of sediment, and sent to a certified laboratory in Halifax for analysis. Analysis included the ocean disposal suite (grain size, PCBs, PAHs, DDD, DDE, DDT, lead, cadmium, copper, zinc and mercury, total organic and inorganic carbon) and petroleum hydrocarbons (TPH and BTEX).

**Halifax**

The sediment chemistry data for this site is provided in Table F.1, Appendix F. The concentrations of all the assessed parameters exceed the *Interim Contaminant Testing Guidelines for Ocean Disposal*. Location HN1 exhibits the highest concentrations which reflects its close proximity to an existing sewer outfall (Figure F.1). The concentrations of BTEX are non-detectable at HN1 and HN2, however, all four analytes were detected at HN3. There are no specific disposal limits for these parameters. At each sampling location, total PAHs exceed the *Interim Contaminant Testing Guidelines for Ocean Disposal*. The concentration of petroleum hydrocarbons exceed the guideline, but are not detected at location HN3.

PCBs and para-para DDE pesticide concentration exceed their limits only at HN1. This location was the only one where pesticides were detected.

**Dartmouth**

The sediment chemistry data for this site is provided in Table F.2. Chemistry analysis of the outfall/diffuser areas show two different bottom types. Sample D2 was taken in a gravel area where fine materials have not accumulated or have been scoured away (*e.g.* by vessels) (Figure F.2). No exceedances in metal concentrations were evident at this location. Lead exceeds the guideline limits at all other sites. At locations D3 and D4, zinc and mercury concentrations are at or exceed the *Interim Contaminant Testing Guidelines for Ocean Disposal*. The concentrations of PAHs, petroleum hydrocarbons and PCBs in the analyzed samples far exceed the interim guidelines.

**Herring Cove**

The marine sediments within 200 m of the proposed outfall/diffuser do not exceed the *Interim Contaminant Testing Guidelines for Ocean Disposal*, with the exception of total petroleum hydrocarbons (Table F.3). The presumed source of the hydrocarbons is from vessel activities in the harbour and the sewage outfall near Herring Cove.

### 4.3.3 Residual Environmental Effects Evaluation Criteria

A **significant** adverse effect is one that results in the degradation of marine sediment by causing the concentration of one or more parameters in the sediment to exceed the maximum allowable concentration stipulated in the *Ocean Dumping Regulations* under the *Canadian Environmental Protection Act*, in one or more subdivisions of the harbour. The effect is also considered significant if it causes a marked increase in the concentrations of one or more parameters such that any existing harbour use is further impaired or there is an increased threat to environmental health.

A **positive** effect is one that results in the improvement of overall marine sediment quality in a harbour area such that the environmental quality objectives are met or closer to being achieved.

### 4.3.4 Potential Interactions, Issues, and Concerns

Disturbance, and consequent resuspension of sediments during construction may result in redistribution of contaminated material over a wider area. During operations, sewer consolidation will result in the concentration of treated sewer discharges in areas not currently affected, or affected at lower flows. This could result in the redistribution of sewer related contaminants. The overall reduction of sewage related suspended solids being discharged to the harbour could have both localized and widespread positive effects on sediment quality.

### 4.3.5 Analysis, Mitigation, and Residual Environmental Effects Prediction

#### 4.3.5.1 Construction

The outfall pipes may be laid in an excavated trench on the seafloor which may involve dredging and blasting. Alternatively, if the sediments are suitable, the pipe may be surface laid on a granular mattress. While this second option will displace softer sediments, it will have less impact on the seafloor than the trenching option. In both cases, a granular cover will be backfilled over the pipe. Any excavated seafloor material from the Inner Harbour sites will likely be disposed on land due to the high levels of contaminants which would make it unsuitable for ocean disposal. The impacts associated with the trenching activity are related to re-suspension and dispersal of contaminated sediments from dredging operations.

Existing data on the quality of the marine sediments in the areas of outfall/diffuser locations proposed for Halifax and Dartmouth show significant contamination with regard to some of the ocean dumping guideline parameters. Each site is variable in types and levels of contamination grade. Monitoring results of other dredging projects indicate that the range of impact from re-suspension and dispersion is limited to within one kilometre from the site if no silt curtains are deployed (HHCI 1992). Considering the existing level of sediment contamination in the Inner Harbour, the effects of dispersion of sediments will likely be insignificant.

The sediments sampled near the proposed Herring Cove outfall/diffuser area are relatively clean, with slight contamination from hydrocarbons. Sediments in the immediate vicinity of the existing shoreline outfall at Watleys Cove were not evaluated for comparison. If outfall trenching occurs in relatively clean sediments, the dispersion of uncontaminated fine material will not affect sediment quality outside of the trenching/blasting area. If tunneling is undertaken, then minimal disturbance results to the seafloor.

Table 4.14 summarizes the residual environmental effects analysis for the construction phase.

### 4.3.5.2 Operation

An analysis was conducted to estimate areas of the harbour potentially affected by sedimentation resulting from residual suspended particles discharged in the treated effluent from the proposed STPs. This analysis was based on assumed residual suspended solids, settling rates, and modelling of diffused effluent concentrations.

The HHTF (1990) recommended an environmental quality guideline for discharge of suspended sediments of "10 percent of background". This criteria also minimizes sedimentation impacts by ensuring that sewage particles are not a significant portion of the natural suspended sediment load and, thus, will not constitute a large fraction of sedimented material. Where this guideline is achieved, it is assumed that sewage particles will not collect in high concentrations either in the water column or on the seabed.

Since the present levels of SS in Halifax Harbour are only approximately 1.2 mg/L, the Task Force criteria is rather stringent, defining a sewage contribution of only 0.12 mg/L. The end-of-pipe discharge limit for SS is 40 mg/L, therefore a dilution of approximately 330:1 is required to achieve the 10 percent objective.

Figure 4.4 shows the percent of diffused effluent projected to occur in 2041 at each STP diffuser location. The 10 percent SS guideline area for the treated 2041 scenario is approximately one fifth the area of the untreated 2041 scenario. Within a localized area, sedimentation is likely to occur from effluent discharge.

The actual amount of material that will settle in any particular area will be a complex function of ambient currents, turbulence levels, and particle settling rates. Treated discharge will behave notably differently than the present raw sewage discharge due mainly to the influence of treatment on: the quantity of solids; the settling rates of the remaining particles; and the distribution of discharge including initial dilution at the diffusers. Advanced primary treatment is expected to remove approximately 75 percent of all solids. The fraction of solids removed will tend to come from the large particle size range. The remaining suspended load will therefore be of a smaller average size and much less apt to settle; in fact without flocculation, settling rates would be very low. Study has shown that at present only about 50 percent of all sewage particles settle within the Harbour (Buckley and Winters 1991) despite poorly located shoreline outfalls.

Assuming that approximately 50 percent of sewage particles will settle in the harbour (a very conservative assumption) and assuming a 75 percent reduction in total solids from sewage treatment, the overall quantity of solids available for sedimentation is approximately 12 percent of input. Very likely, the amount of sedimentation will be further reduced because the material is of a relatively smaller particle size range and will not tend to settle quickly. In addition, discharge of the particles from deep marine diffusers as opposed to shoreline outfalls will cause them to be mixed higher into the water column in deeper water and hence, for any particular settling rate, the amount of material reaching the bottom in the vicinity of the diffuser will be reduced.

As discussed in Section 4.2.5.1, particles settling at a low rate of 1 mm/s (typical of fine unflocculated material) would be conveyed over distances of the order 1-2 km before settling. Quickly settling material representing the small fraction of large particles remaining in the treated discharge, or perhaps flocculated particles, could have much greater settling rates. This small fraction of the total solids would tend to settle within about 100 m of the diffusers. Table 4.15 summarizes the residual environmental effects analysis for the operations phase.

### 4.3.6 Follow-up and Monitoring

Verification of modelling results, removal efficiencies, and sedimentation rates are undertaken through effects and compliance monitoring, respectively. Regulatory agencies will assist HRM and its proponents to evaluate the need for follow-up studies and monitoring.

### 4.3.7 Summary of Residual Environmental Effects Assessment

Localized residual effects will result from accumulation of solids in the immediate area of the diffusers. Overall, the residual environmental effects on sediment quality are predicted to be positive because of the improvement of treated sewage discharged and reduction in accumulation of sewage related sediments on the seafloor.

**Table 4.14 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Marine Sediment Quality (Construction)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects | | | | | Residual Environmental Effects Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Social-cultural and Economic Context | | |
| Trenching and/or blasting for outfall/diffuser | C Redistribution of contaminated sediments (A) | C Land disposal of dredged sediments | 1 | 2 | 1 / 1 | R | 2 | N | 3 |

**KEY**

**Magnitude:** 1 = Low: *e.g.*, specific group or habitat, localized, one generation or less, within natural variation; 2 = Medium: *e.g.*, portion of a population or habitat, 1 or 2 generations, rapid and unpredictable change, temporarily outside range of natural variability; 3 = High: *e.g.*, affecting a whole stock, population or habitat outside the range of natural variation
**Geographic Extent:** 1 = <500 m²; 2 = 500 m² -1 km²; 3 = 1-10 km²; 4 = 11-100 km²; 5 = 101-1000 km²; 6 = >1000 km²
**Duration:** 1 = < 1 month; 2 = 1-12 months; 3 = 13-36 months; 4 = 37-72 months; 5 = > 72 months
**Frequency:** 1 = < 11 events/year; 2 = 11-50 events/year; 3 = 51-100 events/year; 4 = 101-200 events/year; 5 = >200events/year; 6 = continuous
**Reversibility:** R = Reversible; I = Irreversible
**Ecological/Socio-cultural and Economic Context:** 1 = Pristine area or area not adversely affected by human activity; 2 = Evidence of adverse effects.
**Residual Environmental Effect Rating:** S = Significant Adverse Environmental Effect; N = Non-significant Adverse Environmental Effect; P = Positive Environmental Effect
**Confidence:** 1 = Low level of Confidence; 2 = Medium level of Confidence; 3 = High level of Confidence

**Table 4.15 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Marine Sediment Quality (Operations)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects | | | | | Residual Environmental Effects Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Social-cultural and Economic Context | | |
| Discharge of treated sewage effluent | C Reduction of suspended solids and contaminants entering the harbour (P) | C No mitigation required | 3 | 4 | 5 / 6 | R | 2 | P | 3 |
| Refer to Table 4.14 for Key. | | | | | | | | | |

## 4.4 Marine Benthic Habitat

The seafloor provides habitat for demersal fish species and sedentary invertebrates. The marine benthic community is important for its ecological and resource harvesting value; environmental effects on the benthic fauna may affect finfish or shellfish populations in the area. The marine benthic community may be influenced by the accumulation of sewage materials in ecologically sensitive and commercially important areas. Related VECs and VSCs discussed in this assessment include: Marine Water Quality (Section 4.2); Sediment Quality (Section 4.4); and Commercial Fishery (Section 5.1).

Additional information on this VEC can be found in "Marine Benthic Habitat and Sediment Characterisation at Each Diffuser Site" (JWEL 1999c), a component study conducted for the HHSP. The following documents prepared for the HHCI project are also relevant to this VEC: "Environmental Assessment Report", Sections 3.2.3 and 6.7 (HHCI 1992); and "Marine Biological Environment" (JWEL 1991b).

### 4.4.1 Boundaries

The spatial boundary for the assessment of benthic habitat is the zone of influence of the deposition of sewage related material on the seafloor as determined by oceanographic modeling. The temporal boundaries of the assessment of benthic habitat are continuous and year round considering that the benthic habitat and associated communities are present year round as is the discharge of sewage.

### 4.4.2 Description of Existing Conditions

**Marine Benthic Habitat and Seafloor Communities Survey**

A subtidal benthic habitat survey was undertaken on August 26, 1999, at each of the three proposed outfall/diffuser areas, as depicted in Figures F.1 to F.3 (Appendix F). The results of this survey are provided in "Marine Benthic Habitat and Sediment Characterisation at Each Diffuser Site" (JWEL 1999c). The methodology and results of this study are summarized as relevant in this section.

Oceanographic modeling, conducted for HRM by Coastal Ocean Associates, predicts that the zone of deposition of sediment from treated sewage effluent is likely to occur within 100 m of the proposed diffuser for the STPs. A remotely-operated-vehicle (ROV) was employed to videotape 100 m transects perpendicular (north and south directions) to each diffuser location. Each transect consisted of a leadline set on the seafloor marked every 10 metres to provide reference. The benthic survey transects are indicated on Figures F.1 to F.3. Appendix F also contains photographs of the benthic habitat.

**Halifax**

The substrate in the outfall/diffuser area consists of silty, clayey sand (Table F.1) with much less flocculated material than observed on the Dartmouth side and at Georges Island. The bottom is flat with no natural hard surfaces for colonization by epiphytic plants or epifaunal animals. Photo 4 provides a view of the substrate in the surveyed area.

As with other areas of the harbour, the benthic community consists of an infaunal group of organisms dominated by polychaetes. Litter provides a substrate for sea anemones. The starfish (*Henricia sanguinolenta* and *Asterias* sp.) are the most abundant epifaunal animal.

**Dartmouth**

The benthic habitat north and south of the diffuser (between borehole 3 and 4) is composed of a very loose and fluid surficial sediment. The sediment consists predominantly of silt (Table F.2).

A sculpin and a small flatfish were the only fish observed. Starfish were the only numerous epifaunal organism; as with soft bottom areas, polychaete worms are the most prolific animal that live in such habitats (Photo 3). Along the north transect, a large metallic object (debris) provides a hard surface for dense colonization by sea anemones and seaweed (*Desmarestia aculeata*).

**Herring Cove**

The marine benthic habitat 500 m offshore of Hospital Point is typical for open water nearshore environments in Nova Scotia. The sediment consist of sand and silt and is classified as transgressive sand. The bottom sediment is relatively soft and essentially without large topographic feature diversity. This area consists of a considerable region of monotonous, unvegetated, featureless, sedimentary habitat. Habitat diversity is provided by small features such as polychaete tubes, fecal mounds, broken and half shells of small bivalves. The bottom is dominated by infaunal organisms (*e.g.,* polychaetes, amphipods, cumaceans, bivalves, etc.).

The underwater video survey showed a slight difference in benthic communities north and south of the proposed outfall/diffuser area (Photos 1 and 2 ). To the south, brittlestars were numerous (Photo 2 indicating a siltier substrate compared to the north transect). The benthic species observed included a few scallops (*Placopecten magellanicus*), abundant sea urchin (*Stronglyocentrotus droebachiensis*), hard clams such as cockles and perhaps quahaugs (*Mercenaria mercenaria*), rock crab (*Cancer irroratus*), horse mussels (*Modiolus modiolus*), starfish (*Asterias* sp.) and hermit crab (*Pagurus* sp.). The only fish observed during the survey were sculpins.

### 4.4.3 Residual Environmental Effects Evaluation Criteria

A **significant** adverse effect alters the benthic habitat either physically or biologically, in quality or extent, to such a degree that there is a decline in the species diversity of the habitat. This effect would be reflected by a decline in abundance and/or change in distribution of the benthic community within Halifax Harbour beyond which natural recruitment (reproduction and immigration from unaffected areas) would not return that population to its former level within several generations.

A **positive** effect is one that may enhance the quality, increase the species diversity or increase the area of the valued habitat.

### 4.4.4 Potential Interactions, Issues, and Concerns

The seafloor provides habitat for a diverse assemblage of both sedentary and mobile marine organisms. In addition to its inherent value as an ecosystem component, the marine benthic community is important with regard to resource harvesting. Environmental effects on the quality of the flora and fauna found on the seafloor may affect the success of the finfish and lobster fishery in the harbour. The marine benthic community may be influenced by the activities associated with the construction of the diffuser and the discharge of effluent. Sewage-related particles, though significantly reduced by sewage treatment, will settle on the harbour floor with some effect on benthic organisms during project operations.

### 4.4.5 Analysis, Mitigation, and Residual Environmental Effects Prediction

#### 4.4.5.1 Construction

At the Halifax and Dartmouth sites, the outfall pipes may be laid in a trench on the seafloor excavated by dredging or alternatively, laid on a mattress of granular material placed directly on the harbour floor, displacing soft sediment. Using either method, a granular cover will be backfilled over the pipe. Any excavated sediment from the Halifax and Dartmouth sites will likely be disposed on land because high levels of contamination could make it unsuitable for ocean disposal. The impacts associated with the trenching activity are physical disturbance to the benthic habitat and associated communities. The area of habitat to be disturbed will not be known until a final location and design for the outfall/diffuser is developed.

In Herring Cove the outfall pipe may be installed by tunneling with blasting at the ends to provide a trench at the intertidal zone and to breach the seafloor to accommodate the diffuser. In this scenario, the amount of habitat disturbance is minimal, however there are implications to marine fish and commercial fishing which are discussed in Section 5.1.

The benthic habitat associated with the Halifax and Dartmouth sites is poor and significantly influenced by municipal discharges. The benthos consists of a poorly consolidated anaerobic substrate with few epifaunal organisms. The granular backfill associated with the outfalls will be uncontaminated material that provides new habitat for epifaunal and infaunal benthic organisms and algaes that prefer hard substrate. Trenching will result in a localized improvement of benthic environment due to recolonization of a highly diverse community, though this effect will be relatively insignificant considering the existing poor quality of the benthic environment in the Inner Harbour. Considering the existing poor quality of the benthic environment at proposed Inner Harbour outfall/diffuser locations, the effect of construction on benthic communities is anticipated to be insignificant.

Sediments in the Herring Cove area, exclusive of Watleys Cove which is currently affected by untreated sewage discharge, are relatively clean with benthic habitat typical for deep water areas. If this outfall/diffuser is installed by drilling, interaction with the seafloor will result only in the intertidal zone and at the point where the diffuser riser emerges. A very localized impact is predicted. As at the other sites, if the outfall is constructed by trenching and backfilling, it will provide a narrow corridor of granular material not in abundance in this area. Red algal species will dominate the seaweed growth and a small reef like habitat and community will develop. A localized positive affect is likely to result, though relatively insignificant to the harbour area. Excavated material from the Herring Cove area will be acceptable for ocean disposal, if necessary.

Table 4.16 summarizes the residual environmental effects analysis for the construction phase.

#### 4.4.5.2 Operation

Advanced primary treatment will remove up to 75 percent of suspended solids currently discharged into the harbour in untreated sewage. Figure 4.2 shows the result of oceanographic modelling of percent of treated effluent at the STP diffuser locations in the year 2041. This will result in a positive effect in localized areas near outfalls currently discharging raw sewage as the volume of sediment loading decreases. The significant reduction in particulate matter deposition will reduce habitat degradation within the Inner Harbour generally and have positive effects for the Middle and Outer Harbour area as well.

The HHSP will result in some consolidation of existing sewers for treatment and discharge of treated effluent into areas not currently directly receiving discharges. Therefore there is the potential for localized habitat degradation in the area of the diffuser (*i.e.*, within 100 m).

With 75 percent removal efficiency of suspended solids with advanced primary treatment, combined with the high dilution of a diffused discharge, the accumulation of solids, and contaminants in the harbour will be considerably reduced. Therefore, the STPs are expected to have a positive effect, over the long term, on the marine benthic community within the harbour through a reduction in loading of suspended solids.

Table 4.17 summarizes the residual environmental effects analysis for the operations phase.

### 4.4.6 Follow-up and Monitoring

Verification of oceanographic modelling results and projected treatment efficiencies (*e.g.*, removal of suspended solids) are undertaken through environmental effects and compliance monitoring, respectively. Regulatory agencies will assist HRM and its proponents to evaluate the need for follow-up studies and monitoring.

### 4.4.7 Summary of Residual Environmental Effects Assessment

No significant adverse residual effects on the marine benthic habitat and associated communities from the Project are likely. It is likely that the Project will result in localized positive effects due to the introduction of a beneficial substrate and localized widespread positive effects from the significant reduction of the deposition of particulate matter.

**Table 4.16 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Marine Benthic Habitat (Construction)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects | | | | | Residual Environmental Effects Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Social-cultural and Economic Context | | |
| Trenching and/or blasting for outfall/diffuser | C Disturbance of benthic habitat (A) | C Compliance with DFO Guidelines For the Use of Explosives in or Near Canadian Fisheries Waters | 1 | 2 | 1 / 1 | R | 2 | N | 3 |
| Backfill with clean granular material | C Minor habitat improvement (P) | C No mitigation required | 1 | 1 | 1 / 1 | R | 2 | P | 3 |

**KEY**

**Magnitude:** 1 = Low: *e.g.*, specific group or habitat, localized, one generation or less, within natural variation; 2 = Medium: *e.g.*, portion of a population or habitat, 1 or 2 generations, rapid and unpredictable change, temporarily outside range of natural variability; 3 = High: *e.g.*, affecting a whole stock, population or habitat outside the range of natural variation
**Geographic Extent:** 1 = <500 $m^2$; 2 = 500 $m^2$ -1 $km^2$; 3 = 1-10 $km^2$; 4 = 11-100 $km^2$; 5 = 101-1000 $km^2$; 6 = >1000 $km^2$
**Duration:** 1 = < 1 month; 2 = 1-12 months; 3 = 13-36 months; 4 = 37-72 months; 5 = > 72 months
**Frequency:** 1 = < 11 events/year; 2 = 11-50 events/year; 3 = 51-100 events/year; 4 = 101-200 events/year; 5 = >200events/year; 6 = continuous
**Reversibility:** R = Reversible; I = Irreversible
**Ecological/Socio-cultural and Economic Context:** 1 = Pristine area or area not adversely affected by human activity; 2 = Evidence of adverse effects.
**Residual Environmental Effect Rating:** S = Significant Adverse Environmental Effect; N = Non-significant Adverse Environmental Effect; P = Positive Environmental Effect
**Confidence:** 1 = Low level of Confidence; 2 = Medium level of Confidence; 3 = High level of Confidence

**Table 4.17 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Marine Benthic Habitat (Operations)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects | | | | | Residual Environmental Effects Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Social-cultural and Economic Context | | |
| Discharge of treated sewage effluent | C Reduction of suspended solids and contaminants entering the harbour (P) | C No mitigation required | 3 | 4 | 5 / 6 | R | 2 | P | 3 |
| | C Localized habitat degradation in area of diffuser (A) | C No mitigation required. | 1 | 1 | 5 / 6 | R | 2 | N | 2 |

Refer to Table 4.16 for Key

## 4.5 Terrestrial Resources

Undisturbed terrestrial environment is extremely limited in the Project study areas. The majority of land affected by the proposed STPs is located in a highly developed urban setting. The collector system will, to a large extent, follow existing right-of-ways (*e.g.*, roads). Proposed Halifax and Dartmouth STPs sites are located in urban HRM and have hosted industrial and/or commercial land use in the past. However, the site proposed for the Herring Cove STP is a forested area, relatively undeveloped with the exception of a fiber optic cable facility constructed on the site in 1999. The site for the sewage sludge composting facility has not yet been determined, therefore its relevance to this VEC is presently unknown. Terrestrial resources has been selected as a VEC in recognition of potential Project interactions with vegetation and wildlife, at the proposed Herring Cove STP site, and potential interactions with freshwater and groundwater resources in the Herring Cove area.

Additional information on this VEC can be found in "Avifauna at the Proposed Herring Cove Sewage Treatment Plant" (JWEL 1999d). The following documents prepared for the HHCI project may also be relevant to this VEC: "Environmental Assessment Report, Sections 3.1, 6.1, 8.7.1, and 8.7.3 (HHCI 1992); "Wildlife Studies" (JWEL 1991c); and "Vegetation and Soil Survey" (JWEL 1991d).

### 4.5.1 Boundaries

Since the three urban STP sites and collector systems are in highly developed areas, the spatial boundaries for the assessment of effects on terrestrial environment are limited to the proposed Herring Cove STP site and surrounding lands, and MacIntosh Run. The temporal boundary of the assessment of effects on terrestrial resources includes Project construction and operation phases, with emphasis on sensitive wildlife periods (*e.g.*, nesting and breeding periods).

### 4.5.2 Description of Existing Conditions

#### Vegetation

The study area is largely occupied by mature coastal spruce-fir forest. Balsam fir (*Abies balsamea*), black spruce (*Picea mariana*) and white spruce (*Picea glauca*) are the dominant tree species. Along the north side of the property, significant insect damage has occurred in the softwoods. Mountain white birch (*Betula cordifolia*) and red maple (*Acer rubrum*) occur as scattered individuals over most of the site, however, at sites which were heavily disturbed in the past, these species can be as abundant as the fir and spruce. The shrub understory is relatively poorly developed at most locations and is composed largely of advanced regeneration of fir and spruce along with small patches of lambkill (*Kalmia angustifolia*). The ground vegetation is composed largely of mosses and liverworts including Schreber's moss (*Pleurozium schreberi*), stair-step moss (*Hylocomium splendens*), broom moss (*Dicranum* spp.), and bazzania (*Bazzania trilobata*). Vascular plants such as bracken fern (*Pteridium aquilinum*), goldthread (*Coptis trifolia*), bunchberry (*Cornus canadensis*), and twinflower (*Linnaea borealis*) are also present in the ground vegetation layer.

A narrow band of coastal barrens is found between the spray zone and the coastal fir-spruce forest. This band is typically only a few metres wide and consists of a mixture of stunted white spruce, creeping juniper (*Juniperus communis*), common juniper (*Juniperus horizontalis*) and various ericaceous shrubs including fox berry (*Vaccinium vitis-idaea*) and low bush blueberry (*Vaccinium angustifolium*).

Land to the west of the proposed STP site, upon which the fiber optic cable facility is located, previously consisted of abandoned pasture, highly disturbed from ATV traffic. Numerous well worn trails, garbage, abandoned vehicles and a fire pit at Sheehan Cove indicate frequent use by local residents.

**Freshwater Resources**

Two small watercourses occur within the property and are described as drainage features that carry surface and groundwater base flow, from the western portion of the property and lands on the opposite side of the Ketch Harbour Road, to drain into the harbour. These two small streams do not drain area lakes and do not provide suitable fish habitat nor have fish been observed. The northern of the two streams was culverted during the construction of the 360 Network Inc. fiber optic cable facility.

There is presently a pumping station at Roach's Pond that pumps sewage from Mainland South to discharge at Herring Cove (HHCI 1992). MacIntosh Run is a smaller river (ranging from 4 m to 12 m in width) which drains water from Long Lake to Halifax Harbour at Herring Cove. The ecosystem and existing conditions associated with the MacIntosh Run watershed are described in the HHCI Environmental Assessment Report (Section 3.1.1.5) (HHCI 1992). While some storage capacity is currently provided for storm overflows at the Roach's Pond pumping station, this capacity is frequently exceeded causing raw sewage to be discharged into the Run degrading water quality.

**Groundwater Resources**

There are few industrial or residential well water systems in the urban Halifax or Dartmouth areas since these areas are serviced by HRM's central piped water supply. The HHCI "Environmental Assessment Report" (Section 3.1.1.4) (HHCI 1992) describes the groundwater resources in the Herring Cove area which are generally provided by on-site residential well systems, except for several subdivision developments serviced by central well systems (LandDesign Engineering Services 2000). Residents have noted significant problems with well water quality and quantity in the Herring Cove area.

**Birds**

Two bird surveys were conducted on the Herring Cove site for the HHSP; one was conducted during the migration period (May 18, 1999), and the other, during the breeding season (June 16, 1999). The methodology of these surveys are detailed in the "Avifauna at the Proposed Herring Cove Sewage Treatment Plant" (JWEL 1999d). Thirty-eight bird species were recorded on the property during the migration survey (Table 4.18). The most abundant species present during this survey, in descending order of abundance, were: Black-throated Green Warbler, Golden-crowned Kinglet, Black-capped Chickadee, Magnolia Warbler, Yellow-rumped Warbler, and Dark-eyed Junco.

One of the species recorded during the survey, Merlin, is considered to be a rare breeding species in Nova Scotia (Scott 1994) but is frequently observed during migration (Tufts 1986). It was observed during the migration survey but was not observed during the breeding bird survey, suggesting that this species does not breed on the property. As such, construction of an STP on the property is unlikely to significantly affect this species.

Common Loon, a species considered to be sensitive to human activities (Nova Scotia Department of Natural Resources 1998) was also recorded near the property during the survey. Common Loon populations are threatened by poisoning through ingestion of lead, mercury and PCB's. In Nova Scotia, most threats to Common Loon populations are associated with breeding habitat in freshwater including ingestion of lead sinkers, mercury contamination of freshwater fish and loss or degradation of breeding habitat. The study area does not provide suitable breeding habitat and the site does not appear to attract large numbers of migrating or non-breeding loons (one Common Loon was observed approximately 500 m from the property on May 18, 1999 and none were observed on June 16, 1999). As such, construction of an STP is unlikely to have any significant effect on the local Common Loon population.

Two raptor species, Sharp-shinned Hawk and Merlin were observed during the migration survey. Neither species was recorded during the breeding season survey suggesting that they do not breed on the property.

Thirty-one species were recorded during the breeding season survey (Table 4.18). The most abundant species on or near the property during this survey were: Dark-eyed Junco, American Crow, Herring Gull, Blue Jay, Golden-crowned Kinglet, Black-throated Green Warbler, and Double-creasted Cormorant. Five species were confirmed as breeding on the property including: Blue Jay, Black-capped Chickadee, Red-breasted Nuthatch, and Golden-crowned Kinglet. Four species were classed as probable breeders including: Ruby-throated Hummingbird, Northern Flicker, Yellow-rumped Warbler, and White-throated Sparrow. The ten species classed as possible breeders included: American Robin, Ruby-crowned Kinglet, Blue-headed Vireo, Red-eyed Vireo, Black-and-white Warbler, Parula Warbler, Magnolia Warbler, Black-throated Green Warbler, Common Yellowthroat, and Song Sparrow. No evidence of breeding activity was recorded for the remaining species. None of the species recorded during the breeding season survey are considered to be rare in Nova Scotia (Scott 1994) or Canada (COSEWIC 2000), nor are any identified as being sensitive to anthropogenic activities (Nova Scotia Department of Natural Resources 1998). Migratory birds and nests are protected under the *Migratory Birds Conservation Act*.

**Table 4.18 Bird Species Recorded in or Near the Study Area - Herring Cove**

| Scientific Name | Common Name | Number Observed May 18, 1999 | Number Observed June 16, 1999 | Breeding Status |
|---|---|---|---|---|
| *Gavia immer* | Common Loon | 1 | - | Ne |
| *Phalacrocorax carbo* | Great Cormorant | 2 | - | Ne |
| *Phalacrocorax auritus* | Double-crested Cormorant | 6 | 10 | Ne |
| *Accipiter striatus* | Sharp-shinned Hawk | 1 | - | Ne |
| *Falco columbarius* | Merlin | 1 | - | Ne |
| *Bonasa umbellus* | Ruffed Grouse | - | 1 | Ne |
| *Larus marinus* | Great Black-backed Gull | 3 | 1 | Ne |
| *Larus argentatus* | Herring Gull | 7 | 15 | Ne |
| *Columba livia* | Rock Dove | 2 | 1 | Fo |
| *Archilochus colubris* | Ruby-throated Hummingbird | - | 1 | Pr |
| *Colaptes aureus* | Northern Flicker | 3 | 2 | Pr |
| *Tachycineta bicolor* | Tree Swallow | 2 | - | Ne |
| *Cyanocitta cristata* | Blue Jay | 7 | 14 | Cf |
| *Corvus corax* | Common Raven | - | 1 | Fo |
| *Corvus brachyrhynchos* | American Crow | 4 | 15 | Fo |
| *Parus atricapillus* | Black-capped Chickadee | 14 | 7 | Cf |
| *Parus hudsonicus* | Boreal Chickadee | 2 | 1 | Ne |
| *Sitta canadensis* | Red-breasted Nuthatch | 5 | 4 | Cf |
| *Certhia americana* | Brown Creeper | 1 | - | Ne |
| *Troglodytes troglodytes* | Winter Wren | 1 | - | Ne |
| *Turdus migratorius* | American Robin | 5 | 5 | Po |
| *Catharus guttatus* | Hermit Thrush | 2 | - | Ne |
| *Regulus satrapa* | Golden-crowned Kinglet | 18 | 12 | Cf |
| *Regulus calendula* | Ruby-crowned Kinglet | 1 | 1 | Po |
| *Bombycilla cedrorum* | Cedar Waxwing | - | 1 | Ne |

| **Table 4.18 Bird Species Recorded in or Near the Study Area - Herring Cove** | | | | |
|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Number Observed May 18, 1999** | **Number Observed June 16, 1999** | **Breeding Status** |
| *Vireo solitarius* | Blue-headed Vireo | 1 | 1 | Po |
| *Vireo olivaceus* | Red-eyed Vireo | - | 1 | Po |
| *Mniotilta varia* | Black-and-white Warbler | - | 1 | Po |
| *Parula americana* | Parula Warbler | 4 | 2 | Po |
| *Dendroica magnolia* | Magnolia Warbler | 11 | 2 | Po |
| *Dendroica coronata* | Yellow-rumped Warbler | 11 | 8 | Pr |
| *Dendroica virens* | Black-throated Green Warbler | 18 | 10 | Po |
| *Seiurus aurocapillus* | Ovenbird | 1 | - | Ne |
| *Geothlypis trichas* | Common Yellowthroat | - | 1 | Po |
| *Quiscalus quiscula* | Common Grackle | 6 | 1 | Ne |
| *Coccothraustes vespertina* | Evening Grosbeak | 2 | 2 | Fo |
| *Carpodacus purpureus* | Purple Finch | 3 | - | Ne |
| *Carduelis pinus* | Pine Siskin | 4 | - | Ne |
| *Carduelis tristis* | American Goldfinch | 5 | 2 | Fo |
| *Loxia curvirostra* | Red Crossbill | 3 | - | Fo |
| *Loxia leucoptera* | White-winged Crossbill | 6 | - | Fo |
| *Junco hyemalis* | Dark-eyed Junco | 10 | 17 | Cf |
| *Zonotrichia albicollis* | White-throated Sparrow | 1 | 1 | Pr |
| *Melospiza melodia* | Song Sparrow | 3 | 5 | Po |
| | **TOTAL** | 179 | 146 | |

**KEY**
Cf = Confirmed Breeder   Pr = Probable Breeder   Po = Possible Breeder
Fo = Observed Flying Over Study Area   Ne = No Evidence of Breeding Activity

**Other Wildlife**

No rare or vulnerable mammal or amphibian species have been observed on the site, nor is there any suitable habitat to suggest the presence of these species.

### 4.5.3 Residual Environmental Effects Evaluation Criteria

A **significant** adverse effect is one which affects the terrestrial or freshwater environment physically, chemically, or biologically, in quality or extent, to such a degree that there is a decline in the species diversity of the habitat, reflected by a decline in abundance and/or change in distribution of one or more populations of a species dependent upon that habitat, such that natural recruitment would not return the population(s), or any populations or species dependent upon it, to its former level within several generations.

A **positive** effect is one which may enhance the quality of habitat, increase species diversity and include the area of valued habitat.

A **significant** adverse effect with respect to groundwater includes any of the following uncompensated effects:

- yield from an otherwise adequate well supply decreases to the point where it is inadequate for intended use;
- the quality of groundwater from an otherwise adequate well supply deteriorates to the point where it becomes non-potable or cannot meet the Guidelines for Canadian Drinking Water Quality (Health Canada 1996); and/or
- the aquifer is physically or chemically altered to the extent that interaction with local surface water results in stream flow or chemistry changes that adversely affect aquatic life or surface water supply.

A **positive** effect on groundwater is one that enhances the quality or quantity of groundwater supplies.

### 4.5.4 Potential Interactions, Issues and Concerns

Potential interactions, issues and concerns related to Project effects on the terrestrial environment is loss of habitat and effects on sensitive species. Construction of the STP will result in loss of approximately 1 ha of forested habitat plus road clearing. The amount of forested habitat to be lost during construction is small relative to alternative habitat available throughout the general area. Small mammal species which use this site as part of their territory will naturally move to other suitable areas nearby. The project site does not appear to contain any unique terrestrial habitat, however, a rare vascular plant survey has not been conducted. The two watercourses on the site do not support fish habitat. Potential effects to groundwater resources includes changes in quality or quantity of well water supplies during project construction as a result of excavation and blasting activities near the STP site and areas connecting the STP, pumping station, and trunk sewer (refer to Figure 2.4).

There is potential for water quality in MacIntosh Run to improve during project operation. This impact would result from the planned addition of supplemental overflow storage capacity at Roach's Pond thus allowing fewer overflows into the Run.

Since a site has not yet been selected for the sewage sludge composting facility, its potential interactions with terrestrial resources are unknown at this time. Site reconnaissance will be conducted to determine whether terrestrial field surveys will be required at that site to accurately assess Project effects on the terrestrial resources at that site.

### 4.5.5 Analysis, Mitigation, and Residual Environmental Effects Prediction

#### 4.5.5.1 Construction

Construction of the STP will result in the loss of habitat for terrestrial bird species which currently use the site resulting in the displacement of these species. Spruce forests, such as the one present on the site, typically support between 150 and 450 pairs of birds/$km^2$ (Erskine 1977). The amount of habitat lost to construction of the sewage treatment plant will be approximately 1 ha, plus access road clearing. Therefore habitat loss associated with construction will result in the displacement of 1.5 to 4.5 pairs of birds, a very small proportion of the local population. In addition to direct habitat loss as a result of STP construction, there will likely be noise disturbance to species inhabiting the area surrounding the construction site. To the extent possible, construction activities will be scheduled to occur outside of the bird breeding season (avoiding May through August) to minimize effects on breeding and nesting activities. Species inhabiting the STP construction site area may be habituated to human activities and noise due to recent construction activities in the immediate area (*i.e.*, fiber optic cable facility) and local residents' recreational activities (*e.g.*, ATV traffic). The site does not provide critical habitat for any rare or particularly sensitive species, and thus, local populations of birds will not be significantly affected by habitat loss or noise associated with construction. Significant adverse residual environmental effects on birds or other terrestrial resources during Project construction are therefore unlikely.

Potential effects on groundwater resources as a result of project construction (*e.g.*, blasting, trench excavation) may include: dewatering of the local bedrock resulting in a drawdown of the water table; water quality degradation due to acid drainage from exposed mineralized slates; and decrease in well water quantity or degradation of quality associated with physical damage to wells during blasting. A well water survey will be conducted to collect baseline groundwater data for wells potentially affected by deep overburden excavation (dewatering), blasting, or acidic drainage. The survey will include: drilled wells located within 200 m of any blasting; dug wells within 30 m of any overburden cut; and all wells within 500 m of acidic drainage risk areas. The survey will include yield testing and sampling for general chemistry and bacteria scan. Ripping techniques will be used where possible in lieu of blasting, in proximity to residential water wells. Where encountered during construction, exposures of acidic slate will be protected and isolated with material such as shotcrete or impermeable fill, to direct any effluent away from residential wells. Mitigative measures will be undertaken to restore water quality and quantity of any wells adversely affected by the Project, including well replacement if necessary. Table 4.19 summarizes the results of the residual environmental effects analysis for the construction phase.

#### 4.5.5.2 Operation

Operation of the STP can disturb birds preventing them from utilizing suitable habitat. The site is currently surrounded by housing development, and the area where the STP is to be located is frequently used by ATVs. As such, birds using the site are already exposed to various sources of disturbance, and species particularly sensitive to anthropogenic activities do not make extensive use of the site. In addition, the field surveys indicated that the site does not provide critical habitat for rare bird species. Significant adverse residual environmental effects on birds or other terrestrial resources during Project operation are therefore unlikely. Environmental effects related to the operation of the sludge composting facility will be minimized since the facility will be designed and operated in accordance with the "Composting Facility Guidelines" (NSDOE 1998).

Project operation will result in positive effects on freshwater resources in Mainland South as there will be less overflow events to MacIntosh Run due to additional storage capacity provided at the Roach's Pond pumping station. Project operation is not expected to have a significant adverse effect on groundwater resources in Herring Cove assuming that the appropriate mitigative and, if necessary, remedial measures have been undertaken with regard to residential wells during the construction phase. A potential Community Integration Fund project associated with the Herring Cove STP is the provision of municipal water service to Herring Cove. Municipal water, if provided, would potentially benefit those homeowners currently suffering from poor well water quality. Table 4.20 summarizes the results of the residual environmental effects analysis for the operations phase.

### 4.5.6 Follow-up and Monitoring

Once the specific location of the Herring Cove STP site has been confirmed, rare plant, mammal and herpetile (amphibians and reptile) surveys will be conducted on the site to confirm no rare plant species will be affected by the Project. A well water survey will be conducted in Herring Cove prior to collector system or STP construction in that area. When the site is selected for the sewage sludge composting facility, a site reconnaissance will be conducted to determine whether there are any potential Project interactions with terrestrial resources at the site. If the site is previously undisturbed, terrestrial field surveys will be conducted as required. Consultation with the Atlantic Canada Conservation Data Centre (AC CDC) will help to direct site reconnaissance and survey efforts. Surface water and groundwater monitoring will be conducted as required, pursuant to the "Composting Facility Guidelines" (NSDOE 1998).

### 4.5.7 Summary of Residual Environmental Effects Assessment

Based on the relatively small area of forested habitat to be cleared, and the past disturbance of the site and surrounding properties through recreational ATV use and facility construction, disturbance associated with construction and operation of the site are therefore unlikely to have significant effects on local bird populations. There is not likely to be any significant adverse effects on groundwater; there will likely be a positive effect with respect to the potential provision of municipal water supply as a Community Integration project in Herring Cove. The Project will not interact with any other potentially rare or sensitive components of the terrestrial environment, therefore no adverse residual environmental effects on terrestrial resources are likely. There will likely be a positive effect in freshwater resources (*e.g.*, MacIntosh Run) as overflow events are reduced.

**Table 4.19 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Terrestrial Resources (Construction)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects: Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Social-cultural and Economic Context | Residual Environmental Effects Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| STP Construction (Herring Cove) | C Habitat loss and wildlife disturbance (A) | C Conduct rare plant survey at STP site prior to clearing<br>C Schedule construction activities to occur outside bird breeding season (May to August)<br>C Retain natural vegetation around the STP for wildlife habitat | 1 | 1 | 3 / 1 | R | 2 | N | 3 |
| Construction of Collector Systems | C Effect on well water quantity or quality due to excavation (A) | C Conduct pre-construction well water survey to identify and characterize water wells in proximity to construction activities<br>C Follow regulatory blasting guidelines<br>C Remedial action as necessary to restore damaged wells | 1 | 1 | 3 / 1 | R | 2 | N | 2 |
| Sludge composting facility construction | C Potential habitat loss and wildlife disturbance depending on site (A) | C Conduct rare plant and breeding bird surveys at site prior to clearing<br>C Schedule construction activities to occur outside bird breeding season (May to August) | 1 | 1 | 3 / 4 | R | 2 | N | 2 |

**Table 4.19 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Terrestrial Resources (Construction)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects | | | | | Residual Environmental Effects Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Social-cultural and Economic Context | | |

**KEY**

**Magnitude:** 1 = Low: *e.g.*, specific group or habitat, localized, one generation or less, within natural variation; temporary localized effects on aquifer that do not adversely affect well users; 2 = Medium: *e.g.*, portion of a population or habitat, 1 or 2 generations, rapid and unpredictable change, temporarily outside range of natural variability; temporary effects on aquifer to adversely affect water wells, require treatment or modification of wells; 3 = High: *e.g.*, affecting a whole stock, population or habitat, outside the range of natural variation; permanent damage to aquifer supplying wells or interacting with surface water resources, well water supplies need to be replaced

**Geographic Extent:** 1 = <500 m²; 2 = 500 m² -1 km²; 3 = 1-10 km²; 4 = 11-100 km²; 5 = 101-1000 km²; 6 = >1000 km²

**Duration:** 1 = < 1 month; 2 = 1-12 months; 3 = 13-36 months; 4 = 37-72 months; 5 = > 72 months

**Frequency:** 1 = < 11 events/year; 2 = 11-50 events/year; 3 = 51-100 events/year; 4 = 101-200 events/year; 5 = >200events/year; 6 = continuous

**Reversibility:** R = Reversible; I = Irreversible

**Ecological/Socio-cultural and Economic Context:** 1 = Pristine area or area not adversely affected by human activity; 2 = Evidence of adverse effects.

**Residual Environmental Effect Rating:** S = Significant Adverse Environmental Effect; N = Non-significant Adverse Environmental Effect; P = Positive Environmental Effect

**Confidence:** 1 = Low level of Confidence; 2 = Medium level of Confidence; 3 = High level of Confidence

**Table 4.20 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Terrestrial Resources (Operations)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects: Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Social-cultural and Economic Context | Residual Environmental Effects Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| STP operation (Herring Cove) | C Noise disturbance to wildlife (A) | C No mitigation required | 1 | 1 | 5 / 6 | R | 2 | N | 3 |
| | C Reduction of overflow events to MacIntosh Run (P) | C No mitigation required | 1 | 4 | 5 / 6 | R | 2 | P | 3 |
| | C Potential provision of municipal water supply as Community Integration project (P) | C No mitigation required | 2 | 3 | 5 / 6 | R | 2 | P | 2 |
| Sludge composting facility operation | C Noise disturbance to wildlife<br>C Potential effect on surface and groundwater resources from leachate (A) | C Facility operations will adhere to NSDEL Composting Facility Guidelines to manage leachate and monitor effects on surface water and groundwater | 1 | 1 | 5 / 6 | R | 2 | N | 2 |

Refer to Table 4.19 for Key.

# 5.0 SOCIOECONOMIC EFFECTS ASSESSMENT

## 5.1 Commercial Fishery

Halifax Harbour supports an active commercial fishery from which some licensed Nova Scotia fishers earn their livelihood. This fishery includes lobster, groundfish and pelagic species. The construction and operation of the sewage treatment facility may affect the income fishermen receive from the commercial fishery in the harbour in both positive and negative ways, depending on the impacts and benefits of the project.

Additional information on this VEC can be found in "Commercial Fisheries of Halifax Harbour" (JWEL 1999b). The following documents prepared for the HHCI project are also relevant to this VEC: "Environmental Assessment Report", Sections 4.4.3 and 7.6 (HHCI 1992); and "Commercial Fisheries of Halifax Harbour" (JWEL 1991e).

### 5.1.1 Boundaries

The spatial boundary for assessment of commercial fisheries includes the Inner, Middle and Outer Harbour regions. The temporal assessment boundaries have been developed in consideration of fishing seasons for commercial species. The lobster season in Halifax Harbour extends from the last Monday in November to May 31. Pelagic species are fished in the fall and early spring. Groundfish species are fished during the spring, summer and early fall.

### 5.1.2 Description of Existing Conditions

Information and data on commercial fisheries in the harbour was gathered from a variety of sources including a review of recent literature concerning commercial fisheries in the Halifax area, and interviews.

Interviews were conducted with a variety of fisher associations, fish holding facilities, individual fishers and Fisheries Officers. Where possible, a questionnaire and map was provided to gather feedback in written format. Where this was not possible, a telephone interview was conducted to respond to the questionnaire. Fisher associations were not a successful route for communicating with the fishers as the majority of the members were involved with fishing activities and could not be reached for their input.

"Commercial Fisheries of Halifax Harbour" (JWEL 1999b) includes detail on the study methodology and results. It also includes the sample questionnaire and a list of individuals contacted. The findings of this study are summarized in this section.

Statistical landing data and licencing information was obtained from Resources Allocation Branch of Fisheries and Oceans Canada. Specific information was requested on the landings and number of licences for the home ports located within Halifax Harbour.

**Licencing and Landings**

All commercial fisheries are regulated through the issuance of commercial licences by Fisheries and Oceans Canada. Various methods are used to control the amount of harvested fish (landings). The lobster fishery, for example, is controlled through the licence to fish in a defined area. Other control methods include a quota of allowable catch weight for a particular species such as haddock or pollock, or the imposition of trip limits or by-catch quotas as imposed on the haddock and cod fisheries in Area 20.

Halifax Harbour falls within the boundary of the Northwest Atlantic Fisheries Organization (NAFO) division 4W. Both cod and haddock continue to be under direct moratorium for directed fisheries within the 4W division. The moratoria were implemented in 1993 for the cod fishery and in 1994 for the haddock fishery. Both species are currently harvested on a limited basis under strict by-catch provisions of other directed groundfish fisheries.

Licencing data for the 1999 season was obtained for the home ports within the study area. The data is presented by species fished and by registered vessel class used to harvest the species. Table 5.1 presents the number of current licences for each home port within the Halifax Harbour study area. It should be noted that not all of the licences issued are currently being used, therefore, there may be discrepancies between licence data and verbal interview accounts of the number of fishers actively involved in a fishery.

Table 5.2 displays the landings data for all of the home ports within Halifax Harbour including Dartmouth, Eastern Passage, Herring Cove, Portuguese Cove, Purcell's Cove and Woodside. Due to confidentiality restrictions on obtaining commercial fisheries data for any species with less than three fishers per home port, all of the data has been presented in summary for the entire study area, including the total landings and values for the years 1996 and 1997, from both offshore and inshore fisheries. At the time of this report, final data was not available for either 1998 or 1999. It should also be noted that the landed values given are not necessarily associated with vessels registered to those home ports. For example, an offshore herring fleet based in another port may land herring in Halifax for shipment to processing plants elsewhere.

**Table 5.1 1999 Licencing Data for Home Ports Within Project Study Area**

| | | Total Number of Issued Licences for Individual Species | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Home port** | **Vessel Length Class (m)** | **Groundfish[1]** | **Herring** | **Mackerel** | **Lobster[2]** | **Shark** | **Swordfish** | **Tuna** |
| **Bedford** | 13.4 - 19.5 | 3 (4Vn) | 0 | 0 | 0 | 0 | 0 | 0 |
| **Dartmouth** | 0 - 13.4 | 2 (4VWX, 5) | 2 | 2 | 1 (Cat A) | 0 | 0 | 0 |
| **Eastern Passage** | 0 - 13.4 | 21 (4VXW, 5) | 22 | 22 | 16 (Cat A)<br>1 (Cat B) | 1 | 11 | 0 |
| | 13.4 - 19.5 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| **Halifax** | 0 - 13.4 | 11 (4VXW, 5) | 6 | 5 | 2 (Cat A) | 0 | 4 | 1 (NAFO 4 Wd) |
| | 13.4 - 19.5 | 4 (4VXW, 5) | 0 | 0 | 0 | 0 | 0 | 0 |
| | >30.5 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| **Herring Cove** | 0 - 13.4 | 6 (4VXW, 5) | 7 | 7 | 3 (Cat A) | 0 | 1 | 0 |
| **Portuguese Cove** | 0 - 13.4 | 2 (4VXW, 5) | 3 | 3 | 2 (Cat A) | 0 | 0 | 0 |
| **Purcell's Cove** | 0 - 13.4 | 0 | 2 | 2 | 0 | 0 | 0 | 0 |
| **Total Licences for Halifax Harbour** | | **50** | **42** | **41** | **24(Cat A)<br>1 (Cat B)** | **2** | **17** | **2** |

**[1] NAFO Subdivisions -** **Groundfish licences are issued with stipulations as to which areas can be harvested based on boundaries established by the North Atlantic Fisheries Organization (NAFO)**

**[2] Licence Categories -** **Category A is a transferable licence with a trap limit of 250**
**Category B is a non-transferable licence with a trap limit of 75**

| Table 5.2 Total Landings by Species for Home Ports of Dartmouth, Eastern Passage, Herring Cove, Portuguese Cove, Purcell's Cove and Woodside | | | | |
|---|---|---|---|---|
| SPECIES | 1996 Total Landings | 1996 Total Value | 1997 Total Landings | 1997 Total Value |
| | (Metric tonnes, round weight) | ($000's) | (Metric tonnes, round weight) | ($000's) |
| **Groundfish** | | | | |
| Cod | 47 | 65 | 58 | 90 |
| Haddock | 42 | 61 | 49 | 87 |
| Redfish | 437 | 182 | 585 | 247 |
| Halibut | 57 | 369 | 78 | 553 |
| Greysole (Witch) | 0 | 0 | 0 | 2 |
| Greenland Turbot | 0 | 0 | 5 | 6 |
| Pollock | 26 | 23 | 25 | 21 |
| White Hake | 250 | 1668 | 221 | 215 |
| Silver Hake | 1 | 0 | 307 | 327 |
| Cusk | 20 | 18 | 39 | 37 |
| Wolffish | 1 | 0 | 1 | 1 |
| Monkfish | 0 | 0 | 11 | 6 |
| Roundnose Grenadier | 0 | 0 | 1 | 1 |
| Red Hake | 0 | 0 | 3 | 1 |
| **Groundfish Total** | **882** | **887** | **1387** | **1597** |
| **Pelagic and other Finfish** | | | | |
| Herring | 10929 | 1527 | 16524 | 2031 |
| Mackerel | 36 | 16 | 3 | 2 |
| Swordfish | 2 | 22 | 2 | 20 |
| Bluefin Tuna | 31 | 745 | 60 | 1442 |
| Alewives (Gaspereau) | 4 | 1 | 0 | 0 |
| Eels | 0 | 18 | 0 | 24 |
| Skate | 74 | 27 | 334 | 110 |
| Dogfish | 0 | 0 | 1 | 0 |
| Shark | 116 | 162 | 365 | 802 |
| **Pelagic & Other Finfish Total** | **11192** | **2518** | **17291** | **4433** |

| Table 5.2 Total Landings by Species for Home Ports of Dartmouth, Eastern Passage, Herring Cove, Portuguese Cove, Purcell's Cove and Woodside | | | | |
|---|---|---|---|---|
| **SPECIES** | **1996 Total Landings** | **1996 Total Value** | **1997 Total Landings** | **1997 Total Value** |
| | **(Metric tonnes, round weight)** | **($000's)** | **(Metric tonnes, round weight)** | **($000's)** |
| **Shellfish and Mollusc** | | | | |
| Squid | 0 | 0 | 1 | 1 |
| Lobster | 26 | 284 | 31 | 347 |
| Red Crab | 212 | 392 | 136 | 246 |
| Sea Urchin | 0 | 0 | 0 | 0 |
| **Shellfish and Mollusc Total** | **238** | **676** | **168** | **594** |
| **Other** | | | | |
| Marine Plants | 0 | 0 | n/a | n/a |
| Sea Urchins | 1 | 2 | 0 | 0 |
| Fish Parts (livers, fins, oil, skins, etc.) | 0 | 54 | 0 | 0 |
| **Other Total** | **1** | **56** | **n/a** | **n/a** |
| **All Species Total** | **12313** | **4136** | **18961** | **6763** |
| Source: 1996, 1997 Landed Quantities and Value by Species, Commercial Data Division, Fisheries and Oceans, Scotia-Fundy | | | | |

## Commercial Fishery Activities

*Lobster Fishery*

The season for Lobster Fishing Area 33, which includes Halifax Harbour, is active between the last Monday in November and May 31. Figure 5.1 illustrates lobster fishing areas. The majority of the fishers in the Halifax area fish with 250 traps, using a transferable Category A licence that can be sold at a later date. The vessels used in this fishery are less than 13.7 m in length and generally have a crew of two or three. At the end of the 1998 - 1999 season, there were a total of 17 licences from Eastern Passage, five licences from Herring Cove, two from Portuguese Cove and one from Purcell's Cove (B. Sullivan, pers. comm. 1999). The majority of the lobster fishing activity within the Harbour occurs south of a line between the Halterm Container terminals and the Imperial Oil Refinery. The areas of greatest activity occur along the western shore of the Harbour, south of Ferguson's Cove, and the area south of McNabs Island, known as the Thrumcap Shoal.

There are reports of one fisher from Purcell's Cove who fishes throughout the entire Harbour on the western side (Halifax), including the two proposed diffuser locations for Halifax Peninsula North and South.

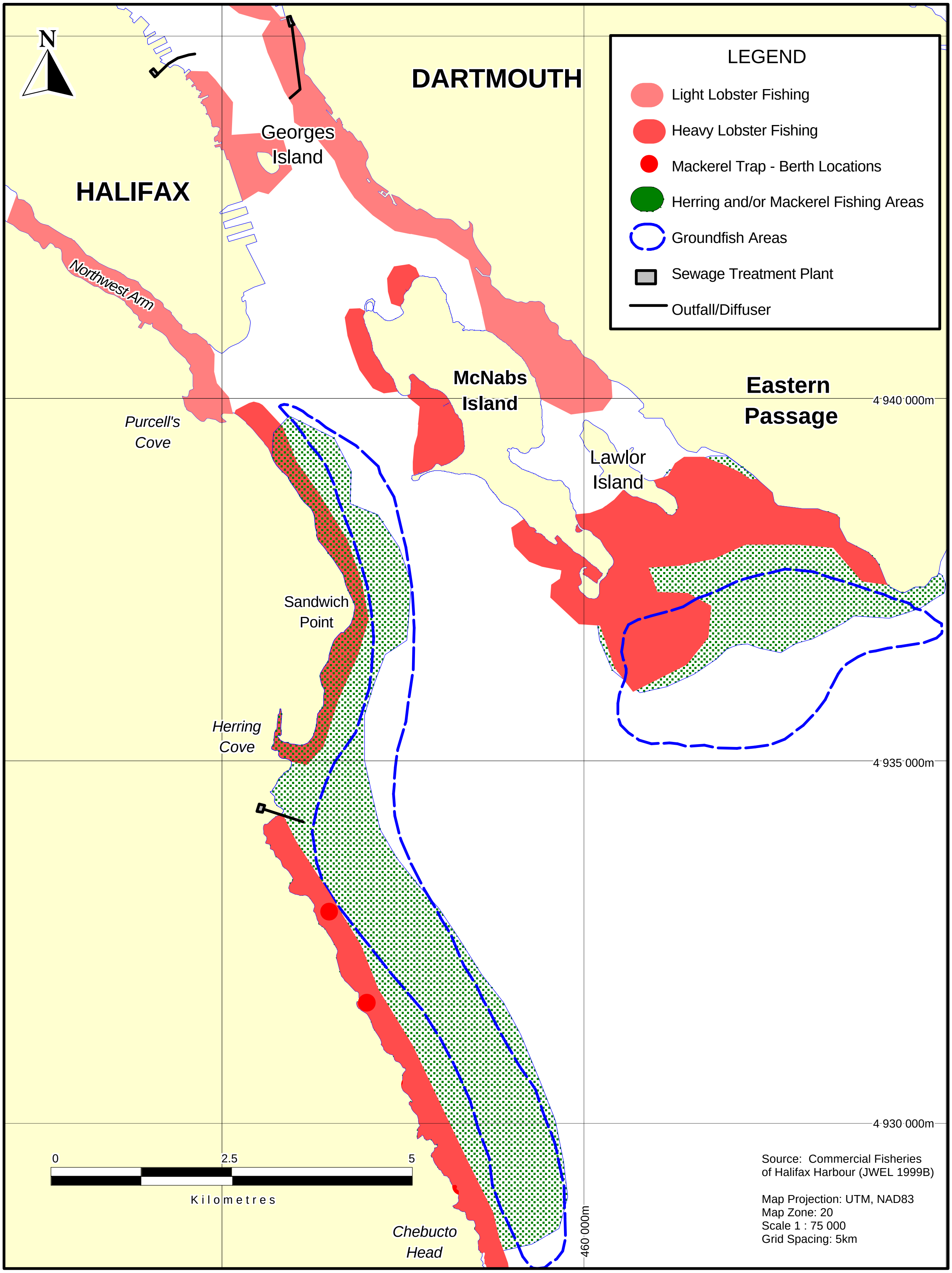



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Figure 5.1
Approximate Locations of Commercial Fisheries Activities in Halifax Harbour

Jacques Whitford Environment Limited

**Halifax Harbour Solutions Project**

HALIFAX REGIONAL MUNICIPALITY

Occasionally, other fishers from the western shore of the Harbour have fished in the more protected Harbour waters during the periods of bad weather experienced in January through March (T. Hennebury, pers. comm. 1999).

Similarly, fishers from Eastern Passage also move some of their traps inside to the north of McNabs Island during periods of heavy weather. These fishers fish the eastern side of the Harbour from Eastern Passage north to the entrance of the Bedford Basin. There are reports of three fishers from the Eastern Passage area who fish throughout the Harbour on a regular basis, with their full complement of traps inside for as much as two full months of the season (T. Hennebury, pers. comm. 1999). The proposed location for the marine diffuser associated with the STP site in Dartmouth is within what is considered to be productive lobster habitat that is fished regularly by at least two fishers, and occasionally by any of the other fishers from Eastern Passage.

The proposed location of the marine diffuser in the Herring Cove area is also located in what is considered to be productive habitat for lobster fishing. Fishers from all of the western shore ports of Halifax Harbour fish the entire length of the coastline between Purcell's Cove and Chebucto Head. Comments were made that Watleys Cove is no longer a productive harvest area for lobster possibly due to the poor quality of the water and habitat due to the existing sewage outfall.

*Pelagic Fishery*

Herring and mackerel are the two principle pelagic species that are fished regularly in Halifax Harbour. Figure 5.1 illustrates herring and mackerel fishing areas. Within the harbour, both of these species are fished primarily as a bait source for the groundfish and lobster fisheries and, to a lesser extent, for human consumption. There were no reports of herring being fished in the harbour as part of the herring roe fishery. Other pelagic species that are fished in the Halifax Harbour area include gaspereau, which have a spring migration up the Sackville River and on rare occasions, bluefin tuna which have been caught within the bounds of the harbour (B. Sullivan, pers. comm. 1999).

The herring fishery in Halifax Harbour is typically undertaken using either drift nets, gill nets or hand lines. These fishing methods are considered fixed gear and as a result, harvesting is controlled by the quota that is assigned to the fixed gear fleet for the coastal Nova Scotia herring stock in Area 20. There are currently 42 licences issued for fishers within the Halifax Harbour area, some of which belong to the Eastern Nova Scotia Fishermen's Protective Association and others which belong to the Halifax West Commercial Fishermen's Association.

Herring are fished mainly along the outer reaches of the harbour, south of Point Pleasant Park and south of McNabs Island using gill or drift nets. The season for the herring fishery is 12 months throughout the year, however, the herring are typically fished according to the timing of the runs along the coast. The spring herring run starts in late February and continues into March and April, while the fall run usually starts in September

(R. Young, pers. comm. 1999). Some fishers have reported fishing for herring throughout the harbour and even as far north as Mill Cove in the Bedford Basin. The proposed site of the marine diffuser in the Herring Cove area falls directly within a reported major herring migration path that is heavily fished by both Eastern Passage and the western shore fishers (Figure 5.1).

Although the season is open from June 1 to December 31, mackerel is predominantly fished as a source of bait for the lobster or groundfish fishery from late summer to early fall. This fishery also corresponds to timing of the mackerel runs, usually with an early summer run and a later fall run, and is most active in the outer reaches of the Harbour where the mackerel travel along the shoreline in tighter schools. Mackerel are harvested using gill nets and hand lines as well as mackerel traps, which are typically set along the western shore of the Harbour between Fergusons Cove and Chebucto Head. There have been approximately four traps or berths reported for this area (B. Sullivan, pers. comm. 1999).

Mackerel is also a very popular recreational species. The entire harbour area is subject to recreational fishers in both pleasure crafts and from the shoreline in select locations. There is no recreational catch limit for this fish and the season is generally from June to the end of the Labour Day weekend in September. Mackerel are likely to be fished in the areas of the proposed Dartmouth and Herring Cove diffuser locations.

Gaspereau are fished during the spring runs up the Sackville River in Bedford and are regulated by Fisheries and Oceans Canada through issuance of seasonal licences. The gaspereau are usually fished using either gill nets, trap nets, or dip nets and are usually fished at the entrance into the river system in which they will spawn. Gaspereau are also used as a bait fish for the groundfish and lobster fisheries.

Tuna are harvested during the summer months from June to October using either mid-water baited trawl or harpooning. There are no tuna fishing licences registered for any of the Halifax home ports although fishers from other areas of the Maritime provinces fish all along the coast of Nova Scotia. Tuna are often fished close to the coastline and can be chased into bays and harbours by vessels. One tuna was reported to have been caught in the mouth of the Bedford Basin in the mid 1990s (B. Sullivan, pers. comm. 1999).

*Groundfish Fishery*

The groundfish fishery in Halifax Harbour is conducted primarily using handlines although there are some reports of fishers using baited trawl (longline) or gillnets (W. Eddy, pers. comm. 1999). Figure 5.1 illustrates areas of groundfish fishing. The directed fishery for both cod and haddock has been under moratorium since 1994 in NAFO division 4W. Both species continue to be fished under by-catch provisions for other directed groundfish species such as pollock, white hake and Atlantic halibut. There are a total of 40 licences issued for vessels less than 13.7 m in length and these are the vessels most likely to be conducting groundfish harvesting within the Harbour. The season for this fishery is year round, with some specific closures for both spawning and juvenile rearing areas within the 4W division. The most active part of the season is from spring to mid or late summer.

Anecdotal reports from fishers indicate that the majority of groundfish harvesting takes place outside the inner Harbour to the south of McNabs Island and off Chebucto Head in the deeper waters. There has been groundfish harvesting throughout the Harbour, in particular to the southeast of Georges Island around Ives Knoll. Catch rates within the Harbour have been reported to be quite low and of little commercial interest.

Groundfish are also fished recreationally within the Harbour. The recreational season extends from early June to the end of the Labour Day weekend in September (R. Young, pers. comm. 1999). The recreational bag limit for groundfish is five fish per day per person excluding Atlantic halibut.

*Shellfish Harvesting*

All shellfish harvesting including the collection of clams, mussels and oysters is prohibited due to fecal coliform contamination within the boundaries of Halifax Harbour north of a line between Devils Island and Chebucto Head.

**Fish Holding Facilities**

Four fish holding facilities that use Harbour water as a water source for large fish aquariums or for live food storage were noted in the HHCI assessment. They were contacted regarding the proposed locations of the four diffusers for the HHSP. They include:

- Clearwater Fine Foods;
- Dalhousie Aquatron;
- Fisherman's Market; and
- Bedford Institute of Oceanography.

Since the HHCI study, however, the facilities at Fisherman's Market moved to a location in Bedford Basin, and as a result, there are no issues or concerns for this operation with respect to the proposed sewage treatment project. Of the remaining three facilities, only one response from Clearwater Fine Foods was received.

### 5.1.3 Residual Environmental Effects Evaluation Criteria

A **significant** adverse effect results in a measurable reduction in a fisher's income as a result of an adverse effect to fish populations or as a result of reduced fishing opportunity due to the presence of the outfall and diffuser.

A **positive** effect is defined as one that increases the success of catch of fish by fishers in the harbour, including re-opening shellfish harvesting.

### 5.1.4 Potential Interactions, Issues, and Concerns

The single greatest issue of all the fishers interviewed in relation to the proposed HHSP is the potential reduction in the amount of gear fouling that currently occurs. Fishers stated that objectionable floatables are often found attached to all types of gear that are used at any location in the harbour. Herring Cove fishers stated that gill nets, drift nets and mackerel traps set near existing sewer outfall at Watleys Cove left for more than a few days became soiled to the point that they had to be soaked and washed to remove the dirt and other contaminants.

Other fishers were concerned that the proposed locations of the Dartmouth and Herring Cove diffusers would degrade lobster habitat in these areas, as well as disturb the migration patterns of pelagic species. There were no concerns indicated about the location of the proposed Halifax STP and diffuser.

Most fishers indicated that any system that would reduce the number of active outfalls and reduce the floatables within the Harbour would be a definite improvement over the existing conditions. One fisher indicated that only full secondary sewage treatment should be considered as the final option, stating that the system in its current configuration would only pipe the sewage away from the higher profile areas of the waterfront and dump it in more remote locations that have viable fisheries.

Concerns indicated from one of the fish holding facilities included the high fecal coliform levels that are often present in the water and total dissolved organics that often result in high production of foam in the live lobster tanks. One concern about the proposed treatment system would be the potential increase in concentration of dissolved organics as a result of the consolidation of a numerous outfalls sewage and the dispersion from single outfalls. These concerns are addressed in Section 5.1.5.2.

### 5.1.5 Analysis, Mitigation, and Residual Environmental Effects Prediction

#### 5.1.5.1 Construction

The construction of diffusers associated with the Halifax STP site occurs in unproductive fishing grounds. These areas are also generally inaccessible to fishing activity due to vessel traffic and jetties. Therefore construction will have an negligible effect on commercial fishing in these locations.

The Dartmouth shoreline is fished for lobsters. Construction activities will have a temporary affect on lobster during trenching and installation of the portion of the outfall and diffuser which occurs in productive lobster habitat. To avoid interaction with lobster fishers, the most effective mitigation is to avoid construction during the lobster fishing season from the last week of November to May 31. Lobster are expected to recolonize the area after the outfall and diffuser are installed. The area of disturbance is less than one percent of the total productive fishing grounds and therefore the effect is considered insignificant.

The most actively fished of the proposed diffuser locations is at Herring Cove and surrounding waters. Construction activity is potentially disruptive to fishers in this area. If tunneling methods are employed then the interaction is expected to be limited to the blasting at the shore end and diffuser area. If the construction scheduling permits, blasting should be undertaken outside of the critical pelagic fishing periods. This schedule requires communication with local fishers, as the fishing periods for pelagics fluctuates with demand and species migrations. This same mitigation is applicable to dredging and blasting a trench. As well, adherence to Fisheries and Ocean's "Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters" (Wright and Hopky 1998) is required if blasting is to be used. As with the Dartmouth location, lobster are expected to recolonize areas of the seafloor that may be disturbed by outfall and diffuser construction.

Table 5.3 summarizes the residual environmental effects analysis for the construction phase.

#### 5.1.5.2 Operation

The STP removal efficiency for suspended solids is expected to be 75 percent. Sedimentation of waste particles may occur within the area predicted to be above background conditions as delineated by the three percent effluent concentration (Figure 4.4)

At the Dartmouth STP, the diffuser location is removed from the nearshore fishery, dilution is relatively good, and the benthic habitat is currently impacted by existing sewage discharges, and therefore, unproductive for lobster. The location for the Halifax South diffuser is not a highly productive lobster fishing area. No commercial fishing occurs in the vicinity of the diffuser associated with the Halifax STP.

The Herring Cove area experiences the most commercial fishing effort of the four diffuser locations. Floatables and sewage particulates foul gillnets and pelagic fish traps set in the vicinity of an outfall. Watleys Cove is largely avoided because of this problem. The STP is expected to remove 100 percent of the floatables and 75 percent of suspended solids, thus the potential for gear fouling at the diffuser sites is reduced significantly.

Dilution and dispersion is enhanced with the diffuser at 500 m from shore near Herring Cove. Although this exposes an area that does not currently receive sewage waste by means of an outfall, the proposed site offers sufficient depth for optimal mixing which is currently lacking at the Watleys Cove outfall location.

The consolidation of numerous outfalls to the STPs will result in an increase of effluent volume discharged at the four outfalls. However this will result in widespread improvements to Harbour quality in the Middle and Outer Harbour areas. Of the four fish holding facilities, Dalhousie's Aquatron facility will experience the most improvement as its intake is located in Northwest Arm. Due to an overall improvement in harbour water and sediment quality, and benthic habitat, there will be an overall positive effect on commercial fisheries and concerns raised by fish holding facilities will be adequately addressed.

Table 5.4 summarizes the residual environmental effects analysis for the operations phase.

### 5.1.6 Follow-up and Monitoring

Verification of modelling results and removal efficiencies are undertaken through effects and compliance monitoring, respectively. Regulatory agencies will assist HRM and its proponents to evaluate the need for follow-up studies and monitoring.

### 5.1.7 Summary of Residual Environmental Effects Assessment

Construction of outfalls and diffusers will be of short duration with disturbed areas of benthic habitat (where productive) able to recolonize. Treatment of the sewage will remove 75 percent of the sewage related particles that foul gear. Water quality and benthic habitat will be improved, creating an overall positive effect for commercial fisheries.

**Table 5.3 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Commercial Fishery (Construction)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects: Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Social-cultural and Economic Context | Residual Environmental Effects Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| Trenching and/or blasting for outfall/diffuser | C Interference with fishing activity<br>C Disturbance to fish and lobster<br>(A) | C Avoidance of fishing seasons<br>C Compliance with DFO Guidelines For the Use of Explosives in or Near Canadian Fisheries Waters | 1 | 2 | 1 / 1 | R | 2 | N | 3 |

**KEY**

**Magnitude:** 1 = Low: *e.g.*, specific group or habitat, localized, one generation or less, within natural variation; 2 = Medium: *e.g.*, portion of a population or habitat, 1 or 2 generations, rapid and unpredictable change, temporarily outside range of natural variability; 3 =High: *e.g.*, affecting a whole stock, population or habitat outside the range of natural variation
**Geographic Extent:** 1 = <500 m²; 2 = 500 m² -1 km²; 3 = 1-10 km²; 4 = 11-100 km²; 5 = 101-1000 km²; 6 = >1000 km²
**Duration:** 1 = < 1 month; 2 = 1-12 months; 3 = 13-36 months; 4 = 37-72 months; 5 = > 72 months
**Frequency:** 1 = < 11 events/year; 2 = 11-50 events/year; 3 = 51-100 events/year; 4 = 101-200 events/year; 5 = >200events/year; 6 = continuous
**Reversibility:** R = Reversible; I = Irreversible
**Ecological/Socio-cultural and Economic Context:** 1 = Pristine area or area not adversely affected by human activity; 2 = Evidence of adverse effects.
**Residual Environmental Effect Rating:** S = Significant Adverse Environmental Effect; N = Non-significant Adverse Environmental Effect; P = Positive Environmental Effect
**Confidence:** 1 = Low level of Confidence; 2 = Medium level of Confidence; 3 = High level of Confidence

**Table 5.4 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Commercial Fishery (Operations)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects | | | | | Residual Environmental Effects Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Social-cultural and Economic Context | | |
| Discharge of treated sewage effluent | C Reduction in gear fouling (P) | Consideration of siting the outfall closer to Watleys Cove (currently impacted by sewage and less heavily fished). | 3 | 4 | 5 / 6 | R | 2 | P | 3 |

Refer to Table 5.3 for Key.

## 5.2 Archaeological and Heritage Resources

For the purposes of this report archaeological and heritage resources are defined as those physical remains which inform us of the human use of and interaction with the physical environment. These resources may be both above and below the surface of the ground and cover the earliest prehistoric times to the relatively recent past.

An archaeological resource is a work of past human activity, or zoological, botanical, geological, or other natural materials found in association with such activity, that:

- is primarily of value for its prehistoric, historic, cultural, or scientific significance; and
- lay on, or was buried or partially buried in land in the province, including land covered by water.

Heritage resources are generally considered to include historic period sites such as cemeteries, heritage buildings and sites, monuments, and areas of significance to First Nations or other groups. Prehistoric refers to the time before the arrival of non-Aboriginal peoples.

Additional information on this VEC can be found in component studies conducted for the HHSP: "Archaeological Screening, Proposed STP Site, Barrington/Cornwallis/Upper Water Streets" (ADI 1999); and "Archaeological & Heritage Resources Overview Assessment" (JWEL 1999a). The following documents prepared for the HHCI project are also relevant to this VEC: "Environmental Assessment Report", Sections 4.6 and 7.8 (HHCI 1992); "Dartmouth Heritage Resources" (JWEL 1991f); "Heritage Resource Survey of the Halifax Collector Tunnel" (Porter Dillon 1991a); and "Marine Archaeological Survey" (JWEL 1991g).

### 5.2.1 Boundaries

Archaeological and heritage resources may be affected by any surficial or subsurface Project related activities or disturbances of the area within which these resources are located. The major interaction between Project activities and heritage resources will therefore occur during construction activities. The spatial boundaries of these interactions will be entirely within the physical limits of these activities. The temporal boundaries for the assessment will include the duration of construction. However, any potential adverse effect will be permanent, as no archaeological site can be returned to the ground in its original state. Longer term temporal boundaries will be considered in terms of erosional action around areas of construction which could negatively affect the integrity of heritage resources.

### 5.2.2 Description of Existing Conditions

Archaeological resources in the province of Nova Scotia are protected under the *Special Places Protection Act*, administered by the Nova Scotia Museum (NSM). Sites which are considered to be valued as archaeological resources may not be disturbed except under strictly controlled conditions imposed by terms of a Heritage Research Permit. The NSM is also responsible for approving or modifying recommended mitigation measures.

Limitations imposed on this assessment include the inability to accurately and completely predict the presence of all existing archaeological sites. However, previous experience in the area and with similar projects allowed the study team to develop a predictive model which, it is anticipated, has identified most of the sites or areas of high potential on or near the Project boundaries.

Relevant heritage resources surveys were conducted for both the previous HHCI project (1991 studies) as well as the current HHSP studies; these included:

- the proposed STP locations at: Halifax, Dartmouth (ADI 1999; JWEL 1999a), and Herring Cove (assuming location at Hospital Point);
- the Dartmouth collector tunnel system (JWEL 1991f); and
- the Halifax collector tunnel system (Porter Dillon 1991a).

The objectives of these studies were to identify all known and potential archaeological and heritage resources located within the area of the various project components. Specific types of resources considered during the surveys were:

- known and potential structures of historic or architectural significance located within the Project areas;
- known and potential First Nations and Euro-Canadian archaeological sites within the Project areas where subsurface disturbance will occur; and
- known and potential First Nations or Euro-Canadian archaeological sites located within the area of marine outfalls and diffusers.

**Methodology**

The assessment of heritage resource potential within the Project areas was composed of two major segments, a program of background research, followed by field surveys.

*Background Research*

The initial step in the assessment of each of the project components was to examine the various project plans to determine physical project boundaries. Several sites were visited to conduct a preliminary assessment of visible heritage resources, and to determine heritage potential and appropriate field survey strategies.

Historic background information was obtained from a number of sources for both the HHCI and HHSP studies, including:

- Nova Scotia Museum;
- Dartmouth Heritage Museum;
- Maritime Museum of the Atlantic;
- Public Archives of Nova Scotia;
- Land Registry Information Service;
- Halifax Defence Complex;
- Maritime Command Museum;
- Department of Natural Resources Map Library;
- Saint Mary's University Library;
- Dalhousie University Library; and
- Halifax Regional Library.

Additional information was solicited from persons with knowledge of the harbour and various terrestrial and marine heritage resources. Information regarding the use of the study area by First Nations for traditional purposes was solicited from the Confederacy of Mainland Mi'kmaq and the Union of Nova Scotia Indians (D. Christmas, pers. comm. 2001; D. Julian, pers. comm. 2001). No evidence regarding First Nations traditional use of lands to be used by the Project has been identified to the study team at this time.

*Field Surveys*

Field surveys were conducted using standard archaeological field procedures and in accordance with the provision of the *Special Places Protection Act*. Survey work involved: the identification of visible heritage features or structures; field assessment of heritage potential for sites where no visible or known subsurface features had been documented; and, either walking transects and/or subsurface testing at various locations where project facilities will be constructed ( ADI 1999; JWEL 1991f, 1999a; Porter Dillon 1991a).

An evaluation of archeological potential along the collector sewer routes was conducted for the HHCI project. Most of these routes are similar for the HHSP. As it was not feasible to survey the entire length of each of the collector sewer routes, field teams focussed on areas identified as potential locations of construction shafts and construction yards where tunnelling was proposed. In general, proposed tunnels will be located several metres below ground in solid bedrock. The potential impact on heritage resources will be in the upper few metres of access shafts and construction yards. The exception to this are those areas where sewers will be constructed using trenching, particularly along the north end of the Dartmouth line and at Herring Cove.

Subsurface testing was conducted for the HHCI using manual and mechanical means. Although manual excavation was the preferred methodology, infill deposits in the most heavily urbanized areas of Halifax and Dartmouth required the use of a backhoe (JWEL 1991f; Porter Dillon 1991a). It should be noted that testing was not possible at some sites due to particular site characteristics (*i.e.*, presence of pavement or buildings).

Artifacts recovered during the field surveys were analysed where appropriate, conserved when needed, and catalogued according to standard archaeological procedures. No subsurface testing was conducted for the 1999 studies of the proposed STP sites for HHSP.

An archaeological assessment was conducted at the Chain Rock Battery in Point Pleasant Park to determine archaeological resources in the vicinity of the proposed pumping stations. The Chain Rock Battery dates from 1762 and was rebuilt three times up to the twentieth century (R. MacDonald, pers. comm. 2001). The exact extent of the battery is unknown but remains of its earthworks are clearly visible on the site. The archaeological assessment included: consultation with NSM and Parks Canada personnel; archival review; and sub-surface testing for unrecorded archaeological resources.

An archaeological assessment was also conducted at the proposed alternate Halifax STP site in the Halifax Dockyard. The Naval Dockyard has been in active operation since the founding of Halifax in 1749 and has attracted much civilian activity. The location of the potential archaeological resources is not well known but the archaeological potential for this area is predicted to be moderate to high based on the lack of development within the study area. The archaeological assessment of this site included: consultation with NSM and DND personnel; archival review; and sub-surface testing for unrecorded archaeological resources.

**Results of Field Program**

*Historical Background*

Records at the Nova Scotia Museum indicated that no planned HHSP facilities are to be located on any known prehistoric archaeological sites (MARI 2000). However, there are a number of prehistoric archaeological sites in the Greater Halifax area that demonstrate the occupation and use of the harbour area from the retreat of the last Pleistocene glaciers 10,000 years ago, up to the period of contact between the Mi'kmaq and European settlers.

Archival and background information indicates that many of the Project related facilities will be located on or very near to land that has been used throughout the 250 year history of Halifax and Dartmouth. In particular, the central portion of the Dartmouth collection system and the south portion of the Halifax collector system run through areas of long historic use (JWEL 1991f; Porter Dillon 1991a). Archival research also indicated that the land for the proposed Herring Cove STP site had at one time been the location of a historic homestead (JWEL 1999a). Most of the remaining features of this homestead (*e.g.*, cellar) have been removed during the construction of a fibre optics cable facility located landward of the proposed STP site.

Underwater marine heritage resources are located near two of the proposed STP outfall/diffusers. This includes three shipwrecks near the Herring Cove site and two shipwrecks near the Dartmouth site (JWEL 1999a). Only one of the shipwrecks at the Herring Cove site, the *Deliverance*, could potentially be affected by the proposed outfall/diffuser location. At the Dartmouth site, the *Trongate* wreck has been recorded as lying where it could potentially be affected by the outfall/diffuser, depending upon final placement of he outfall pipe.

Along the collector system as defined by the HHCI project in 1991, 14 sites were identified has being subject to surface disturbance. Nine of these sites were tested for subsurface features (JWEL 1991f). Five archaeological sites were discovered as a result of testing, and were assigned Borden numbers by the NSM (HHCI 1992). The location and heritage resources from the HHCI study still relevant to the HHSP are detailed in Table 5.5.

**Table 5.5 Location and Nature of Discovered Heritage Resources**

| Location | Borden # | Resource |
|---|---|---|
| | ***Halifax*** | |
| Sackville and Lower Water Streets | n/a | Deposits of construction rubble; building foundation; ceramic tile drain; variety of 19th century artifacts |
| Barrington Street, between Young and Hanover | n/a | Burned refuse dump; four 19th century artifacts |
| | ***Dartmouth*** | |
| Geary Street | BdCv 16 | Dartmouth railway station, late 19th/early 20th century |
| Maitland Street | BdCv 17 | 19th century wharf/public dock |
| King Street | BdCv 18 | 19th century dump site |
| Jamieson Street | BdCv 19 | Late 19th/early 20th century dump site |
| Ferguson Road | BeCv 18 | Mid to late 19th century domestic structure |
| | ***Herring Cove*** | |
| Umlah Site | BdCv 31 | Historic cellar foundation; linear stone walls; domestic artifacts |

<u>Halifax</u>

A visual inspection of the Halifax STP site revealed that although all historic buildings have been demolished due to redevelopment over the latter portion of the 20th century, there are still remnants of 19th century structures and other historic features at ground level, particularly in areas which are not presently developed (ADI 1999).

Along the collector system a visual reconnaissance was made of six shaft locations proposed by HHCI. However, subsurface testing occurred at only three sites, mainly due to the presence of existing roadways and parking areas which did not allow access to the ground surface (Porter Dillon 1991a). Subsequent project redesign has changed the location of two of the tunnel system access sites (H7 and H8 in the 1991 study), only one of which had been tested (H7). At both locations along the current tunnel alignment where testing has occurred (*i.e.,* Sackville and Lower Water, Barrington between Young and Hanover) archaeological materials were encountered (Porter Dillon 1991a). These results are detailed in Table 5.5.

Archaeological testing at the proposed pumping station at Chain Rock revealed no archaeological features. A visual inspection of the cove north of the Chain Rock Battery site revealed no evidence to support pre-contact occupation of the cove (In Situ 2001a).

Archaeological fieldwork at the proposed alternate STP site identified two areas of moderate archaeological potential. The first is the northwest corner of the HRM property bordering Artz Street where testing indicated existence of intact late $19^{th}$ and $20^{th}$ century industrial deposits. The second area of archaeological potential was at the south end of the site on either side of the former Gerrish Street where two late $19^{th}$ to $20^{th}$ century cellars were identified (In Situ 2001b).

<u>Dartmouth</u>

A visual inspection of the Dartmouth STP site was undertaken for this study. All of the land where the facility is proposed to be located is the result of infilling. While no known archaeological or heritage resources exist at this site, the waterfront location suggests the possibility that there could be prehistoric archaeological resources within the project site boundaries. The proposed forcemains and collector sewers at the north and south ends of the Dartmouth collection system will run either under roads or along areas which have not been subject to archaeological testing.

<u>Herring Cove</u>

An archaeological assessment was conducted of the Herring Cove STP site (JWEL 1999a). A number of features related to a domestic homestead were located in the area of the proposed STP site (Table 5.5). A historic cellar (BdCv 31) has been mapped and partially excavated during an archeological assessment conducted for the development of the fibre optic cable facility subsequently built at the site. A number of artifacts associated with the house place the date of occupation in the mid $19^{th}$ century (JWEL 1999). A number of stone walls related to the cellar are still standing on the property.

No archaeological assessment has been conducted on the proposed Herring Cove collector system or pumping station facility.

### 5.2.3 Residual Environmental Effects Evaluation Criteria

A **significant** adverse effect is one which comprises any unmitigatable Project related disturbance to, or destruction of, archaeological or heritage resources considered by affected communities, First Nations, or provincial heritage regulators to be of major importance due to factors such as rarity, condition, spiritual importance, or research importance.

A **positive** effect is one that results in enhanced understanding of local, regional, or cultural heritage through increased knowledge, or provides physical protection for a site that might otherwise have been destroyed through natural or non-Project anthropogenic events, in the absence of the Project.

### 5.2.4 Potential Interactions, Issues, and Concerns

Certain activities associated with the construction of the proposed STPs and collector systems will cause surficial or subsurface disturbance which could affect archaeological and heritage resources. These disturbances, if unmitigated, could result in the loss of the resource and the potential knowledge to be gained from its interpretation. As a result of the archaeological and heritage resources research program conducted for this assessment, 23 areas of heritage potential have been identified within the limits of Project-related facilities (refer to Table 5.6).

Effects on archaeological and heritage sites are not likely to occur during the operation phase of Project facilities, being limited to possible subsurface disturbance during facility maintenance. With new information being gathered and made available to researchers, communities, regulators, and other stakeholders, the potential overall effect of the project could be seen as positive.

### 5.2.5 Analysis, Mitigation, and Residual Environmental Effects Prediction

#### 5.2.5.1 Construction

A total of 23 locations of archaeological/heritage potential have been identified within the limits of the Project (Table 5.6). Eighteen of these sites were examined for the HHCI project. The remaining locations are the result of differences between the HHCI and HHSP. In general, it is preferable to avoid areas of elevated heritage potential. However, avoidence may not be practical, particularly for the Project areas in downtown Halifax and Dartmouth, where historic occupation is widespread, and any location chosen for project facilities is likely to encounter heritage remains. A number of Project sites have been tested and the heritage resources recorded (Table 5.5). All of the heritage areas identified could be adversely affected by Project activities if recommended mitigation for each location is not followed. Locations and recommended mitigation procedures are presented in Table 5.6 and described below for each of the Project areas.

All 23 sites will require monitoring by a qualified archaeologist during Project construction activities. A total of five sites (three in Halifax, one each in Dartmouth and the Herring Cove sites) will require archaeological assessment and/or subsurface testing prior to any construction activities due to differences in Project design between HHCI and HHSP. These areas were not tested for the HHCI project. If heritage resources are identified during testing or monitoring further archaeological work, possibly including archaeological site excavation, may be required. Appropriate mitigation will be determined by the archaeological monitor and personnel from the NSM.

**Table 5.6 Recommended Mitigation for Heritage Locations**

| Site | Mitigation |
|---|---|
| ***Halifax*** | |
| Sackville & Lower Water Streets | Monitoring during construction |
| Duke & Lower Water Streets | Pre-construction assessment; monitoring during construction |
| Barrington Street between Young & Hanover | Monitoring during construction |
| Duffus & Barrington Streets | Monitoring during construction |
| Chain Rock Pumping Station to Ocean Terminals | Pre-construction assessment: monitoring during construction |
| Point Pleasant Drive/Halterm Entrance | Pre-construction assessment; monitoring during construction |
| Halifax STP and/or Alternate STP Site | Pre-construction assessment; monitoring during construction |
| ***Dartmouth*** | |
| Ferguson Road | Monitoring during construction |
| Jamieson Street | Monitoring during construction |
| Geary Street | Monitoring during construction |
| King Street | Monitoring during construction |
| Maitland Street | Monitoring during construction |
| Pinehill Road | Monitoring during construction |
| Cuisack Street | Monitoring during construction |
| Grove Street | Monitoring during construction |
| Lyle Street | Monitoring during construction |
| North Street | Monitoring during construction |
| Melva Street | Monitoring during construction |
| Forcemain and Collector Sewer, North End | Monitoring during construction |
| Forcemain and Collector Sewer, South End | Pre-construction assessment; monitoring during construction |
| Dartmouth STP | Monitoring during construction |
| ***Herring Cove*** | |
| Herring Cove Pumping Station & Forcemain | Pre-construction assessment; monitoring during construction |
| Herring Cove STP | Monitoring during construction |

**Halifax**

A total of seven sites within the Halifax STP and collector route will require further archaeological work (Table 5.6). Three of these sites, Duke and Lower Water Streets, the Halifax STP site (and/or alternate site), and the Point Pleasant Drive/Halterm Entrance will require pre-construction archaeological testing to fully delineate heritage features and/or potential. Construction monitoring is recommended for all seven sites (Table 5.6).

**Dartmouth**

A total of 14 sites for the Dartmouth STP and collector system could be affected by Project related activities. Nine of these sites - Cuisack Street, Old Ferry Road, Maitland Street, King Street, Geary Street, Jamieson Street, Pinehill Road, and Ferguson Road - have been subject to previous testing, resulting in the recording of five archaeological sites (Table 5.5). Archeological monitoring during construction is recommended for all 14 sites if subsurface distance is to take place.

**Herring Cove**

The Herring Cove pumping station and collector system has not yet been assessed for archaeological sites and heritage potential. It is recommended that once final plans for this facility are determined that a full archaeological assessment of the Project facilities be undertaken prior to Project activities. Monitoring of construction activities at these facilities, as well as the location of the STP is also recommended (Table 5.6).

Table 5.7 summarizes the residual environmental effects analysis for the construction phase.

#### 5.2.5.2 Operation

Adverse effects on archaeological and heritage resources during operations are unlikely to occur. Potential effects would be limited to inadvertant subsurface disturbance of resources during facility maintenance in previously undisturbed areas. Mitigation consists of worker education to minimise the risk of such effects. Table 5.8 summarizes the residual environmental effects analysis for the operation phase.

### 5.2.6 Follow-up and Monitoring

Follow-up work required includes more clearly delineating the location of outfalls in order to minimize potential effects on underwater heritage sites. It is also recommended that an archaeological assessment be made of Project facilities not yet identified including sludge management facilities and any new access roads into Project facilities. It should also be noted that any changes in the Project which are not covered by either the HHCI or HHSP studies will require further archaeological assessment.

Recommendations for archeological monitoring are presented as construction mitigation measures in Section 5.2.5.1. No long term monitoring of project operations on heritage resources is required.

### 5.2.7 Summary of Residual Environmental Effects Assessment

The development of the proposed STPs and related collector system has the potential to disturb any archaeological or heritage sites that may exist within these areas during surficial and subsurface Project activities. Assuming that proper mitigative procedures are followed and recommended follow-up work is completed prior to construction, significant adverse residual environmental effects of the Project on archaeological and heritage sites are not likely. Moreover, with new information being gathered and made available to researchers, communities, regulators, and other stakeholders, the potential effect could be seen as positive.

**Table 5.7 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Archaeology and Heritage Resources (Construction)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects: Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Socio-cultural and Economic Context | Residual Environmental Effect | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| C Trenching and/or blasting for the collector system, including pumping stations<br>C Installation of surface shafts associated with tunneling<br>C STP excavation<br>C Sludge management facility excavation | C Disturbance of any archaeological, heritage or traditional land use resource (A) | C Pre-construction testing at selected locations<br>C Monitoring during all activities involving surface disturbance<br>C Contingency plan for discovery of resources<br>C Archaeological excavation of resources which may be disturbed | 2 | 3 | 4 / 6 | I | 2 | N | 3 |
| | C Improved understanding of cultural history (P) | C No mitigation required | n/a | n/a | 5 / 6 | n/a | 2 | P | 3 |

## Table 5.7 Residual Environmental Effects Assessment Matrix
## Valued Environmental Component: Archaeology and Heritage Resources (Construction)

**KEY**

| | |
|---|---|
| **Magnitude:** | 1 =Low: *e.g.*, all or part of a site of minor importance, common resource with virtual duplicates; 2 = Medium: *e.g.*, all or part of a site not fully assessed, part of a rapidly depleting group of sites; 3 =High: *e.g.*, all or part of a site considered to be of major importance due to individual attributes or rarity. |
| **Geographic Extent:** | 1 = <500 $m^2$; 2 = 500 $m^2$ -1 $km^2$; 3 = 1-10 $km^2$; 4 = 11-100 $km^2$; 5 = 101-1000 $km^2$; 6 = >1000 $km^2$ |
| **Duration:** | 1 = < 1 month; 2 = 1-12 months; 3 = 13-36 months; 4 = 37-72 months; 5 = > 72 months |
| **Frequency:** | 1 = < 11 events/year; 2 = 11-50 events/year; 3 = 51-100 events/year; 4 = 101-200 events/year; 5 = >200events/year; 6 = continuous |
| **Reversibility:** | R = Reversible; I = Irreversible |

**Ecological/Socio-cultural and Economic Context:** 1 = Pristine area or area not adversely affected by human activity; 2 = Evidence of adverse effects.

**Residual Environmental Effect Rating:** S = Significant Adverse Environmental Effect; N = Non-significant Adverse Environmental Effect; P = Positive Environmental Effect

**Confidence:** 1 = Low level of Confidence; 2 = Medium level of Confidence; 3 = High level of Confidence

**Table 5.8 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Archaeology and Heritage Resources (Operations)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects | | | | | Residual Environmental Effect | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Socio-cultural and Economic Context | | |
| Facility maintenance or repair involving subsurface disturbance | C Inadvertent disturbance of previously undisturbed resources (A) | C Monitoring<br>C Education<br>C Contingency plan | 2 | 2 | 5 / 6 | I | 2 | N | 3 |

Refer to Table 5.7 for Key.

## 5.3 Land Use

Land use is considered a VSC due to its importance to residential communities and the local economy in the respective study areas. Any Project-related effect on land use has the potential to alter established patterns of activity within these communities. Other potential effects on lands in the study area are discussed in other sections of this report (Section 4.1, Atmospheric Resources; Section 5.4, Transportation, and Section 5.5, Public Health).

The following documents prepared for the HHCI project are also relevant to this VSC: "Environmental Assessment Report", Sections 4.2, 4.3, 4.4, 7.2, 7.3, and 7.5 (HHCI 1992); "Demographics, Land and Water Use" (Porter Dillon Limited 1991b); "Community Profiles" (MacLaren Plansearch Limited 1991b); and "Tourism and Recreation" (JWEL 1991h).

### 5.3.1 Boundaries

The spatial boundaries of the assessment of land use have been developed in consideration of the specific types of land use (*e.g.*, residential, commercial/industrial) and potential effects and potential Project-related effects on use of the land. The assessment boundaries related to the proposed STP sites (250 m radius) are indicated on Figures 5.2, 5.3, and 5.4. Spatial boundaries associated with collector systems are indicated on Figures 2.2 to 2.4. Though different land uses may be affected by different Project activities at various periods during Project construction, the temporal boundaries for the assessment are regarded as continuous during all phases of the Project. Seasonal considerations for land use are an important temporal boundary during Project operation due to increased outdoor activities and potential increase/reduction in sewage-related effects.

An important temporal consideration for this assessment is that the various Project components are scheduled to be constructed over a 10 year period. Land use could potentially change significantly over that period of time. It may be necessary to review aspects of the assessment pertaining to land use for currency as components of the Project near development.

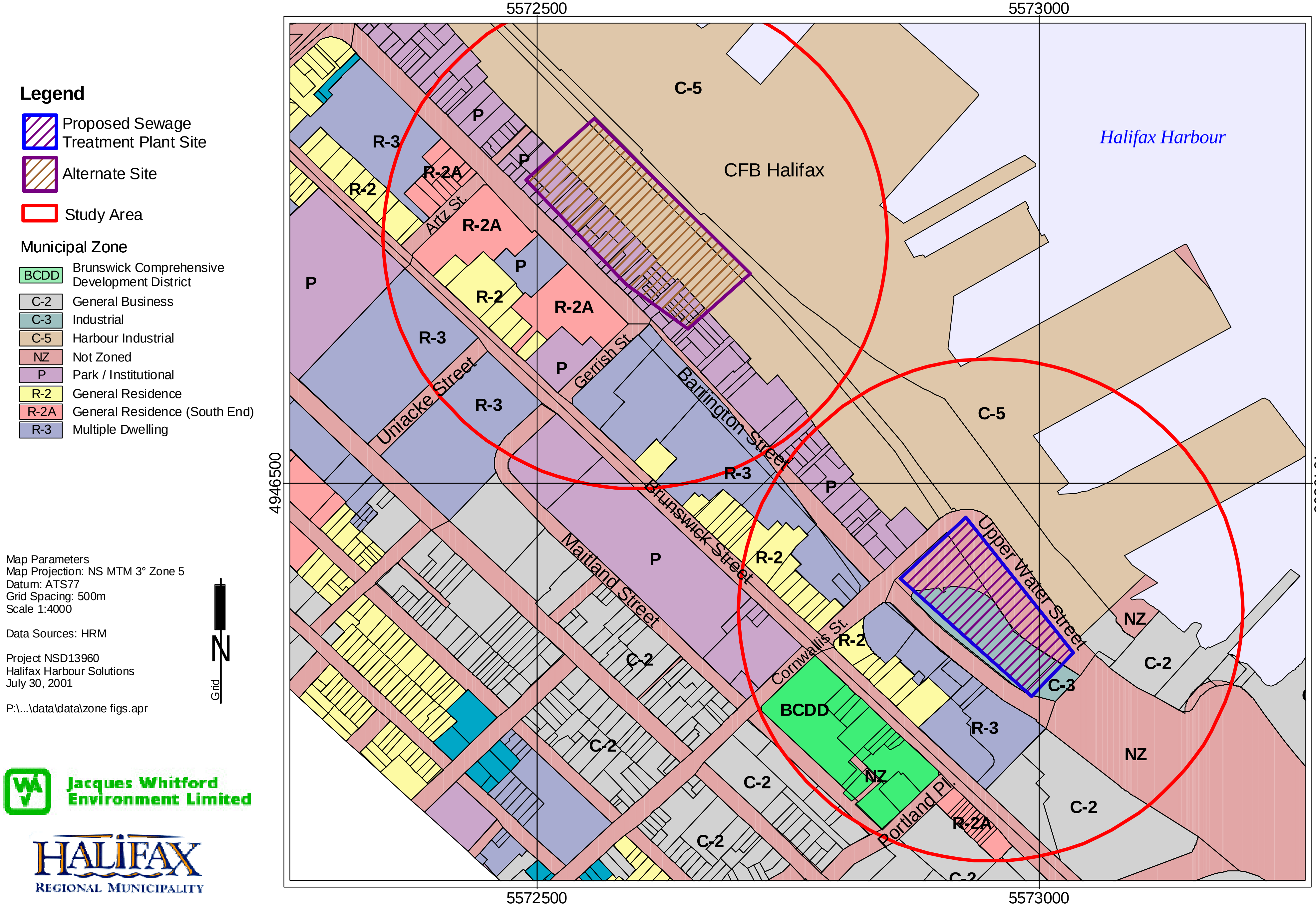
### 5.3.2 Description of Existing Conditions

Existing land use in the study areas was characterized through field reconnaissance, review of relevant municipal planning documents, associated documents, and consultation with municipal planning staff and development officers.

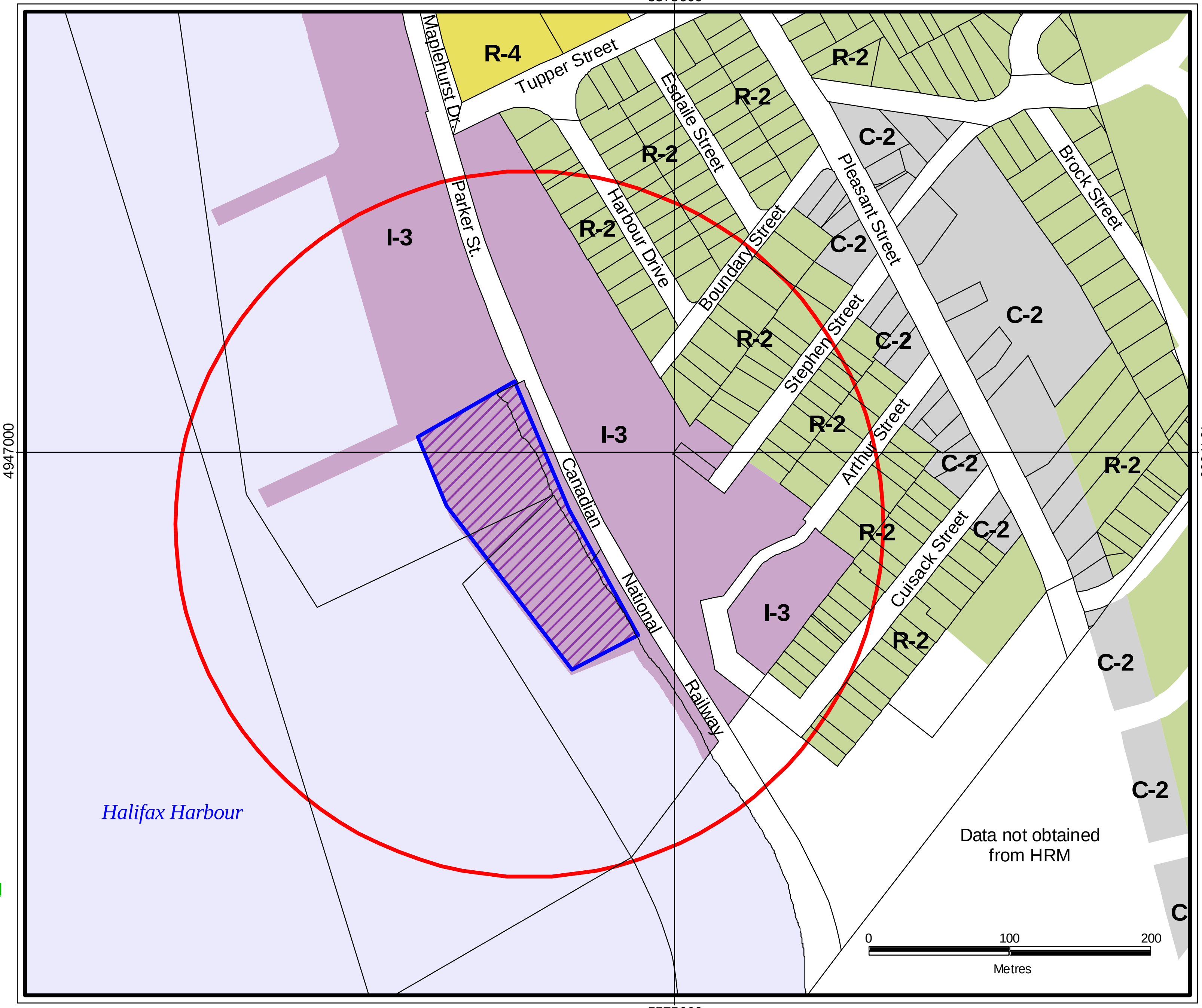
**Overview of Harbour Use**

Metro Halifax (including the former City of Dartmouth, City of Halifax, and Town of Bedford) is the major urban centre of the Atlantic Provinces. The population of the HRM is approximately 330,000 (Statistics

# Figure 5.2 Municipal Zoning of the Halifax STP Site and Surrounding Lands



# Figure 5.3 Municipal Zoning of the Dartmouth STP Site and Surrounding Lands




**Legend**

Proposed Sewage Treatment Plant Site

Study Area

Municipal Zone

- C-2 General Business
- I-3 Harbour-oriented Industrial
- R-2 Two Family Residential
- R-4 Multiple Family Residential (High Density)

Map Parameters
Map Projection: NS MTM 3° Zone 5
Datum: ATS77
Grid Spacing: 500m
Scale 1:4000

Data Sources: HRM

Project NSD13960
Halifax Harbour Solutions
Feb 8, 2001

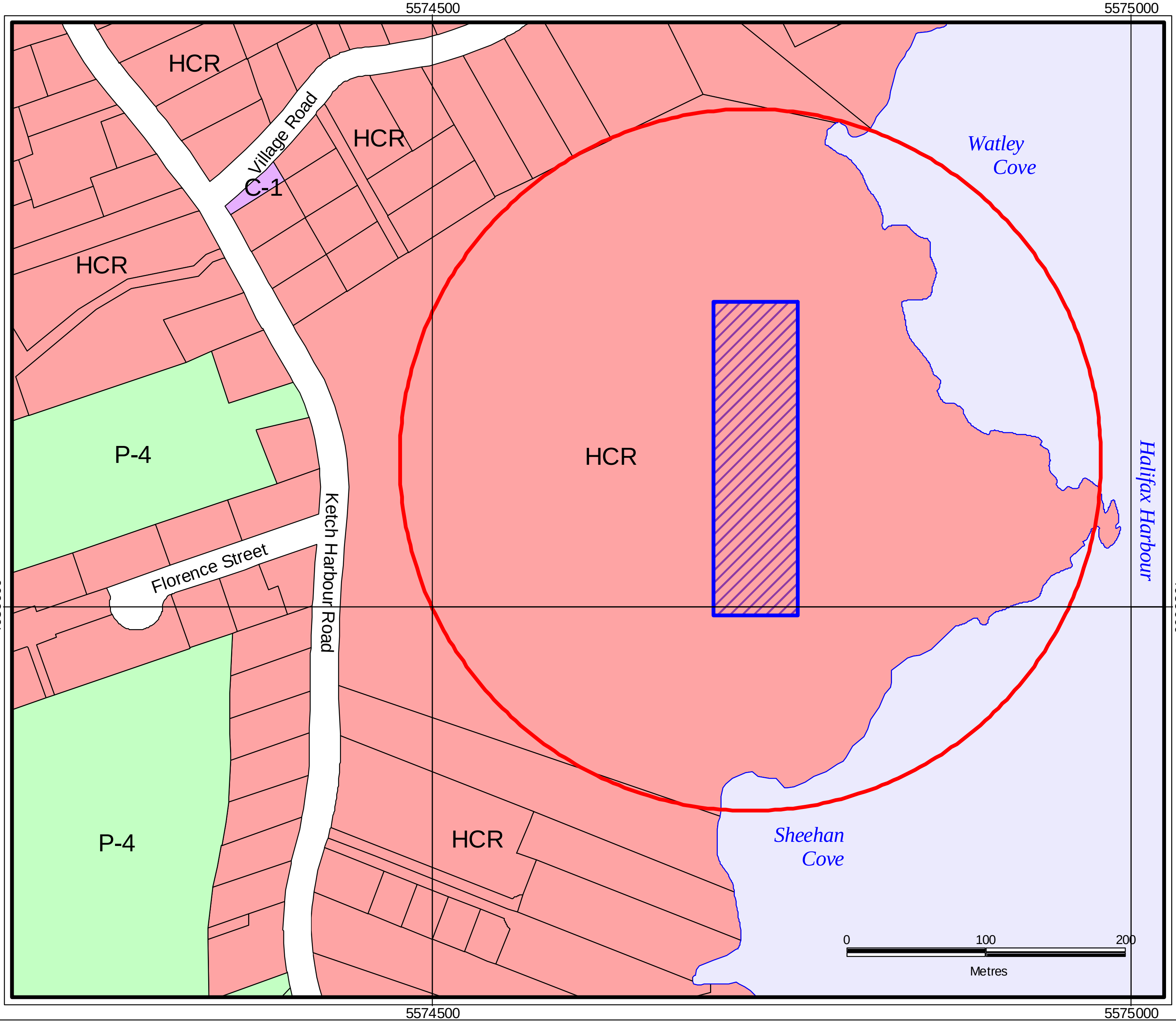
P:\...\data\data\proj1.apr

N
Grid

Jacques Whitford Environment Limited

HALIFAX REGIONAL MUNICIPALITY

# Figure 5.4 Municipal Zoning of the Herring Cove STP Site and Surrounding Lands




**Legend**

Proposed Sewage Treatment Plant Site

Study Area

Municipal Zone

C-1 Local Business

P-4 Conservation Area

HCR Herring Cove Residential

Map Parameters
Map Projection: NS MTM 3° Zone 5
Datum: ATS77
Grid Spacing: 500m
Scale 1:4000

Data Sources: HRM

Project NSD13960
Halifax Harbour Solutions
March 12, 2001

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Jacques Whitford Environment Limited

HALIFAX REGIONAL MUNICIPALITY

Canada 1996). For almost 250 years, Halifax has been an internationally important naval port. In the 18th and 19th century, the harbour and its strategic North American location enabled it to play a pivotal role in Britain's acquisition and defence of much of Canada. In the First and Second World Wars Halifax was still of great importance as a centre for Allied trans-Atlantic convoys and as a base for the Allies' North Atlantic Operations. Halifax still remains an important naval and commercial shipping port and has flourished within the world's second largest natural harbour (Norris and Patterson 2000).

Tourism and recreational uses of Halifax Harbour have always been important parts of the cultural community of Halifax. The current high level of tourism in and around Halifax Harbour was facilitated by the 1984 International Tallships event and the 1995 G-7 Summit. Those events promoted investment dollars in Halifax's tourism industry and more specifically Halifax's waterfront. In general, tourism in Halifax has grown into a multimillion dollar industry.

Georges and McNabs Islands play an important cultural and recreational role in the history of Halifax Harbour. Georges Island, a small drumlin located in the middle of Halifax Harbour, occupies a strategic location which made it ideally suited to becoming the heart of the seaward defences for Halifax's important naval base. For nearly two hundred years Georges Island was the scene of constant military activity and in recognition, it was designated as a national historic site in 1965. Parks Canada is responsible for the preservation and stabilization of the cultural resources on Georges Island. Parks Canada is currently preparing George's Island for public visitation; nevertheless, the island is currently not open to the public due to the fragile and unstable condition of the site.

McNabs Island, approximately 5 km long by about 1.5 km wide, is situated near the mouth of Halifax Harbour. For three-quarters of a century McNabs Island and its various military installations served as the gatekeeper of Halifax Harbour guarding the outer channels to the harbour. Through two World Wars, MacNabs Island housed the Port of Halifax's Examination Station that was responsible for the crucial task of checking ships to ensure that they did not pose a risk to port security. Fort McNab was decommissioned in 1959 and ownership was transferred to Parks Canada. Several private companies provide ferry service to, and/or guided history nature tours of, McNabs Island as well as Lawlors Island and Devils Island, both located in Halifax Harbour. Since 1991, the non-profit group, the Friends of McNabs Island Society has sponsored an annual Spring Beach Sweep of McNabs Island; as of 1999 they have collected more than 6,000 bags of beach litter, a portion of which originates in sewage.

The harbour supports constant commercial and naval traffic including the oldest continuously operating saltwater ferry (since 1752) in North America which connects Halifax and Dartmouth. The recreational uses of Halifax Harbour are extensive. The Waegwoltic Club, located on the Northwest Arm, offers sailing, boating, swimming and tennis activities. The Saint Mary's Boat Club, also located on the Northwest Arm, houses both the Sea Sun Kayak School & Adventures Tours, and the Halifax Rowing Club which make extensive use of the harbour during summer months. Recreational sailing is a popular harbour activity. The membership of the Alderney Sailing & Boating Association, Armdale Yacht Club, Bedford Basin Yacht Club, Dartmouth Yacht Club, Royal Nova Scotia Yacht Squadron, Saint Mary's Boat Club, and the Shearwater Yacht Club all use Halifax Harbour extensively during the summer boating season. In addition to private sailboats, local tour operators also offer harbour cruises. Halifax Harbour also has a well-developed industry of deep sea fishing, nature tours, and whale watching tours.

Several parks and tourist facilities exist along the harbour waterfront including: the DeWolfe Park in Bedford; Seaview Park on the Narrows in Halifax; Point Pleasant Park and Sir Sandford Fleming Park (The Dingle) on the Northwest Arm; Ferry Terminal Park in Dartmouth. Additional tourist facilities that have developed along specific areas of the harbour's waterfront include: the Halifax boardwalk; and Fisherman's Cove at Eastern Passage.

Point Pleasant Park is a 75 ha park at the tip of the Halifax peninsula, jutting into the mouth of the harbour. It has extensive walking paths (38 km of trails) along the coast and through forest, and contains ruins of several fortresses, once part of the Harbour defence systems. Sir Sandford Fleming Park is a 38 ha park with walking trails and sandy beach on the Northwest Arm. The Park's most distinctive feature is Dingle Tower, built in 1912 to commemorate 150 years of representative government.

Ferry Terminal Park is located along Dartmouth's harbour edge past the Dartmouth Marine Slips. This waterfront park is located where the ship Alderney landed, carrying the first 353 settlers to Dartmouth in 1750 from Gravesend and Plymouth, England. This park contains numerous monuments dedicated to the area's maritime history as well as the World Peace Pavilion (containing stones and bricks donated by more than 70 countries including a portion of a brick from the Great Wall of China and a piece of the Berlin Wall) opened during the 1995 Halifax G-7 Economic Summit. Adjacent to the Ferry Terminal is Alderney Gate, a large office, library and commercial complex. The adjoining Alderney Landing includes Dartmouth's farmers' market, a visual arts gallery, specialty shops, live theatre and a Visitor Information Centre. Extending from Alderney Landing is an Events Plaza designed and equipped for outdoor festivals and events.

The Halifax boardwalk runs uninterrupted for 3.8 kilometres, connecting businesses and visitor attractions along the Halifax waterfront. One of those attractions, the Maritime Museum of the Atlantic, is the oldest and largest Maritime Museum in Canada. Several blocks north of the Maritime Museum are the Historic Properties Development which is Canada's oldest surviving group of waterfront warehouses and now a major tourist attraction. The Historic Properties are located next to the Halifax Sheraton, the only waterfront hotel on Halifax Harbour. A boardwalk connects the Halifax Sheraton to the new waterfront Casino Nova Scotia on Lower Water Street.

The Fisherman's Cove area at Eastern Passage is a working fishing village which offers a variety of "access to the ocean" activities. Visitors to Fisherman's Cove can enjoy the boardwalk, tours to McNabs and Lawlors islands, deep-sea fishing, local shops offering East Coast crafts, and the seafood restaurant.

Waterfronts in North America have historically been marginalized lands. However, cities now covet the waterfront and actively redevelop these lands as the cornerstones to their urban centers. The HRM is actively redeveloping the waterfront, as evidenced by the recent development of the Bishop's Landing project, a new 238-unit residential complex, which is the first multi-unit residential development on Halifax Harbour.

The Halifax waterfront planning process was officially launched by Halifax Regional Council and the Board of Waterfront Development Corporation Limited in January, 1999. Since then, the Waterfront Development Corporation Limited and HRM have been working with the public and stakeholders to create a plan for future open spaces and development of the Halifax waterfront.

The final draft "Open Space and Development Plan" (EDM 2001) includes: a detailed analysis and recommendations on the context of the study area; principles (outlined below); a detailed vision of the waterfront; a civic structure context; architectural and place making guidelines; and market assessment and economics. The following seven principles form the core challenges for the future development of the Halifax waterfront and have been incorporated into the plan:

1. Maintain Continuous Public Access
2. Increase Connections Between the Waterfront and Other Parts of HRM
3. Improve Public Street Corridor Views and Connections
4. Improve Open Spaces
5. Encourage Mixed Waterfront Land Uses
6. Respect the Character of the City
7. Development Should be Fiscally Responsible.

In summary, Halifax Harbour, and especially the harbour edge, is in many ways the social, cultural, and economic hub for the citizens of the HRM and, to an important degree, the entire province of Nova Scotia. The Halifax and Dartmouth waterfronts are in the process of redevelopment as multi-use areas intended to bring residents and visitors into closer proximity to the harbour. The quality, and possibly extent, of harbour related activities, particularly those related to tourism and recreation, are adversely affected by the poor water quality in the harbour due to the introduction of untreated sewage. Sewage related effects, particularly in the waters and shoreline near sewer outfalls, have been widely reported to include odour, visible sewer "boils" and unslightly "floatables". Shellfish harvesting is prohibited due to bacterial contamination. Primary contact recreation (*e.g.*, swimming, windsurfing) is either prohibited or ill advised due to the health risk associated with sewage contaminated water.

**Proposed STP Sites**

*Halifax*

The proposed Halifax STP Site is a 9,000 square metre property encompassing a block of land bounded by Cornwallis Street to the north, Barrington Street to the west, and Upper Water Street to the east. The proposed STP site is located within the Peninsula North Planning Area - Area 7 and is east of the Brunswick Street Heritage Area. The site is currently zoned C-3 Industrial. HRM owns the entire city block on which the proposed STP would be built. Currently this block contains a car rental agency and an automotive glass repair shop on land and buildings leased from HRM. The proposed Halifax STP site, alterative site and study area is shown on Figure 5.2.

The proposed alternate Halifax STP site is located approximately 350 m north of the proposed Halifax STP site. This alternate site is 23,000 $m^2$ area with a generally north-south axis. The site is steeply graded from its western boundary on Barrington Street down to the CFB Halifax parking lot on the eastern boundary. The steeply graded portion of the site comprises more than 30 separate parcels of property, all owned by HRM. The CFB Halifax portion of the site is paved parking lot with a capacity of approxiamately 250 vehicles.

Residential Land Use

The STP site does not contain or abut any residential properties. Residential land use within the study area consists primarily of medium density residential use along Brunswick Street including a concentrated area of registered heritage properties in the Brunswick Street Heritage Area. The Heritage Area contains registered heritage properties with similar architecture and historical development and generally retains the atmosphere of a Victorian streetscape.

The Heritage Area also abuts the Brunswick Street Comprehensive Development District. Any development of the Brunswick Street Comprehensive Development District must generally conform to the intent of policies set out for the Heritage Area, which specifies that development must enhance, and complement the neighbourhood (HRM 2000b, Section XI - Policy 9.7.1).

Properties located across Barrington Street to the immediate west of the Project site are designated by HRM for future high density residential development. The Brunswick Street Heritage area is designated for medium density residential. The Brunswick Street Heritage Society has been an active member of the HHSP Community Liaison Committee for Halifax North (refer to Section 9 for more information on Public Consultation).

The proposed alternate Halifax STP site generally reflects the same neighborhood characteristics as the current proposed STP site. Specifically, the alternate site does not contain or abut any residential properties. The site is located on the eastern side of Barrington Street which is down grade of a block of medium to high density residential properties bounded by Artz Street to the north, Gerrish Street to the south, and Brunswick Street to the west. These residential properties are generally low income affordable housing owned by HRM and the HRM Non-profit Housing Society. The one significant difference in the alternate Halifax site is that it does not buffer the Brunswick Street heritage area, nor are there any registered heritage properties with the alternate study area.

Commercial Land Use

Commercial land use within the study area is primarily concentrated in the Downtown Halifax Central Business District. A car rental agency and an auto glass repairs shop currently lease buildings and land from HRM on the property designated for the STP site. A second car rental agency is located across the street. Businesses outside the study area in the Downtown Halifax Central Business District include hotels, business office towers, shopping malls, call centers, restaurants, and retail shopping outlets. The businesses located in the Brunswick Street Comprehensive Development District and along Gottingen Street are a mix of new and well established small service-oriented businesses.

The alternate Halifax site study area does not contain any commercial landuses.

Industrial Land Use

To the immediate east of the Project site is CFB Halifax which is the home port of Canada's East Coast navy. CFB Halifax's dockyard is approximately 37 acres (15 ha) of naval infrastructure along the Halifax waterfront and houses ship repair and maintenance facilities, a hazardous material storage facility, bulk fuel storage tanks, administration buildings, warehouse buildings, extensive ship supply infrastructure and ship docking facilities.

The proposed alternate Halifax site encompasses a portion of CFB Halifax parking (approximately 250 spaces). The remainder of the alternate site comprises more than 30 parcels of HRM property, which are currently undeveloped. Prior to their demolition in the 1960's, these properties contained a mix of residential, commercial, and industrial land uses.

Institutional Land Use

The closest institutional land use is located at the Metro Turning Point homeless men's shelter, located approximately 30 m across Barrington Street from the proposed STP site. The Centre currently accommodates 50 overnight guests and offers daytime support services for homeless males aged 16 years and older. Metro Turning Point also acts as the main shelter support for all new refugees entering Canada through Nova Scotia and the Maritimes.

The neighboring community also has several churches located on Brunswick Street including the St. Patrick's Glebe Roman Catholic Church on Brunswick Street, and St. George's Anglican round church (National Historic Site) located at the corner of Cornwallis Street and Brunswick. The most significant church on Brunswick Street is the Anglican "Little Dutch Church" which is a designated historic site because it is the oldest domestic structure in Halifax. The proposed Halifax STP site and its alternate are both located with 250 m of St.Patrick's-Alexandra Elementary/Junior High (primary-grade 9) which is located on the western side of Brunswick Street, between Gerrish Street and Cornwallis Street.

Vacant/Open Space Land Use

Vacant/open space includes properties which are currently undeveloped but may have, at one time, been developed. Currently, the city block that is owned by HRM and is the location for the proposed STP, has several vacant property lots on Barrington Street which are assumed to have been at one time developed and/or cleared. The only other vacant property in the area is located more than 150 m west of the proposed STP at the corner of Brunswick and Cornwallis Street, across from St. George's Church. This lot was the site of the local YMCA facility until it was destroyed by fire in 1991 and subsequently demolished.

The property parcels owned by HRM on the alternate site are currently undeveloped and are in a state of natural vegetative regrowth. These HRM properties contain a mixture of grassy areas and dense vegetation primarily of mature and young decidous trees. This open space is currently inaccessible to the public due to its location abutting the naval dockyard and the Barrington Street arterial route. No other open space occurs within the study area.

Other Land Use

HRM and the former City of Halifax have for many years been discussing the concept of removing the Cogswell Street interchange and thereby creating approximately 18 acres of land for redevelopment. The Downtown Halifax Business Commission is actively promoting the redevelopment to support the development of new facilities for an expanded downtown core (*e.g.*, parking, visitor's centre). However, this concept has not yet been developed as a formal plan presented to the HRM Council. HRM has not prepared any official policy position on removal of the Cogswell Street Interchange. (G. Porter, pers. comm. 2000). The alternate STP site does not impinge upon any proposed future or planned land uses in the area.

*Dartmouth*

The proposed STP site is located on a 8.75 acre property which is currently owned and occupied by the Canadian Coast Guard as a buoy and boat storage yard. This property was created by infilling and is bounded on the western edge by Halifax Harbour and by undeveloped land to the east. As federal crown property, the proposed STP site is not subject to the land use restrictions, zoning regulations and/or by-laws of a municipality. Nevertheless, the site is zoned I-3 (Harbour-oriented Industrial) and designated as a Marine Business Zone by HRM. The proposed Dartmouth STP site and study area is shown on Figure 5.3.

Residential Land Use

The Hazelhurst residential neighborhood is located more than 100 m and at a significantly higher elevation from the proposed STP site. This neighborhood was originally built before the turn of the century and still retains some of that historic character. Residential development in this area tended toward traditional housing on small lots as is prevalent in the Stephen Street, Arthur Street, and Cuisack Street areas. However, consolidation of lots in the 1960s and 1970s made way for medium and high density residential apartment buildings, as can be seen at the end of Arthur Street, Parker Street and Old Ferry Road.

Commercial Land Use

No commercial development occurs directly within the study area as defined on Figure 5.3. Nevertheless, the fullest extent of the Hazelhurst neighborhood boundary does include various small local commercial activities (retail, grocery, service, etc.).

Industrial Land Use

Dartmouth Cove and eastern waterfront area of downtown Dartmouth continues a tradition of industrial marine uses related to ship repair and support services. The importance of the area as a marine industrial service centre is expected to grow as the offshore oil and gas industry expands in Nova Scotia.

Institutional Land Use

The Coast Guard land proposed for the STP site currently serves as a general storage area for navigational buoys, small boats, and associated equipment. In April 2000, the federal government announced plans to relocate the Coast Guard station from Dartmouth Cove to the Bedford Institute of Oceanography (at the mouth of Bedford Basin) and transfer ownership of these lands to HRM. The HRM identified this land in its "Downtown Dartmouth Secondary Planning Strategy" as the site for the Dartmouth sewage treatment plant (HRM 2000c). This allowance has been incorporated into the "Downtown Dartmouth Land Use Bylaw" (Section 12 Part 2) (HRM 2000d) which specifically permits a sewage treatment facility within a Marine Business Zone.

Vacant/Open Space Land Use

The proposed STP site is buffered from the surrounding residential neighborhood by a 4.5 acre parcel of land which is also owned by the Canadian Coast Guard. This property is currently vacant and wooded, with limited development potential due to the steep terrain. The "Downtown Dartmouth Secondary Planning Strategy" (HRM 2000c)) requires this buffer to be maintained and to be reserved as a corridor for a waterfront trail connecting Dartmouth Cove to the Woodside Ferry Terminal. Planning of the proposed trail has not begun nor have any funds been allocated specifically for this Project. Nevertheless, as redevelopment

(STP or any other permitted development) of the former Coast Guard base progresses, HRM would typically attempt to incorporate civic trails and/or other recreational amenities into the development approval process of the proposed Project.

*Herring Cove*

Herring Cove is one of the larger coastal communities on the Chebucto Peninsula. Originally settled as a fishing community, the patterns of earlier development hugging the slopes of the harbour have been supplemented with more formal subdivision and linear development patterns of post-1980 development (MacLaren Plansearch Ltd. 1991b).

Although a site has not yet been secured for the proposed STP in Herring Cove, a tentative site has been identified for purposes of environmental assessment and project tendering at Hospital Point on property currently owned by 360 Networks Inc., a fiber optics cable company. HRM is negotiating with 360 Networks Inc. to obtain property for the STP site.

Herring Cove is located in the eastern part of Planning District 5 of the former Municipality of Halifax County. With the exception of the fiber optic cable plant constructed in 2000, the proposed site is undeveloped. The site, much like the majority of Herring Cove, is zoned for residential land use. The "Herring Cove Area Settlement and Servicing Strategy" (LandDesign Engineering Services 2000) identifies Hospital Point as a potential STP site. The proposed Herring Cove STP site and study area is shown in Figure 5.4.

Residential Land Use

Residential land use in Herring Cove consists primarily of single-family development. The character of the community is centered on the historic cove and fishing village although it has expanded to include more modern, urban subdivisions inland from the cove. New development may be characterized as suburban, as the employment base in the community has not expanded and many residents commute to their jobs in the urban core of HRM. HRM has been actively working with community residents to develop a Herring Cove Area Settlement and Servicing Strategy (LandDesign Engineering Services 2000) that would help preserve the existing rural character of Herring Cove, while accommodating future growth through the future provision of central sewer and water services to the community. The proposed Herring Cove STP site is currently zoned for residential use. The nearest residential dwelling, however, is approximately 200 m from the proposed STP site, off Village Road.

Commercial Land Use

360 Networks Inc. operates a transatlantic fiber optic cable facility approximately 120 m west of the proposed STP site. There is no other commercial land use within 500 m of the proposed STP site.

Industrial Land Use

Fishing continues to be the main industry in the community, with the shoreline surrounding the Herring Cove proper zoned for fishing activities to preserve the fishing village character, provide marine services, and allow community development (LandDesign Engineering Services 2000). Industrial land use in Herring Cove is therefore mainly limited to fishing wharfs and sheds. There is no industrial land use in close proximity to the proposed STP site.

Institutional Land Use

There is no institutional land use (*e.g.,* schools, hospitals or churches, community facilities) within 500 m of the proposed STP site (LandDesign Engineering Services 2000).

Vacant/Open Space Land Use

The Herring Cove community is surrounded by extensive open spaces. There are extensive provincial crown land holdings on the Chebucto Peninsula. A block of crown land to the west of Herring Cove extends from the coast to the height of land at Long Lake and is referred to in the District 5 MPS as the Chebucto Corridor. To the east of Herring Cove, a smaller block of crown land extends inland along the MacIntosh Run. Provincial crown lands, with the exception of some park areas, are designated for conservation. The presence of this open space and its accessability contributes to the quality of life of Herring Cove (LandDesign Engineering Services 2000). The blocks of undeveloped crown land contribute to the open space atmosphere of the community.

The area of the proposed STP site, and on which the fiber optic plant currently exists, consists of abandoned pasture and coastal spruce-fir forest. Local residents have used the property for informal recreational use (*i.e.,* hiking, all-terrain vehicles (ATVs)) and waterfront access (JWEL 1999e).

**Collector System**

Land and easements will be required for various components of the collector system infrastructure such as sewers, pumping stations, and access shafts. It is anticipated that most of the sewers will be installed in existing public rights-of-way such as roads. Some public and private lands will likely be required for sewer and pumping station installation and access.

**Outfalls/Diffusers**

Outfalls and diffusers will require use of Crown Lands under the jurisdiction of the Halifax Port Authority (Inner Harbour) and Coast Guard (Herring Cove). Easements through water lots may also be required from DND and private owners.

**Sludge Management Facility**

A site for the central sludge management facility has not been identified at this time. Therefore land use on and surrounding the future site is currently unknown. It is anticipated that this site will be provided by the private sector proponent and will be located outside of the urban core of HRM. The facility must be sited and developed according to the provincial Composting Facility Guidelines (NSDOE 1998) which specifies that the facility must be sited in order to maintain specified separation distances from surrounding land uses which is intended to minimize land use conflicts and nuisances.

### 5.3.3 Residual Environmental Effects Evaluation Criteria

A **significant** adverse effect is any Project-related effect that degrades or displaces established or planned land uses. Impacts must affect a major portion of land used by a local population and be of long duration or be of such magnitude in the short term, that they result in permanent change to land use in the study area that cannot be adequately compensated.

A **positive** effect is defined in one that enhances the use of lands in the study area.

Since the impact on land use may be significantly influenced by noise and air emissions from STP and effects on transportation infrastructure, this VSC is also closely linked to the assessment of Atmospheric Resources (Section 4.1), Transportation Infrastructure (Section 5.4), and Public Health (Section 5.5).

### 5.3.4 Potential Interactions, Issues and Concerns

**Residential Land Use**

Residential land use may be sensitive to potential conflicts caused by development of a municipal utility use such as a sewage treatment plant. No residential land will likely be required for Project development. However, concerns exist for adjacent or nearby residential areas, near the Halifax, Dartmouth and Herring Cove STP sites. These concerns include temporary disturbances (*e.g.*, noise, dust, traffic) during construction and longer term concerns related to potential noise and odour generation and facility aesthetics during facility operation. There is a potential for residential areas near STPs to benefit from HHSP Community Integration Projects (*e.g.,* parks, water supply), and residential areas near the harbour to benefit from a reduction in sewage related nuisances (*e.g.,* odour and beach litter).

**Commercial/Industrial Land Use**

Commercial/industrial landowners may experience similar effects as residential landowners. Harbour related tourist and recreation businesses (*e.g.,* restaurants, tour boats, fishers) will benefit in particular from sewage treatment, as will local businesses that will supply goods and services to the Project. Improved site amenities (*e.g.*, landscaping, Community Integration projects) will likely improve the value and use of these lands. Access limitations during construction may be a potential issue for commercial businesses, but is not likely to be significant with proper mitigation.

**Institutional Land Use**

Due to the limited amount of institutional land potentially interacting with the Project, there are few issues and concerns. One potential issue of concern is related to the location of the Halifax STP and the proximity to the Metro Turning Point mens shelter and the alternate site's location near the non-profit housing along Brunswick Street. The neighbourhood adjacent to the alternate site has the potential to benefit from the HHSP Community Integration Projects such as open space, parks, etc.

**Open Space/Vacant**

Potential issues related to Project effects on open space/vacant land is generally related to future land uses. Depending on the location of these lands in reference to the specific Project area, the future use of this land may be limited or enhanced. For example, land adjacent to the Community Integration amenities (parks, playgrounds, trails, etc.) may be valued for future residential development. Alternatively, the use of currently vacant land, located near the STPs, may be restricted due to the proximity of the Project.

**Collector Systems**

Potential effects of construction of the proposed sewage collection systems and tunnels are expected to be minor. These construction activities would be no more significant than the periodic maintenance and repair of roads and municipal services. The scheduling of construction activities is important in areas where there may be potential interaction with surrounding land uses. Operational issues of concern include potential odour and noise emissions from the CSOs and pumping stations, and general integration of the pumping station facilities within the community. Section 5.4 discusses potential Project-related effects on transportation infrastructure.

**Outfalls/Diffusers**

Potential issues and concerns regarding construction and operation of outfalls and diffusers are mainly related to interactions with marine uses such as anchoring, shoreline structures (*i.e.*, wharves), and recreational uses. Siting of outfalls/diffusers will avoid, to the greatest extent possible, conflict with existing marine uses.

**Sludge Management Facility**

Potential effects related to the sludge management facility include dust and noise emissions associated with construction of the facility, and odour, noise and increased traffic associated with operation of the facility. The specific effects of this facility are unknown at this time, since the site has not yet been chosen. However, the facility will be sited, constructed, and operated according to applicable regulations. Application of high quality composted sewage sludge may be considered a project related benefit.

### 5.3.5 Analysis, Mitigation, and Residual Environmental Effects Prediction

#### 5.3.5.1 Construction

**Residential Land Use**

The greatest concern with respect to Project construction effects on residential land use is in the Stephen Street, Arthur Street, and Cuisack Street area near the Dartmouth STP site, and the Brunswick Street area near the Halifax STP site. The main potential effects on residential land use during Project construction include air, dust and noise emissions from construction equipment. Other areas along the collector system may also be affected temporarily as sewer construction proceeds. The significance of these effects will vary according to: the precise location of the property with respect to the Project site; the terrain and vegetation in the immediate area (*e.g.,* topography and existing structures may serve to mitigate noise, dust and visual impacts); and the particular sensitivities of the residents to construction disturbance. Issues and mitigative measures related to noise, dust and traffic associated with Project construction are presented in Sections 4.1 and 5.4 respectively, of this report. As discussed in these sections, it is anticipated that these construction disturbances can be successfully mitigated through application of good construction planning and practices. Construction of the STPs and collector systems is similar to other large scale construction and municipal infrastructure projects in Metro Halifax which are generally well tolerated by the public. There may be some temporary, localized disturbance to residents located closest to construction activities.

A dedicated service road will be constructed to access the Dartmouth STP site to minimize Project-related traffic on residential roads (refer to Section 5.4). In addition to proposed mitigative measures, contractors will be required to provide adequate notification to nearby residents and businesses in advance of construction activities. It is also anticipated that the proponent and construction contractors will implement a project information line where residents can receive information regarding Project activities in their area and register complaints if necessary. Information requests will be acted upon promptly by the proponent with complaints and resolution tracked in an appropriate system. Construction will be scheduled to minimize the amount of time that property owners would be subjected to construction activity. Contractual incentives may be offered to promote timely completion of projects.

**Commercial/Industrial Land Use**

In general, issues and mitigative measures presented above for residential land use also apply to commercial/industrial land use. However, depending on the type of business and time of year, this land use will be generally less sensitive than residential land use.

Restricted access is a particular concern for commercial/industrial land use during Project construction. Transportation issues and mitigative measures are presented in Section 5.4 of this report. It is anticipated that access for vehicles and pedestrians will be generally well maintained throughout the construction period by use of standard traffic management planning and practices. Temporary detours and alternate access may be required for some businesses during construction of the sewer collector system. This may cause temporary inconvenience for businesses and customers in localized areas as sewer construction periods. These effects can be further mitigated through provision of signage and advance notification. STP construction is unlikely to restrict access to commercial/industrial land. It is anticipated that access will be adequately maintained through careful Project planning and consultation with commercial/industrial organizations (*e.g.,* DND at Dockyard regarding realignment of Lower Water Street and access to alternative STP site). The small commercial businesses currently located in buildings owned by HRM, on the proposed Halifax STP site, will need to relocate, and CFB Halifax would need to relocate parking for a minimum of 250 vehicles for the Halifax alternate site.

As indicated in Section 5.4, work undertaken in and around rail facilities will be conducted according to established guidelines. These precautions, along with proper Project planning and communication with the rail company, will mitigate any potential impacts to rail operations. The construction of the Halifax STP (or the alternate site) are not expected to interfere with commercial redevelopment of the Cogswell Street Interchange.

The redevelopment of industrial areas for new industrial uses is a generally acceptable practice. The potential use of industrial/commercial sites intended for the STPs for non-industrial purposes (*e.g.*, tourist facilities) will be restricted. However interpretive facilities may be incorporated along with attractive site planning creating a general revitalization of commercial/industrial land uses in the surrounding areas and an overall positive effect.

**Institutional Land Use**

No significant adverse effects are predicted for institutional land use. The Coast Guard facility in Dartmouth will be relocated.

**Open Space/Vacant Land Use**

The main effects of Project construction on open space/vacant land are change to the existing landscape and possible preclusion of future development of those lands. The Halifax STP site and alternative, and the Dartmouth STP site are located on previously disturbed and/or existing industrial uses which will limit the effects with regard to Project construction. Innovative design of the Halifax STP may incorporate future development opportunities above the STP (*i.e.,* on the roof).

The proposed Herring Cove STP site is currently undeveloped, with the exception of the fiber optic facility located approximately 120 m to the west. Construction of the STP will preclude future development of this site. However, there are currently no other known plans for development of this site and this development is in accordance with the "Herring Cove Area Settlement and Servicing Strategy" (LandDesign Engineering Services 2000). Surrounding vacant lands will serve as buffer zone between the STP and residential development.

In summary, there are not likely to be any significant adverse environmental effects on land use as a result of Project construction. Residential land use is the land use likely to be the most sensitive to construction related effects, such as noise and dust emissions, and increased traffic. However, these effects will be temporary, localized, and successfully mitigated through standard construction practices. These construction activities and effects will not differ greatly from other typical urban construction projects, which are common in urban HRM and generally well tolerated. STPs are generally consistent with the indicated uses for the proposed sites. Innovative site design and Community Integration projects will integrate the STPs into the surrounding communities. While future land use, particularly at the under-utilized or developed sites will be precluded, site planning and design can improve these sites and can serve to revitalize commercial and industrial use in these areas. Table 5.9 summarizes the residual environmental effects analysis for the construction phase.

### 5.3.5.2 Operation

**Residential Land Use**

Some residential properties will be in relatively close proximity to Project components during the operational phase. Landowner concerns include: noise and odour generation from the STPs and pumping stations; traffic; and aesthetic effects. The potential severity of these effects may vary according to distance from facilities, time of year, and operating condition of odour control equipment. Potential effects from odour, noise, and traffic, along with mitigative measures are described in Sections 4.1 and 5.4. The potential for aesthetic impacts will be mitigated for area residents through a combination of: attractive site planning; landscaping and choice of building design and materials (all sites); community integration projects (all sites); and green buffers and natural topography (Dartmouth, Herring Cove).

Residents' enjoyment of their property near the harbour are currently restricted in many cases due to sewage related odour and shoreline litter (refer to Section 5.5 for discussion of health risk). Sewage treatment will create an important positive effect for these landowners.

The Project is expected to have a positive effect on residential land use, particularly in Herring Cove, with the provision of water and sewer services. With some exceptions, development in Herring Cove has relied upon on-site sewerage and water systems. Furthermore, since the 1960s, raw sewage from the nearby urban community of Spryfield has been pumped to an outfall at Watleys Cove near Herring Cove. Herring Cove residents have expressed concern over the raw sewage discharge into Watleys Cove and sewage overflows to MacIntosh Run which has severely affected water quality and water-based activities at both of these locations. The proposed STP in Herring Cove will bring sewer and water services to the community, improving drinking water quality and eliminating the discharge of raw sewage into Watleys Cove. An upgraded overflow facility at Roaches Pond will reduce the frequency of sewage overflows into MacIntosh Run. However, some residents are concerned that through the provision of sewer and water services to Herring Cove, the community will encounter new challenges related to growth as development potential increases. The "Herring Cove Area Settlement and Servicing Strategy" (LandDesign Engineering Services 2000) and other similar HRM and community initiatives and ongoing public consultation will serve to control and effectively plan future community development in accord with community and HRM intent.

**Commercial/Industrial Land Use**

Commercial land use around the proposed STP sites is limited, therefore interactions between commercial land use and Project operation are also limited. Subsequent commercial development near the Mill Cove STP site in Bedford strongly suggests that the main limiting factor for commercial development is the availability of land. The Halifax STP site may encourage commercial development through innovative design and planning of the site including possible rooftop development. It is assumed that DND parking lost due to the potential development of the alternate Halifax site will be replaced at the STP facility or nearby, perhaps through a land swap with HRM; no net loss of DND parking is therefore assumed. Assuming effective land use coordination and planning during construction, there is not likely to be any adverse effects on adjacent commercial land use of the fiber optic facility in Herring Cove. Project operation may have a positive effect on commercial land use, particularly in Herring Cove by increasing the number of skilled employees working in the community and acting as an anchor business for the area. It is anticipated that a variety of local businesses will benefit from the provision of goods and services to the STPs and staff.

Overall, since site conditions will be physically improved on each of the STP sites, and potential nuisances (*e.g.*, odour) will be effectively mitigated, commercial land uses will realize a positive effect from the Project. Industrial land uses in the vicinity of the STP sites, in particular, Halifax will not likely experience any adverse environmental effects as a result of Project operations.

**Institutional Land Use**

Project operation is not likely to have any significant adverse environmental effects on institutional land use.

**Open Space/Vacant Land Use**

The Halifax site and its alternate site are partially vacant and would be improved by the addition of a well designed and operated STP with community integration features. The open space surrounding the Dartmouth site may be acquired as a community integration feature to be preserved as a green buffer and area for trail development and/or passive recreation. This land, currently used informally for these purposes would, along with the Project-related cleanup of the shoreline, become a valuable community asset as well as a buffer for the STP. Open space surrounding the Herring Cove site will be maintained as a buffer zone for the STP and may continue to provide local residents with waterfront access to Hospital Point.

**Harbour Related Uses**

All waterfront activities, harbour-related tourism, and recreational use of the Harbour will benefit substantially from operation of the STPs. Sewage-related odour, unsightly floatables, shoreline debris, and sewage boils will be eliminated or greatly reduced throughout the Inner Harbour, and Herring Cove, particularly near existing major outfalls.

Untreated sewage will continue to enter the harbour through CSOs during periods of high rainfall (*i.e.,* greater than 4 x ADWF). These overflow events will be relatively infrequent, will be screened to remove floatables and debris, and will generally be much more diluted than normal sewage flows. It is estimated that at least 75 percent of all sewage will be fully treated with up to 25 percent being discharged and partially treated through CSOs.

Harbour users benefitting from sewage treatment include: cruise ship passengers; tour boat passengers; tourists and sightseers at beaches, parks and on the boardwalks; restaurant patrons; and pleasure boat operators. It is possible that harbour uses not currently permitted or ill-advised (*e.g.*, swimming, shellfish harvesting) will become acceptable after monitoring confirms that bacteria and other contaminants are reduced to acceptable levels.

Given the high level of recreational use in Point Pleasant Park, concern has been expressed recording the aesthetic design and odour and noise control of the pumping station at Chain Rock, within the Park. HRM has held discussions with Point Pleasant Park officials regarding the construction and operation of the pumping station and associated collector system in the Park. Concerns regarding facility design and potential amenities (e.g., public washrooms) have been incorporated into the RFP. Strict odour and noise controls have also been imposed and are discussed in Section 4.1.

As described in Section 2.11 it has been estimated that sewage treatment will also create substantial economic benefits for harbour users and HRM residents and businesses (GPI 2000).

In summary, Project operation is anticipated to have a net positive effect on all land uses, particularly those adjacent to harbour waters. Table 5.10 summarizes the residual environmental effects analysis for the operations phase.

### 5.3.6 Follow-up and Monitoring

The requirements for any follow-up and monitoring programs related to land use will be determined through discussions with HRM and other relevant regulatory officials. In particular, monitoring programs may be developed to detect if improved harbour water quality can support currently restricted uses such as swimming and shellfish harvesting.

### 5.3.7 Summary of Residual Environmental Effects Assessment

Provided the recommended mitigative measures are implemented, there are not likely to be any significant adverse residual environmental effects on land use. Project operation is expected to produce benefits for many land uses, particularly those in close proximity to the waterfront, due to improved harbour water quality.

**Table 5.9 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Land Use (Construction)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Adverse Environmental Effects: Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Social-cultural and Economic Context | Residual Environmental Effects Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| Construction of collector system | C Dust and noise emissions<br>C Localized traffic delays and access restrictions<br>(A) | C Contract incentives for rapid completion<br>C Noise and dust control (Section 5.1)<br>C Traffic management (Section 5.4)<br>C Communications, planning, signage to facilitate property/business access | 1 | 2 | 2 / 5 | R | 2 | N | 3 |
| Construction of STP | C Dust and noise emissions<br>C Preclusion of future development on previously vacant or under-utilized land<br>C Increased traffic<br>C Displacement of existing occupants<br>C Loss of DND parking at Halifax alternate site<br>(A) | C Contract incentives for rapid completion<br>C Noise and dust control (Section 5.1)<br>C Traffic management, including construction of access road for Dartmouth North STP (Section 5.4)<br>C Innovative site planning and architectural designs<br>C Community Integration projects<br>C Adequate notice to existing occupants<br>C Nearby replacement of DND parking if Halifax alternate site is selected | 1 | 1 | 3 / 5 | R | 2 | N | 3 |

**Table 5.9 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Land Use (Construction)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Adverse Environmental Effects: Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Social-cultural and Economic Context | Residual Environmental Effects Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| Construction of Sludge Management Facility | C Dust and noise emissions<br>C Preclusion of future development on previously vacant land<br>C Increased traffic<br>(A) | C Site selection and design according to NSDEL Guidelines<br>C Community involvement program<br>C Contract incentives for rapid completion<br>C Noise and dust control (Section 5.1)<br>C Traffic management (Section 5.4) | 1 | 1 | 3 / 1 | R | 2 | N | 2 |

**KEY**

**Magnitude:** 1 = Low: *e.g.,* not significantly affecting use or enjoyment of land or harbour; 2 = Medium: *e.g.,* moderately affecting use or enjoyment of lands or the harbour within a significant portion of the community; 3 = High: *e.g.,* severe and lasting effects on use and enjoyment of lands or harbour for a significant portion of the community
**Geographic Extent:** 1 = <500 m²; 2 = 500 m² -1 km²; 3 = 1-10 km²; 4 = 11-100 km²; 5 = 101-1000 km²; 6 = >1000 km²
**Duration:** 1 = < 1 month; 2 = 1-12 months; 3 = 13-36 months; 4 = 37-72 months; 5 = > 72 months
**Frequency:** 1 = < 11 events/year; 2 = 11-50 events/year; 3 = 51-100 events/year; 4 = 101-200 events/year; 5 = >200events/year; 6 = continuous
**Reversibility:** R = Reversible; I = Irreversible
**Ecological/Socio-cultural and Economic Context:** 1 = Pristine area or area not adversely affected by human activity; 2 = Evidence of adverse effects.
**Residual Environmental Effect Rating:** S = Significant Adverse Environmental Effect; N = Non-significant Adverse Environmental Effect; P = Positive Environmental Effect
**Confidence:** 1 = Low level of Confidence; 2 = Medium level of Confidence; 3 = High level of Confidence

**Table 5.10 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Land Use (Operations)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Adverse Environmental Effects | | | | | Residual Environmental Effects Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Social-cultural and Economic Context | | |
| Collector system operation | C Odour emissions at CSOs and pumping stations (A) | C Odour control at CSOs and pumping stations (Section 5.1) | 1 | 1 | 5 / 6 | R | 2 | P | 3 |
| STP operation | C Odour and noise emissions<br>C Increased traffic (A) | C Odour and noise control at STP (Section 5.1)<br>C Traffic management (Section 5.4) | 1 | 1 | 5 / 6 | R | 2 | N | 3 |
| | C Compatibility with surrounding land uses (P) | C Design to integrate facility into surrounding landscape<br>C Community Integration Fund projects | 2 | 2 | 5 / 6 | R | 2 | P | 2 |
| | C Sewage treatment to reduce harbour odours and aesthetic concerns and pathogens (P) | C No mitigation required | 2 | 4 | 5 / 6 | R | 2 | P | 3 |
| Sludge Management Facility operation | C Odour emissions<br>C Increased traffic (A) | C Adherence to NSDEL Composting Facilities Guidelines<br>C Traffic management (Section 5.4) | 1 | 1 | 5 / 6 | R | 2 | N | 2 |

**Table 5.10 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Land Use (Operations)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Adverse Environmental Effects | | | | | Residual Environmental Effects Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Social-cultural and Economic Context | | |
| | C Beneficial end use of compost (P) | C Adherence to CCME compost quality guidelines | 1 | 4 | 5 / 6 | R | 2 | P | 3 |

Refer to Table 5.9 for Key.

## 5.4 Transportation Infrastructure

Transportation Infrastructure is a VSC because the safe, convenient, economic and efficient movement of persons and goods is essential to individuals and businesses within the HRM. The modes of transportation that are considered include road, rail, marine, public transit, bicycle and pedestrian.

Additional information on this VSC can be found in the following documents prepared for the HHCI project: Environmental Assessment Report, Sections 4.4.1, 4.5, and 7.7 (HHCI 1992); and "Transportation Infrastructure in the Halifax-Dartmouth Region: Relevance to the Proposed Sewage Treatment Facility" (Porter Dillon 1991c).

### 5.4.1 Boundaries

The study boundaries for the transportation impact evaluation include the following areas which are shown in Figure 1.1:

- Halifax Peninsula, from the MacKay Bridge to Point Pleasant Park;
- Dartmouth, from the MacKay Bridge to Highway 111;
- Halifax Harbour, from the Macdonald Bridge to Point Pleasant Park;
- Herring Cove, near Village Road; and
- The Atlantic Ocean at Herring Cove.

The temporal boundaries during which the Project will affect transportation include both construction and operation phases. Although construction scheduling is uncertain at this time, construction of each STP and associated land and marine pipe installations, is expected to take from 18 to 24 months. The operation phase for the facilities will be ongoing.

### 5.4.2 Description of Existing Conditions

The existing conditions of roadways, rail lines, and marine, public transit, bicycle and pedestrian facilities, are described below. Traffic volume information on streets and roads was obtained from the Traffic and Transportation Services division of HRM. The descriptions of transportation facilities have been prepared from the study team's knowledge of the area, review of maps and plans, and reference documents.

**Roadways**

The environmental assessment conducted for HHCI (1992) included detailed descriptions of the transportation infrastructure that could be affected by the construction of a single STP off McNabs Island and its extensive collector system. Although the HHSP incorporates a revised Project concept (*i.e.*, three STPs), the existing conditions regarding roadways within and adjacent to the collector system corridors are basically unchanged.

Existing roadway conditions adjacent to each STP and associated collector system corridors are summarized below.

*Halifax*

The Halifax STP is located at the corner of Barrington and Cornwallis Streets. Barrington Street is a two lane arterial street between the MacKay Bridge and just south of Duffus Street, with the remaining section to the STP site having four lanes. The street provides a primary route from the MacKay and Macdonald Bridges to Downtown Halifax. The east end of Cornwallis Street is a two lane section of street providing a connection from Upper Water Street and the DND South Gate to Barrington Street. Weekday traffic volumes on Barrington Street vary from 24,000 vehicles per day (vpd) north of Devonshire Avenue to about 29,000 vpd just north of Cornwallis Street. The collector system for this STP will involve Barrington Street from Duffus Street to the STP and Lower and Upper Water Streets to the STP. Lower and Upper Water Streets are narrow two lane streets, with narrow sidewalks adjacent to Historic Properties and the Marine Museum of the Atlantic. Lower Water Street provides two-way traffic movement south of George Street, and Lower/Upper Water Streets are one-way northbound north of George Street.

The collector system in Halifax Peninsula South will connect the Chain Rock Northwest Arm outfall to the STP by way of force and gravity mains along area residential streets to Marginal Road and Upper Water Street. Traffic volumes on residential street are considered to be low. The southern end of Franklyn Street provides the only access to four adjacent residential streets between the Northwest Arm and Point Pleasant Park.

The discussions concerning existing roadway conditions adjacent to the Halifax STP and the associated collector systems are also applicable to the alternate STP site.

*Dartmouth*

The Dartmouth STP is located on Coast Guard property at Dartmouth Cove between the railroad tracks and the eastern shore of Halifax Harbour. There are adjacent residential neighbourhoods between the railroad tracks and Pleasant Street. Pleasant Street has four traffic lanes and is the only continuous north/south street between Portland Street and Highway 111. Weekday traffic volumes vary from about 14,000 vpd near the Nova Scotia Hospital to 16,000 vpd near Highway 111. The collector system for the STP involves Windmill Road from Tufts Cove to the Macdonald Bridge and land adjacent to the railroad tracks from the Bridge to the area south of Highway 111. Weekday traffic volumes on Windmill Road are about 15,000 vpd north of Albro Lake Road and about 11,000 vpd south of Albro Lake Road.

*Herring Cove*

The Herring Cove STP is located at Hospital Point on a site between Herring Cove Road and the shore of the Atlantic Ocean. Herring Cove Road near the site is two lanes wide. Traffic volumes are not available near the site, however, since the weekday volume on Herring Cove Road is only about 6,000 vpd 2.5 km north of the site, it is assumed that volumes would be much lower adjacent to the site.

**Rail Lines**

The Dartmouth STP is located between the railroad and the Harbour shoreline. The rail line generally follows the Harbour shoreline throughout the length of the collector system from Tufts Cove to Highway 111. Major businesses served by the Dartmouth rail line include Autoport and Imperial Oil. The collector system for the Halifax STP will cross rail lines serving the Halterm Container Port and the Port of Halifax Ocean Terminals. The rail lines in this area provide track space for rail car storage, train make-up and 24 hours-a-day active service to Halterm. Crossing of the rail lines may be accomplished by trenching and/or tunnelling.

**Marine**

The ultimate capacity of Halifax Harbour for marine traffic is well above the current demand (Porter Dillon 1991c). The marine diffuser associated with the Dartmouth STP is near Anchorage #3. The Port Harbourmaster, Queen's Harbourmaster (DND), and Fisheries and Oceans Canada (Coast Guard) are responsible for ship movements in the Inner Harbour. Fisheries and Oceans Canada (Coast Guard) is responsible for the areas adjacent to Herring Cove.

**Public Transit**

Metro Transit operates transit buses and bus stops on most arterial or major streets in the vicinity of the STPs and collector systems. Metro Transit also operates three passenger ferries between the Halifax, Dartmouth and Woodside Ferry terminals.

**Bicycles**

The recent addition of the exclusive bicycle lane on the Macdonald Bridge has prompted provision of other exclusive bicycle lanes on Downtown streets on both sides of the Harbour. The locations of recently constructed bicycle lanes should be determined during final plant and collector system planning.

**Pedestrians**

Heavy pedestrian movements occur in the following locations near STP or collector system sites:

- Upper / Lower Water Streets from the Sheraton Hotel / Historic Properties area to Sackville Street;
- Approaches to the Halifax Ferry Terminal; and
- Approaches to the Dartmouth Ferry Terminal

### 5.4.3 Residual Environmental Effects Evaluation Criteria

A **significant** adverse effect is one that necessitates closure or restricted use of, or introduction of new traffic onto, a portion of transportation infrastructure, and that degrades any aspect of the transportation level of service to a level unacceptable or undesirable by engineering standards or professional judgement on an ongoing basis.

A **positive** effect is one that provides an improved or rehabilitated component of transportation infrastructure as part of the project activities and that remains as a permanent part of an improved transportation network.

### 5.4.4 Potential Interactions, Issues and Concerns

The primary interaction between the Project and transportation infrastructure will occur to transportation facilities during the construction phase adjacent to STP sites or along collector system trench corridors or tunnel access points. In particular, construction activities at the Halifax and Dartmouth STP sites appear to have the greatest potential interactions with transportation infrastructure. With respect to the Halifax site, realignment of bordering streets (*e.g.,* Lower Water Street) to accommodate STP site development may temporarily affect the current access to the DND property at the south gate to the Dockyards. Furthermore, the location of the STP and possible roadway realignment, may have implications for potential future re-design of the Cogswell Street interchange concept that has been discussed by HRM for several years without advancement.

Since the alternate Halifax STP site borders the section of Barrington Street adjacent to the south approaches to the MacDonald Bridge Access Ramp, site access will not be possible from Barrington Street at that location. Access to the site would be from Provo Wallis Street which is on DND property. Although there will be traffic volume impacts on that street, access to DND property at Cornwallis Street and DND Scotian on Upper Water Street will not be affected.

With respect to the Dartmouth STP site, residential property owners east of the STP site are concerned that both construction and operation vehicles will use their narrow and steep streets to gain access to Pleasant Street.

Conflicts with marine transportation may occur during construction of marine outfall/diffusers for each STP.

### 5.4.5 Analysis, Mitigation, and Residual Environmental Effects Prediction

#### 5.4.5.1 Construction

The construction of the STPs and collector system have the potential to interact with all transportation modes.

**Roadways**

The Halifax and Dartmouth STPs will be constructed in an urban environment. Both public and private construction projects commonly occur adjacent to urban streets. During 1999/2000 the construction of Casino Nova Scotia, major reconstruction of the Macdonald Bridge, and the construction of Barrington Street approach ramp to the Bridge, have occurred in Metro Halifax with minimal traffic impacts. During the early months of 2001, condominium and hotel construction sites on Hollis Street and a major condominium project on Lower Water Street have taken place. The Bishops Landing project on Lower Water Street involves construction of approximately 250 condominium units on a 1.9 ha site. These projects will be completed prior to the start of construction on the Halifax STPs.

Sewer and water pipe system installation projects are also a common occurrence in urban areas. In-street installation of these linear facilities are a fact of urban life, and any temporary delays that may be caused by construction are generally well tolerated by the public.

A new dedicated access road will be constructed to the Dartmouth STP construction site. The roadway will allow access to Pleasant Street without use of any local residential streets. The new access road will be used both during construction and operation of the STP.

Access to the alternate Halifax STP site, if selected, would be via Provo Wallis Street which is on DND property. STP construction traffic has potential to create temporary impacts on the routine flow of DND traffic on this roadway. These impacts can be minimized through consultation with DND, careful traffic management procedures during construction and communications with DND during construction activities. Access to the Dockyard or Scotian are not expected to be restricted by the development of the alternate Halifax site.

HRM will require that traffic control in the vicinity of construction sites for STPs and along collector system corridors be planned and provided in accordance with the "Temporary Work Place Traffic Control Manual"

(NSTPW undated). HRM may also restrict work activities that affect traffic movement during AM and PM peak travel periods on a site-by-site basis. HRM will also regulate use of full time or temporary truck routes for movement of construction vehicles.

The construction of each treatment plant will involve from 10 to 200 employees on site at a time, depending on the construction phase. Each site will attract from 15 to 20 (maximum 40) heavy trucks and 20 to 25 lighter vehicle trips per day.

The location for the sludge management facility has not yet been determined, but will likely be located outside the urban core. Construction traffic will be managed as with the construction of the STP facilities.

Traffic volumes generated during construction will be light compared to existing street and road traffic volumes in most places. Also, since traffic near STP and collector system construction sites will be controlled in accordance with HRM regulations, significant effects are not expected.

**Rail Lines**

Construction in the vicinity of rail lines will involve installation of collector pipe lines under rail road tracks and the provision of temporary work site rail crossings for construction access. Construction of collector system trenching crossings of rail lines are currently regulated by *General Order No. E-10 (Pipe Crossing Under Railway Regulations)* which will be in effect until the *Standards Respecting Pipeline Crossings Under Railways* comes into effect, sometime in 2001.

Approvals for construction crossings of rail lines for movement of construction materials and equipment must be arranged by the construction contractor. The contractor must apply for and agree to a Private Crossing Agreement for Construction Purposes. This agreement is arranged through the local rail road office.

Significant effects on rail service are not expected, since construction projects near railways, or crossing of active rail lines, are heavily regulated and will be undertaken according to specific guidelines.

**Marine**

The construction of bottom trenches or gravel beds for the diffusers and outfall pipes will involve two or three scows, a tug boat and one or more work boats. The outfall pipes may be placed in excavated trenches and then the trenches will be backfilled. Alternatively, the pipes may be placed on a bed of granular material that has been laid directly on the seafloor, with armourstone covering the pipe. Concrete diffusers will be fabricated onshore and then taken to the disposal site and placed in position on a prepared granular bed. The Herring Cove diffuser will be installed using similar equipment, except the rocky bottom may also require blasting for outfall and diffuser installation. The marine work for each diffuser will probably require about three to four months.

It is expected that the effects of constructing outfall pipes and diffusers (*i.e.,* potential conflicts with marine traffic) will be restricted to the immediate area of each site. Construction of the outfall and diffuser will require an authorization under the *Navigable Waters Protection Act* from Fisheries and Oceans Canada

(Coast Guard). This authorization will require an assessment by Coast Guard of the final outfall/diffuser plans, to ensure that the construction activities and infrastructure will not pose a hazard to ship navigation or anchoring. The outfall/diffusers must be located in an area where they cannot be easily damaged by harbour vessels (*e.g.,* by anchor dragging). HRM will consult with the Harbourmaster and possibly the Queens Harbourmaster regarding final location and design of the outfall and diffuser. For example, Anchorage #3 may require relocation to accommodate the outfall/diffuser associated with the Dartmouth STP. The Halifax Port Authority was consulted regarding the preliminary outfall/diffuser locations as specified in this document.

Harbour vessels will also be notified of marine construction activities through publication in "Notice to Mariners" as well as ongoing communication with the Harbourmaster. Since the capacity of Halifax Harbour is well above current marine traffic demand, there will not be significant effects on the overall operation of the Harbour.

**Public Transit**

Collector system construction may require localized temporary changes to transit routes, schedules and bus stop locations. The contractor will work closely with Metro Transit officials to minimize disruption to operations. Transit users should be advised of any changes by signs, notices, Metro Transit web site or newspaper advertisements. Except for these localized temporary effects, there will not be significant effects on the operation of Metro Transit.

**Bicycles**

Trenching and broken pavement along collector corridors will cause discomfort and possibly riding hazards to bicyclists. Appropriate signs warning cyclists of uneven pavement surfaces will be posted. Newspaper advertising should be used to indicate location and duration of work that may affect cyclists. Every effort will be made to minimize the time from pavement breaking to repaving the trenched areas. The effects will be localized and of short duration, and, given the proposed mitigative measures, are not expected to have a significant impact on bicycle travel.

**Pedestrians**

In areas identified to be heavily traveled by pedestrians, care will be exercised to ensure that adequate width and reasonably smooth surfaced pedestrian detours are provided in collector system trenching areas. Appropriate temporary structures will be provided to allow pedestrian crossing of open trenches. Barricades, fencing and adequate lighting will be installed to minimize pedestrian hazard associated with open excavations. The effects will be localized and of short duration, and, given the proposed mitigative measures, are not expected to have a significant impact on pedestrians.

In summary, the construction of STPs is not likely to have any significant adverse environmental effects on transportation infrastructure. Although there may be site specific areas along collector system installation corridors where there will be relatively short term adverse effects (*e.g.,* Upper Water Street at Historic Properties) with regard to traffic and pedestrian movement, the overall impact of collector system construction is not likely to be significant. Construction of STPs and collector systems are typical of other large scale construction and municipal infrastructure projects in Metro Halifax. Such projects are generally well tolerated by the transiting public assuming careful transportation planning, and adherence to guidelines and other standard mitigative measures.

Table 5.11 summarizes the residual environmental effects analysis for the construction phase.

#### 5.4.5.2 Operation

**Roadways**

Expected vehicle movements related to each STP's operation include:

- Sludge haulers (average two tractor trailers per day);
- Chemical delivery vehicles (average two per week);
- Lighter delivery vehicles (two per day); and
- Private vehicles for employees and visitors (12 to 15 per day).

CSO locations will require periodic trips by loaders and trucks to remove accumulated solids collected at these facilities. The frequency of these trips has not been determined, but will, in part depend on the frequency of overflow events at those locations.

The location of the sludge treatment facility has not been determined. However, the siting, construction and operation of that facility will comply with Provincial requirements, including community consultation and traffic planning. Sludge haulers will follow normal requirements for truck movements and will follow marked truck routes. Special sludge handling trucks will be used to transport sludge from the STPs to the off-site treatment facility. The trucks will be designed to securely contain the sludge and to prevent odour emissions. The trucks will be loaded within the STP facility under controlled atmosphere and will be washed after loading and unloading.

Construction of a new access road to the Dartmouth STP will mitigate the concerns of area residents for traffic impacts on local streets during STP operation. At the Halifax site, appropriate access to DND Scotian and possible future changes to the Cogswell street Interchange will be considered in the design details of the STP site. It is anticipated that the future redevelopment of the Cogswell Interchange, should it take place, can incorporate the STP as part of the overall development plan. Operation of the alternate Halifax STP will not affect traffic on DND roadways, access to DND Scotian, or have any impacts on the possible redevelopment of the Cogswell Street interchange lands.

Since the number of trips generated by STP and CSO operation will be very low compared to the existing high volumes on area streets and roads, there will not be any significant impacts on transportation infrastructure.

**Marine**

The STP outfall and diffusers will be of sufficient depth as not to impede ship movements. Although subsea infrastructure will be protected by placement of armor rock, appropriate warnings will be placed on Harbour navigation charts to ensure that ship anchoring or anchor dragging does not damage the installation. Although the overall Harbour capacity is well above current marine traffic demand, replacement of Anchorage #3 may be required to mitigate long range anchorage shortages. This matter will be discussed with the Harbourmaster. Occasional maintenance of diffusers may be required to ensure continued effectiveness (*e.g.,* no clogging); these activities are not expected to affect marine transportation. The operation of the STPs and the underwater diffusers are not expected to have a significant impact on marine transportation.

**Other**

The operations of the STPs and collection systems are not anticipated to have any adverse environmental effects on pedestrians or bicycle traffic.

Table 5.12 summarizes the residual environmental effects analysis for the operations phase.

### 5.4.6 Follow-up and Monitoring

HRM will continue consultations with the Harbourmaster, Queens Harbourmaster and Coast Guard regarding finalized locations of outfalls and diffusers and the need to avoid conflict from marine traffic and anchoring; and the possible need to reconstruct Anchorage # 3.

### 5.4.7 Summary of Residual Environmental Effects Assessment

Construction of STPs and collector systems are typical of other large scale construction and municipal infrastructure projects that are generally well tolerated by the public. Operation activities will generate very low volumes of traffic on area streets and roads. Effective communication with the Harbourmaster will help to mitigate any potential effects on marine traffic as a result of the project. In summary, there are not likely to be any significant adverse environmental effects on transportation infrastructure as a result of construction and operation activities of the Project.

**Table 5.11** **Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Transportation Infrastructure (Construction)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects | | | | | Residual Environmental Effects Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Social-cultural and Economic Context | | |
| Construction of Collector System (Trenching and Tunnelling) | C Site specific traffic congestion at areas with existing restricted capacity<br>C Traffic movement changes that reduce levels of performance near collector system trenching / tunnelling areas<br>C Congestion /hazards for cyclists and pedestrians<br>C Conflict with rail activity<br>(A) | C Plan and operate work areas in accordance with the "Construction and Work Area Manual"<br>C Advise public of potential traffic impacts so they can alter traffic patterns where possible<br>C Restrict construction activities during peak traffic periods<br>C Maintain two through lanes for peak flow direction in high traffic areas<br>C Conduct rail crossing according to guidelines | 1 | 2 | 2 / 1 | R | 2 | N | 3 |

**Table 5.11 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Transportation Infrastructure (Construction)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects: Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Social-cultural and Economic Context | Residual Environmental Effects Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| Construction of STPs | C Traffic congestion during construction of treatment plants (A) | C Plan and operate work areas in accordance with the "Construction and Work Area Manual"<br>C Advise public of potential traffic impacts so they can alter traffic patterns where possible;<br>C Restrict site deliveries to off-peak traffic periods<br>C Maintain two through lanes for peak flow direction in high traffic areas<br>C Construct dedicated access road to Dartmouth site<br>C Consultations with DND regarding access to Dockyard<br>C Consultations with DND regarding potential traffic impacts on DND roadways associated with alternate Halifax site; traffic management/communications | 1 | 2 | 3 / 6 | R | 2 | N | 3 |

**Table 5.11 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Transportation Infrastructure (Construction)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects | | | | | Residual Environmental Effects Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Social-cultural and Economic Context | | |
| Construction of outfalls/diffusers | C Interference with marine traffic (A) | C NWPA approval<br>C Notice to Mariners<br>C Consultations with Harbourmaster and Coast Guard<br>C Notification of Harbourmaster | 1 | 2 | 2 / 6 | R | 2 | N | 3 |
| Construction of sludge composing facility | C Increased traffic to the site (A) | C Plan and operate work areas in accordance with the "Construction and Work Area Manual"<br>C Advise public of potential traffic impacts so they can alter traffic patterns where possible;<br>C Restrict site deliveries to off-peak traffic periods<br>C Maintain two through lanes for peak flow direction in high traffic areas | 1 | 2 | 3 / 6 | R | 2 | N | 3 |

| **Table 5.11** | **Residual Environmental Effects Assessment Matrix**<br>**Valued Environmental Component: Transportation Infrastructure (Construction)** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects | | | | | | Residual Environmental Effects Rating | Level of Confidence |
| | | | Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Social-cultural and Economic Context | | | |

**KEY**

**Magnitude:** 1 = Low: *e.g.*, temporary degradation in level of service of a route; 2 = Medium: *e.g.*,temporary alteration in travel patterns of people and goods in the community; 3 = High: *e.g.*, permanent change in long-established activity patterns of the community

**Geographic Extent:** 1 = <500 m²; 2 = 500 m² -1 km²; 3 = 1-10 km²; 4 = 11-100 km²; 5 = 101-1000 km²; 6 = >1000 km²

**Duration:** 1 = < 1 month; 2 = 1-12 months; 3 = 13-36 months; 4 = 37-72 months; 5 = > 72 months

**Frequency:** 1 = < 11 events/year; 2 = 11-50 events/year; 3 = 51-100 events/year; 4 = 101-200 events/year; 5 = >200events/year; 6 = continuous

**Reversibility:** R = Reversible; I = Irreversible

**Ecological/Socio-cultural and Economic Context:** 1 = Pristine area or area not adversely affected by human activity; 2 = Evidence of adverse effects.

**Residual Environmental Effect Rating:** S = Significant Adverse Environmental Effect; N = Non-significant Adverse Environmental Effect; P = Positive Environmental Effect

**Confidence:** 1 = Low level of Confidence; 2 = Medium level of Confidence; 3 = High level of Confidence

**Table 5.12 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Transportation Infrastructure (Operations)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects | | | | | Residual Environmental Effects Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Social-cultural and Economic Context | | |
| Collector system Maintenance | C Occasional vehicle traffic to CSOs and pumping stations (A) | C Use of approved truck routes where necessary | 1 | 1 | 5 / 2 | R | 2 | N | 3 |
| STP operation and maintenance | C Supply/maintenance vehicles and employee vehicles traffic to STP (A) | C Use of dedicated access road to Dartmouth STP<br>C Use of approved truck routes where necessary<br>C Possible restriction of trucks to off peak hours in congested areas | 1 | 1 | 5 / 6 | R | 2 | N | 3 |
| Outfall/diffuser operation and maintenance | C Occasional marine traffic to maintain facility (A) | C Publication in Notices to Mariners<br>C Notification of Harbourmaster | 1 | 1 | 1 / 1 | R | 2 | N | 3 |

**Table 5.12 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Transportation Infrastructure (Operations)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects | | | | | Residual Environmental Effects Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Social-cultural and Economic Context | | |
| Biosolids handling and management | C Sludge truck traffic (2/day) to sludge composting facility from each STP<br>C Supply, employee and other vehicle traffic (daily) to sludge composting facility<br>(A) | C Use of approved truck routes where necessary<br>C Loading and unloading of sludge trucks to control odour and secure truck contents<br>C Truck washing | 1 | 1 | 5 / 6 | R | 2 | N | 3 |

Refer to Table 5.11 for Key.

## 5.5 Public Health

Protection of human health is one of the most important factors in the general well-being of a community. Sewage treatment is generally recognized as having widespread benefits to human health due to the high level of removal of human pathogens from treated effluent through solids removal and disinfection. Public health was considered as a VSC for this assessment due to public concerns expressed regarding the operation of sewage treatment plants near residential communities. The assessment of this VSC will therefore focus on the effects of Project operation on public health. Occupational health and safety risk is not considered in this assessment as this risk will be adequately managed according to the *Occupational Health and Safety Act* and *Regulations*. Related VECs discussed in this assessment include: Atmospheric Resources (Section 4.1); Marine Water Quality (Section 4.2); Sediment Quality (Section 4.4); and Transportation Infrastructure (Section 5.4).

Additional information on this VSC can be found in "Screening Level Human Health Risk Assessment" (JWEL 2001), and "Wastewater Characterization Study - 1999" (SNC Lavalin 1999), component studies conducted for the HHSP. The following documents prepared for the HHCI project are also relevant to this VSC: Environmental Assessment Report, Sections 4.7 and 7.9 (HHCI 1992); "Marine Water and Sediment Quality" (Land and Sea Environmental Consultants 1991); and "Human Health Risk Assessment" (Bio-Response Systems Limited and JWEL 1992).

### 5.5.1 Boundaries

The spatial boundary for the assessment of public health extends to adult and child residents in the vicinity of the STPs, harbour related recreational users, and adults and children consuming shellfish and crustaceans which may be harvested from the presently closed areas of Halifax Harbour. The temporal boundaries of the assessment of public health are continuous and year round, in consideration of the continuous operation of the STP and discharge of treated sewage.

### 5.5.2 Description of Existing Conditions

Halifax Harbour currently receives more than 150 million litres of untreated sewage effluent per day from the metropolitan area through over 40 sewer outfalls. The discharge of raw sewage and surface runoff into the harbour has elevated the concentration of pathogenic microorganisms and chemical compounds in harbour waters. Public health is a concern due to exposures to pathogens through: direct contact or ingestion of harbour water (during recreational use of the harbour); inhalation of sewage effluent; and consumption of shellfish and crustaceans which may be harvested from the harbour.

**Pathogens and Chemicals of Concern**

With the exception of potential exposure to volatile organic compounds (VOCs), the potential pathogens and other chemicals of concern in domestic sewage and the associated hazards of exposure to these have been well defined in previous reports (Land and Sea Environmental Consultants 1991; Bio-Response Systems Ltd. and JWEL 1992; SNC Lavalin 1999; COA 2000). A summary of these hazards include the following:

- **Bacteria**: *Campylobacter* spp., enteropathogenic *Escherichia coli*, *Proteus* spp., *Pseudomonas aeruginosa*, *Salmonella* spp., *Shigella* spp., *Staphylococcus* spp., *Vibrio cholerae*, and *Yersinia enterocolitica;*

- **Viruses**: Adenoviruses, coxsackieviruses, echoviruses, hepatitis A virus, non-A, non-B hepatitis virus, Norwalk virus, poliovirusis, reoviruses, and rotaviruses;

- **Protozoa**: *Entamoeba hystolytica* and *Giardia lamblia*;

- **Metals**: includes those expected to be identified dissolved in sewage, such as cadmium, nickel, copper, lead and zinc. Additional metals which may be present include: aluminum, arsenic, barium, boron, chromium, iron, manganese, mercury, molybdenum, selenium, silver, strontium;

- **Volatile Organic Compounds (VOCs)**: studies of STPs in other jurisdictions have identified the following VOCs which may result from STP operations: acetone, benzene, chloroform, dichloromethane or Methylene Chloride (MC), tetrachloroethylene (Perc), toluene, trichloroethylene (TCE) 1,1,1, Trichloroethane (TCA); and

- **Other contaminants**: polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), petroleum hydrocarbons (TPH).

The assumed discharges and distribution of these chemicals and biological contaminants varies widely throughout the harbour. Analytical data collected from previous characterization studies are presented in Appendix G and the concentrations of selected hazards have been predicted using oceanographic modeling (COA 2000). In order to account for potential VOCs present in the untreated sewage influent, specific VOC concentrations have been assumed based on other studies of municipal wastewater characteristics in other jurisdictions (Zhu *et al.* 1999).

**Airborne Contaminants and Pathogens**

Outfalls currently discharge untreated sewage to Halifax Harbour, some in close proximity to residential and recreational areas along the Halifax and Dartmouth waterfronts and near Herring Cove. A broad cross-section of the population is therefore exposed to untreated VOC emissions from many of these outfalls.

**Waterborne Contaminants and Pathogens**

The human health risk assessment conducted for HHCI (Bio-Response Systems Ltd. and JWEL 1992) identified waterborne contaminants and pathogens from untreated sewage being discharged into Halifax Harbour as a significant public health hazard. The exposure assessment component of that report has also identified human exposures to waterborne contaminants and pathogens as significant. The significant potential pathways identified for waterborne contaminants include the following:

- dermal contact with harbour water through recreational contacts (*i.e.*, swimming, sailing, SCUBA diving, etc.); and
- ingestion of shellfish and crustaceans harvested from Halifax Harbour.

*Predictive Modeling of Pathogen Distribution in Halifax Harbour*

Section 4.2 of this report describes water quality modelling undertaken for the HHSP. This modelling compares fecal coliform concentrations (an indicator of the presence of sewage) for untreated 1991 conditions and those predicted for the year 2041 in the absence of a sewage treatment project. The modelling shows an increase in the aereal extent and concentration of bacterial loading in the harbour as the predicted volume of discharge increases over this time period (Figure 4.3).

*Risk Characterization from Waterborne Contaminants and Pathogens*

The following section provides a discussion about the significance of existing exposures to waterborne contaminants and pathogens.

<u>Recreational Users</u>

Faecal coliform is commonly used an indicator for regulatory purposes as a measure of sewage contamination in water as well as the risk to humans through typical direct contact exposures such as swimming, diving or sailing activities. High levels of coliform indicators have been detected in 88 percent of the waterborne disease outbreaks in North America (Moore *et al.* 1994). Epidemiological studies show that there is a risk of disease associated with recreational use of sewage-contaminated water where direct contact is involved (Bio-Response Systems Ltd. and JWEL 1992).

<u>Consumption of Shellfish</u>

The harbour is closed to harvesting of mollusks, therefore theoretically, there is no risk to humans from ingestion of mollusks under present conditions. However, there have been cases of illness associated with the consumption of mollusks from Halifax Harbour. At present there is no indicator of pathogenic contamination of mollusks. Therefore, there is a risk to those that choose to ignore harvesting prohibition and to those that purchase (wholesale or retail) mollusks from unknown suppliers.

The "Human Health Risk Assessment" Component Study Report for HHCI (Bio-Response Systems Ltd. and JWEL 1992) evaluates in detail the dose-response for the consumption of lobster taken from Halifax Harbour. The results of that risk assessment concluded that consuming lobster hepatopancreas (commonly called tomalley) presents a higher risk for both PCBs and PAHs than consuming only lobster meat. The highest estimated contaminants levels for both meat and hepatopancreas from the consumption of lobsters are from those lobsters taken from Dartmouth Cove and Bedford Basin.

**Sewage Sludge Exposure**

Sewage sludge from existing sewage treatment facilities in HRM (*e.g.*, Mill Cove, Eastern Passage) is transported to a sludge settling pond in the Aerotech Business Park near the Halifax International Airport. This facility is not adjacent to any residential areas therefore there is currently minimal public exposure to sewage sludge.

### 5.5.3 Residual Environmental Effects Evaluation Criteria

A **significant** adverse effect is defined as one that increases the risk(s) to human health beyond acceptable levels as determined by a human health risk assessment that references accepted public health guidelines.

A **positive** effect is defined as one that has the potential to reduce existing risks to human health.

### 5.5.4 Potential Interactions, Issues, and Concerns

Based on public comment and professional judgement of the study team, the following issues have been identified regarding potential public health effects of the HHSP operation: airborne emissions from the STPs; waterborne and sediment contaminants affecting recreational water use and consumption of crustaceans and shellfish; and offsite management of sewage sludge. Potential public health issues related to Project construction have been addressed through the assessment of related VECs and VSCs. Potential interactions related to the dust emissions generated during construction are addressed in Section 4.1, Atmospheric Resources. Potential interactions with the transiting public during the construction phase are addressed in Section 5.4, Transportation Infrastructure.

### 5.5.5 Analysis, Mitigation, and Residual Environmental Effects Prediction

#### 5.5.5.1 Construction

As noted in Section 4.1, Atmospheric Resources, and Section 5.4, Transportation Infrastructure, no significant effects on public health during Project construction are anticipated.

### 5.5.5.2 Operation

Ongoing operation of the STPs will result in the discharge of treated sewage effluent and air emissions. Operation of the sludge management facility will also produce air and liquid emissions. These discharges have the potential to interact with residents living in close proximity to the facility sites as well as with recreational harbour users and consumers of harbour shellfish and crustaceans. The "Screening Level Human Health Risk Assessment" (JWEL 2001) predicts the human health risk associated with Project operation. The expected overall improvement in water quality, sediment quality, and air quality will result in an overall positive effect for human health. While the Human Health Risk Assessment focused on public health rather than the occupational health of HRM sewage treatment employees, current occupational health and safety information for the existing STPs in HRM indicate lower than average sick time for staff within the same union local. (A. Brady, pers. comm. 2001) The following sections summarize the risk assessment of Project operation.

**Airborne Contaminants and Pathogens**

Municipal wastewater treatment plants tend to emit low levels of VOCs that may be found in the influent due to disposal of small amounts of chemicals from commercial and industrial sources through municipal wastewater systems. Air dispersion modelling conducted for HHSP revealed that predicted VOC emission rates from the STPs are significantly lower than the maximum allowable emission rates based on the Ontario Ministry of the Environment air quality criteria and point of impingement standards criteria. To be conservative, the model was run assuming no air scrubbers; however the design of the facility will incorporate an air scrubbing system to control odours. Scrubber systems can achieve up to 99 percent reduction of VOC emissions, thereby providing an additional margin of safety for the surrounding community.

**Waterborne Contaminants and Pathogens**

*Effects on Recreational Users*

The recreational limit for faecal coliform bacteria for contact recreation is 200 coliform bacteria /100 mL. Modelling has shown that these limits are consistently exceeded in the Inner Harbour, the Northwest Arm and near Herring Cove (Figure 4.3). It is predicted that the HHSP, which includes advanced primary treatment and UV disinfection, will dramatically reduce the concentration of faecal coliform and associated pathogens in the harbour. It is anticipated that post-treatment bacteria levels will be acceptable for contact recreation in most areas of the harbour. Figure 4.3 indicates that without the Project, bacteria levels will continue to rise with increased future flows.

Where chlorine has been used for disinfection, the reduction of coliform numbers to target limits provides sufficient reduction to pathogens and viruses to prevent the transmission of communicable disease. UV disinfection has been shown to achieve better virus inactivation than the comparable chlorine dose (Yip and Konasewick 1972).

*Effects Related to Shellfish Consumption*

Modeling shows a reduction in faecal coliform bacteria concentration throughout the harbour to levels below the shellfish limit of 14 counts/100 mL with the proposed treatment system (COA 2000) (Figure 4.3). However, faecal coliforms cannot be used to quantify the risk of illness from consumption of mollusks. Only a monitoring program using adequate indicators will evaluate the potential for harvesting and aquaculture in some areas of the harbour. Industrial harbours such as Halifax are generally closed to mollusk harvesting for a number of reasons including bacterial pollution. It is unclear if sewage treatment will permit the reopening of mollusk harvesting areas within the harbour.

The model predictions show a 25 percent reduction in metals discharge due to primary treatment. However, no analysis was undertaken for PCBs or PAHs. These organic contaminants will be largely adsorbed onto organic and particulate matter rather than in a dissolved state. The removal efficiency of total suspended solids is predicted to be approximately 75 percent. Therefore, a significant reduction of PCB and PAH loadings to the harbour is anticipated. Over the long term, contaminant uptake by lobsters is likely to reduce in areas outside the zones of influence of settleable solids from the four outfalls. There is expected to be an overall long term reduction in contaminant uptake by harbour lobster and a consequent reduction in risk to humans who consume them.

*Summary of Risk from Waterborne Contaminants and Pathogens*

The operation of the Project is anticipated to have a positive effect on human health with respect to the decrease in pathogens and contaminants entering the harbour as a result of sewage treatment. There will likely be a decrease in the potential for illness associated with direct contact with harbour water, as well as a net improvement in the quality of shellfish and crustaceans harvested from Halifax Harbour.

**Sewage Sludge Exposure**

While the location of the sewage sludge management facility has not yet been identified, the siting, design and operation will be subject to provincial regulations and guidelines that will, in part, serve to protect public health from the uncontrolled release of pathogens. It is anticipated that the facility will be located in an industrial park or other area suitable for this type of operation. HRM has identified certain sludge management options which are not acceptable (*i.e.*, landfilling, incineration, and ocean dumping). HRM seeks to promote beneficial use of sludge, and thus, some form of composting is considered to be the most likely option.

The "Composting Facility Guidelines" (NSDOE 1998) outline the requirements for construction and operation of a compost facility in Nova Scotia and incorporate the CCME "Guidelines for Compost Quality" (CCME

1996). The sludge management facility will adhere to these guidelines and will also require regulatory approval from NSDEL pursuant to Section 26 of the *Activity Designation Regulations* under the Nova Scotia *Environment Act*.

In accordance with these guidelines, the sludge management facility will include the following components and specifications.

- Impermeable pads will be installed at receiving and tipping areas including enclosed structures.

- Containment systems for the actual composting and curing areas including drainage control and leachate collection and treatment.

- Specific leachate management systems will be designed to collect, monitor, control and treat leachate.

- Discharge standards for liquid effluents from composting facilities will meet background water quality in the receiving water body and the *Canadian Water Quality Guidelines*. Effluents must not be deleterious to fish as required by the Section 36 of the *Fisheries Act*.

- Facilities are required to develop and submit surface water management plans including a comprehensive monitoring program.

- Groundwater monitoring plans are required to be implemented and must remain in force throughout the life-cycle of the facility. Groundwater monitoring must include background and down gradient groundwater sampling in close proximity to operating areas to ensure early detection of contaminant migration laterally or vertically.

- Odours will be controlled as a condition of approval of all composting facilities. Handling areas will be enclosed and operate under negative atmospheric pressure in order to avoid the escape of odours. Ventilation systems will incorporate treatment systems.

- Separation distances are imposed on composting facilities. Separation distances required by the operating approvals are as follows:

| | |
|---|---|
| Residential or Institutional Buildings | 500 metres |
| Commercial or industrial buildings | 250 metres |
| Property Boundaries | 100 metres |
| Property Boundaries (engineered facilities)* | 30 metres |
| Watercourses (fresh water or marine) | 30 metres |

*Note: Any modification of separation distances will only be permitted with the written consent of all adjacent property owners.

- Feedstocks are also restricted by the approval. All facilities are required to prepare and implement emergency response plans to deal with reasonably foreseeable emergencies including fires, explosions, leachate leaks or spills.

Prior to removal for offsite applications (*e.g.*, agricultural use), the composted sludge will be analyzed for various quality parameters (including metals and pathogens) to determine if it is acceptable for the intended area. Sealed containers will minimize odour migration during sludge transfer from the STP to the collection truck. If a spill were to occur, an Emergency Response Plan would be activated.

In summary, there are not expected to be any significant risks to public health from the operation of the sludge management facility. Table 5.13 summarizes the residual environmental effects analysis for the operations phase.

### 5.5.6 Follow-up and Monitoring

Routine, ongoing compliance monitoring for faecal coliform will be conducted at the STPs to ensure that the plants consistently meet the NSDEL requirements. Compliance monitoring will also be undertaken at the sludge management facility to ensure that effluents and discharges, as well as compost quality meet all regulatory requirements. Treated sewage effluent and air discharges from STPs will also be analyzed for the presence and concentration of VOCs to confirm amounts predicted in the screening level human health risk assessment.

### 5.5.7 Summary of Residual Environmental Effects Assessment

In summary, construction and operation of the STP is not likely to have any significant adverse effects on public health. In general, there is expected to be an overall improvement in the water quality, sediment quality, and air quality due to the HHSP resulting in decreased health risk from human exposures through direct harbour water contact, inhalation of VOCs, or ingestion of shellfish harvested from the Halifax

Harbour. The proposed sewage treatment project will provide a proven means for HRM to reduce risks associated with existing exposure to untreated sewage. There is predicted to be an important, long term positive effect on public health as a result of HHSP operations.

**Table 5.13 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Public Health (Operations)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects | | | | | Residual Environmental Effects Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Social-cultural and Economic Context | | |
| STP operation | Ç Release of low levels of VOCs from STP air discharge (A) | Ç Dispersed air discharge from STP below Guideline limits for VOCs<br>Ç Air scrubber system further reduces levels of VOCs | 1 | 1 | 5 / 6 | R | 2 | N | 3 |
| | From treated effluent discharge:<br>Ç Decreased overall contaminant and pathogen concentrations in harbour water<br>Ç Long-term decrease in contaminant loading and consequent uptake and bioaccumulation in food species (P) | Ç No mitigation required | 2 | 3 | 5 / 6 | R | 2 | P | 3 |
| Sludge handling and management | Ç Discharge of pathogens from sludge or composting process and/or application of processed sludge (A) | Ç Compost facility will adhere to NSDEL and CCME Guidelines and approval conditions<br>Ç Sludge compost will be tested to ensure acceptable quality prior to end use | 1 | 1 | 5 / 6 | R | 2 | P | 2 |

**Table 5.13 Residual Environmental Effects Assessment Matrix**
**Valued Environmental Component: Public Health (Operations)**

| Project Activity | Potential Positive (P) or Adverse (A) Environmental Effect | Mitigation | Significance Criteria for Environmental Effects | | | | | Residual Environmental Effects Rating | Level of Confidence |
|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration/Frequency | Reversibility | Ecological/Social-cultural and Economic Context | | |

**Magnitude:** 1 = Low: *e.g.*, specific group of individuals, localized, one generation or less; 2 = Medium: *e.g.*, portion of a population, more than one generation; 3 = High: *e.g.*,entire definable group of people, several generations.
**Geographic Extent:** 1 = <500 m²; 2 = 500 m² -1 km²; 3 = 1-10 km²; 4 = 11-100 km²; 5 = 101-1000 km²; 6 = >1000 km²
**Duration:** 1 = < 1 month; 2 = 1-12 months; 3 = 13-36 months; 4 = 37-72 months; 5 = > 72 months
**Frequency:** 1 = < 11 events/year; 2 = 11-50 events/year; 3 = 51-100 events/year; 4 = 101-200 events/year; 5 = >200events/year; 6 = continuous
**Reversibility:** R = Reversible; I = Irreversible
**Ecological/Socio-cultural and Economic Context:** 1 = Pristine area or area not adversely affected by human activity; 2 = Evidence of adverse effects.
**Residual Environmental Effect Rating:** S = Significant Adverse Environmental Effect; N = Non-significant Adverse Environmental Effect; P = Positive Environmental Effect
**Confidence:** 1 = Low level of Confidence; 2 = Medium level of Confidence; 3 = High level of Confidence

## 6.0 MALFUNCTIONS AND ACCIDENTAL EVENTS

As with any industrial system, malfunctions and accidental events associated with construction and operation of a sewage treatment system may occur unexpectedly. These may range from small, easily managed events such as small spills inside an STP, to failure of system controls resulting in failure of effluent treatment or odour control, affecting larger areas. The probability of serious accidental events or those causing significant adverse environmental effects is low, particularly when design, construction, and operational procedures incorporate system redundancy, contingency and emergency response planning.

The design of Project facilities incorporates redundancy of key systems such as: power generation; odour control; and dual forcemains. STPs and collection system components are designed to handle a minimum of four times average dry weather flows. Therefore, most of the time the system will be operating with excess treatment capacity (*e.g.*, tankage, tunnels) that can provide storage in the event of an upset in the treatment system. These and other features will promote the continuous treatment of effluent and odour management in the event of accidental failure of a major system.

Construction and operation procedures will be in accordance with relevant regulations and guidelines. Environmental Management Plans (EMPs) will be developed for Project construction and operation (Section 10). These plans will include preventative measures designed to reduce the likelihood of malfunctions and accidents that could result in environmental effects. The EMPs will also include emergency response and contingency plans to reduce the magnitude, duration, and extent of effects should an accident or malfunction occur.

The following section discusses potential Project malfunctions and accidents, relative likelihood of occurrence, potential effects on VECs and VSCs, and contingency planning.

**Contaminated Sites/Acidic Rock Encounters**

During Project construction, contaminated sites and/or potentially acid generating rock may be encountered. A Phase 1 Environmental Site Assessment (ESA) is a preliminary but comprehensive investigation and evaluation of all available historical and current information about a site to determine whether potential exists for contaminants to be present that may cause unacceptable impacts or risks to human health and safety and/or to the environment. Phase 1 ESAs have been conducted on the Dartmouth and alternate Halifax STP sites.

Potentially contaminated sites will be managed in accordance with the Guidelines for Management of Contaminated Sites in Nova Scotia (NSDOE 1996). If a potentially contaminated site is encountered, the owner of the site is notified. The site is evaluated in a timely manner to determine whether there are off-site impacts or unacceptable on-site impacts. If impacts or risks are identified, the owner is required to: advise affected third parties, if appropriate; determine whether active remediation or ongoing site management is to be implemented; and submit a contaminated site Notification Report to NSDEL.

Excavation may occur in areas of bedrock with acid generating potential. Runoff from exposed sources of sulphide mineralization can reduce water quality by acidification. If acid generating bedrock is encountered and is unavoidable, potential effects will be minimized through various mitigation measures. Prior to excavation in bedrock, evaluation of depth to bedrock by geotechnical investigation and testing for acid producing and acid consuming potential will be undertaken at and in the vicinity of watercourse crossings where there is a concern for site runoff into nearby watercourses. Testing will comply with specification outlined in the *Sulphide Bearing Material Disposal Regulations*. Exposure, removal and disposal of potentially acid generating bedrock will be conducted in compliance with the Guidelines for Development on Slates in Nova Scotia (NSDOE and Environment Canada 1991), and the *Sulphide Bearing Material Disposal Regulations*. Exposure of acid generating bedrock to rain and air will be reduced by keeping any exposed or stockpiled material covered, and capturing and neutralizing any runoff before discharge. If excavated material exceeds acid generating limits, bedrock will be disposed of in accordance with the *Sulphide Bearing Material Disposal Regulations*. Exposed bedrock will be backfilled with clay.

**Hazardous Materials Spills**

Potentially hazardous materials that may be used in relatively large quantities at STPs include polyelectrolytes, alum, and sodium hypochlorite. Much smaller amounts of other potentially hazardous materials to be used, primarily for maintenance activities, include cleaners, salts, fertilizers, paints, oils and greases, solvents, and fuel. UV technology will be used to disinfect treated effluent, therefore no chlorine gas will be used. Relatively large amounts of lime will be used for sludge stabilization at the sludge composting facility. All of these chemicals will be stored and handled according to provincial and federal regulations by qualified personnel. Hazardous materials and the elements of proposed chemical treatment or flocculation methods to be used will be inventoried and reviewed for implications under *Nova Scotia Environment Act* and Regulations and *Canadian Environmental Protection Act (CEPA)* and Regulations (*e.g.*, List of Toxic Substances).

Large spills of hazardous materials are highly unlikely. Smaller spills will be extremely limited in area affected and will be rapidly and effectively cleaned up by onsite personnel and materials (*e.g.,* absorbants). Contingency planning will ensure an effective response by providing emergency response training, and ensuring the availability of neutralizing agents and personal protective equipment. Hazardous material management practices and contingency plans will be detailed in environmental management plans to be developed for the STPs and sludge management facility. These are standard provisions at existing HRM STPs.

In the unlikely event of a spill into the marine environment (*e.g.,* through a storm sewer), marine water and sediment quality, benthic habitat, and commercial fishing are the VEC/VSCs most likely to be affected. It is likely that these spills would be noticed immediately and clean-up would be mobilized in accordance with the hazardous materials spill contingency plan and coordinated with the provincial Emergency Measures Organization. The area of impact would likely be very localized.

### Breaks in the Collector System

The failure of a major component of the collector system is expected to be unlikely and of short duration, particularly due to back-up generators at the pumping stations and dual forcemains. Failure of a pumping station at or before the STP, if protracted, could result in backup and overflows through CSOs, a situation very close to existing conditions in the affected portion of the harbour. Assuming the CSO treatment facilities (*e.g.,* screening) were operating, the effluent would not have any floatables, and settleable material would be partially removed. The break may have localized and temporary effects on marine water and sediment quality, marine benthic habitat, and commercial fishing. In the unlikely event of failure of the pumping station resulting in release of untreated effluent to the Northwest Arm, marine water quality criteria associated with the water use classification system (SB) would be temporarily exceeded thereby resulting in a significant adverse effect on marine water quality.

The magnitude of overflows and effects related to a sewer break would depend on the location of the break. If a collector system break results in raw sewage flow over land, there could be potential effects on atmospheric resources, land use and human health. Dual (redundant) forcemains will reduce this risk. Immediate response and contingency planning would limit the extent of and duration of the event, therefore no significant adverse environmental effects are anticipated with the possible exception of local odour generation. Human contact with raw sewage will naturally be limited thereby reducing the risk of exposure to released pathogens.

### Breakage of the Diffuser/Outfall

A malfunction of the diffuser and/or outfall is unlikely to be noticed beyond routine inspections. The frequency of those inspections will dictate the expediency of the repair of damage and restoration of design flows. A break in the outfall pipe or diffuser would result in essentially a single port discharge, potentially in shallower water than the proposed diffuser location. This would result in a more concentrated and persistent effluent plume, which, depending on its location, may be similar to existing conditions at some of the larger outfalls. Depending on the location (primarily water depth) and duration of the break, other localized impacts might occur, including dissolved oxygen depression and increased localized sedimentation. If the break were protracted, enhanced algal growth could be promoted. In general, breakage of the diffuser would have localized effects, temporarily affecting marine water and sediment quality, marine benthic habitat, and commercial fishing. None of these effects are anticipated to be significant since the effects would be localized and temporary, and compliance with water use guidelines is unlikely to be affected.

### Failure of Effluent Treatment

The STP systems will be designed with excess capacity during dry weather flows (4xADWF) and standby power to minimize the potential for treatment disruption. Furthermore, routine inspection and maintenance, and monitoring of the Supervisory Control and Data Acquisition (SCADA) system is likely to identify any deteriorations or malfunctions in the system prior to an accidental failure. In the unlikely event of treatment failure, either at the CSOs or at the STP facilities, raw sewage would enter the harbour directly from the CSOs. Because of the hydraulic design of the STP, there will be no untreated effluent discharge from the STP.

In the event of a complete malfunction, the marine water quality would temporarily revert to conditions similar to the modelled no-project levels (refer to Section 4.1) within the particular sewershed serviced by the failed STP; however the effluent would be distributed differently (*i.e.,* away from the Narrows and the Northwest Arm) due to the HHSP outfall consolidation. CSOs would continue to provide some treatment (*e.g.,* screening) in the event of treatment failure at the STP. In the event of a malfunction, recreational access to certain areas may need to be curtailed. Such impacts would be temporary until treatment is restored. It is extremely unlikely that more than one STP would fail at the same time resulting in harbour wide discharge of untreated sewage.

**Failure of Odour Controls**

Failure of odour controls could occur in the unlikely coincidence of electrical outage combined with power back-up failure. Impacts would include temporary release of odour emissions to the surrounding environment, potentially affecting surrounding land uses as a nuisance until the systems are reestablished. The risk of odour control failure is minimized by effective preventative maintenance programs and continuous monitoring. In the unlikely event of failure of odour controls, there would likely be a persistent exceedance of the HRM odour performance criteria (*i.e.,* 4 ppb over a 5 minute rolling average) at the point of air exhaust; therefore there would be a significant effect on atmospheric resources.

**Transportation Accidents**

Any construction project that affects public streets, rail roads or gas pipelines has the potential for transportation related malfunctions and accidents. Although considered remote, the following potential accident situations warrant discussion:

C Rail Crossing Accidents - Construction crossings of the Dartmouth rail line will be designed, flagged and monitored in accordance with CN requirements. This is essential considering the amount of petroleum products and chemicals shipped from and to the Imperial Oil Refinery.

C Natural Gas Pipeline Accidents - Construction of the Dartmouth collector system may require crossing of the Maritimes & Northeast Pipeline (Halifax Lateral) near Tufts Cove. Also, collector system construction may require crossing of natural gas distribution system piping or business and residential laterals. Necessary permits will be obtained prior to excavation and the relevant precautions will be taken when digging in the vicinity of pipelines.

- Sludge Hauling Collisions - The removal of sludge from the four treatment plants will involve about 700 truck trips per year both entering and exiting each STP. Chemical trucks will account for an additional 100 trips both entering and exiting each STP. These trucks will travel on designated roadways and will represent only a small fraction of truck traffic on highways likely to be used to transport sludge. Contingency plans will be implemented in the unlikely event of an accident. There is not likely to be any significant effects associated with Project-related truck collisions.

**Fires and Explosions**

Sewage treatment facilities are not prone to fire (HHCI 1992). In the unlikely event of a fire at the STP, first response measures, as outlined in an emergency response and/or environmental protection plan would be taken by facility personnel to contain and suppress the fire until emergency personnel arrive on the scene. A major fire and/or explosion could affect air quality by releasing particulate matter and/or gases into the atmosphere. The magnitude of the effect would be determined by the size and duration of the blaze and matter of combustible material. If partially contaminated materials are released to the marine environment, marine and sediment quality, and benthic habitat may be affected.

**Summary**

In summary, potential interactions between VECs and VSCs and malfunctions and accidental events during construction or operation is limited due to the design, and construction and operational procedures to be implemented for this Project. In the unlikely event of a malfunction or accidental event, adverse effects on VECs and VSCs are anticipated to be limited due to their temporary and localized nature. A system failure resulting in untreated effluent entering the Northwest Arm through the CSO at Chain Rock, or a failure of an odour control system could result in a significant adverse effect on marine water quality and atmospheric resources respectively. These significant effects would be temporary and localized, and are considered to be unlikely.

# 7.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

The definition of environmental effects under Section 2(1) of the CEAA includes "any change to the project that may be caused by the environment". Project design must include consideration of physical environment characteristics and their potential effects on the Project. Potential effects of the environment on the Project are described below. Where effects of the environment on the Project may be responsible for malfunctions, the potential environmental effects are addressed in Section 6.0.

**Sea Level Rise**

Over the long term operation of the HHSP, changes to climate may result in sea level rise. Sewer interceptors and CSOs will be designed to function satisfactorily at harbour water levels that may be 1 m higher than the present extreme high tide elevation. Therefore sea level rise is not anticipated to have a significant effect on the Project.

**Climate Change and Storm Events**

Changes in climate may result in increased precipitation and potential increased overflow events. Additional storage capacity can be provided, if required, through several options. For example, if flows exceed STP capacity (initially designed for 2021 flows), the STPs can be upgraded earlier than scheduled to 2041 flow capacity to reduce the amount and frequency of overflow bypassing the STP. Another option is to increase storage capacity of wet wells of pumping stations and reduce the pumping rate to the STP. Options for reducing overflow events will be evaluated depending on the frequency and volume of the events and the system design options.

**Waves and Currents**

Halifax Harbour is a fairly well protected inlet and wave heights will be limited primarily by fetch. Herring Cove is open to the east and will on occasion be subject to high wave conditions. In these instances the wave height and associated bottom currents at Herring Cove are limited by shoaling. Tidal current patterns in the harbour are well known but must be augmented by estuarine and storm currents for design purposes. Estuarine currents are highly variable but can be characterized by existing data records. Storm currents may be wind driven or surge driven and must be assessed on the basis of models or theory. The outfall at Herring Cove will be designed and built for major storm events. This will involve a heavy duty outfall and diffuser structure anchored to the seabed.

**Sedimentation and Seabed Type**

Sedimentation may foul diffusers and/or reduce the height of discharge above the bottom. Seabed type (mud, sand, gravel or bedrock) may affect long-term stability of bottom structures (*e.g.*, outfalls, diffusers). Low sedimentation rates in the harbour (less than about 0.001 m/yr average over the past 10,000 years - HHTF 1990) will minimize the potential for interference with diffuser performance. Good engineering design will, nonetheless, ensure that velocities in discharge pipes and diffusers exceed scour limits for ambient sediments. This will ensure that the system will be “self-cleaning”.

Harbour bottom types range from bedrock to mud. Most of the latter has been deposited during the Holocene period (past 10,000 years) and can amount to several metres in some parts of the Harbour (HHTF 1990). The thickness of the mud layer is highly variable in space at some Inner Harbour locations. Pipeline routing and diffuser siting must take these variation into account. At Herring Cove the bottom is mostly sand. Structures placed there will need to account for sand build-up and/or scour to ensure stability without the possibility of burial.

**Seismic Activity**

Nova Scotia has a low potential for seismic activity. In accordance with the National Building Code, the coefficient of risk of seismic activity in the Project location will be incorporated into standard engineering design of the facilities. Seismic activity is therefore not likely to have a significant impact on the Project.

**Acid Rock Drainage**

Acid generating bedrock is widespread throughout the Halifax region and will likely be encountered during construction of the STPs and collector systems, particularly on the Halifax peninsula. Acidic water produced from exposed bedrock may have a corrosive effect on buried metallic pipe and/or other metallic components of collector system infrastructure. To minimize the risk of corrosion, plastic and/or concrete sewer pipes will be used to the greatest extent possible. Standard acid drainage mitigation procedures will be applied during construction to minimize the exposure of acid rock and consequent drainage, and ensure disposal of the rock is conducted in accordance with applicable provincial and federal regulations (refer to Section 6.0).

# 8.0 CUMULATIVE EFFECTS SUMMARY

As required by the *CEAA*, consideration of the environmental effects of a project must also consider any cumulative environmental effects that are likely to result from the project in combination with other past, present or future likely projects or activities.

As discussed in the Cumulative Effects Assessment Practitioners Guide (CEA Agency 1999), a key component of cumulative effects assessment is the determination of the regional context for VECs/VSCs. The methodology applied to this assessment has considered the regional context for each VEC/VSC to identify potential cumulative effects with other projects and activities, and in consideration of the regional distribution of the VEC/VSC. In general, environmental effects associated with past and present projects or activities have been considered within a regional context, where applicable, in the discussion of existing conditions for the VECs/VSCs in this report (Sections 4 and 5). For example, past and present harbour activities (*e.g.,* untreated sewage and industrial discharge) have contributed to the existing environmental conditions of the harbour with respect to marine water quality, sediment quality, and benthic habitat.

A cumulative effects scoping exercise was conducted to identify past, present, or likely (*i.e.,* approved) future projects that might interact cumulatively with the Project. Several projects that have not been approved and may not proceed (*i.e.,* Cogswell Interchange redevelopment, induced development in the Herring Cove area) have also been considered. The potential cumulative effects associated with two policies/programs have been considered as well. The projects, activities and policies/programs outlined in Table 8.1 were identified based on discussions with HRM staff, including municipal development officers, as well as the professional judgement of the study team.

While some future approved projects are relatively well defined (*e.g.,* where building permits have been approved), other likely future activities are more difficult to define in terms of potential spatial and temporal interactions with the Project. It is within this context that the potential for cumulative environmental effects resulting from these other projects and activities are evaluated for each of the VECs and VSCs as relevant. Potential cumulative interactions are presented on Table 8.1.

| **Table 8.1 Summary of Potential Cumulative Effects Evaluation** | | | |
|---|---|---|---|
| **Project** | **Status** | **Potential Interaction** | **VECs/VSCs Potentially Affected by Cumulative Effects** |
| ***Land-Based Projects and Activities*** | | | |
| Building development (mainly residential units) | Ongoing | Traffic; additional receptors for potential odour and noise emissions | C Atmospheric Resources<br>C Land Use<br>C Transportation Infrastructure |
| Redevelopment of Cogswell Street Interchange | Potential future project; not approved; design uncertain | Halifax STP site potentially lies at the northern end of a comprehensive redevelopment of the Cogswell Street Interchange. STP site and associated uses would potentially need to be incorporated into planning process if redevelopment proceeds. | C Land Use<br>C Transportation Infrastructure |
| Fibre optic cable facility, Herring Cove | Fibre optic facility and access road recently constructed near potential STP site | Incremental traffic; lighting; noise | C Atmospheric Resources<br>C Terrestrial Resources<br>C Archaeological Resources<br>C Land Use<br>C Transportation Infrastructure |
| Provision of municipal water supply to Herring Cove due to STP | Municipal water infrastructure will likely be brought to Herring Cove as part of the STP project | Improved water quality for Herring Cove residents currently on a well water supply; increased potential for increased development potentially affecting the rural character of the community. Settlement and Servicing Strategy has been completed. | C Land Use |

**Table 8.1 Summary of Potential Cumulative Effects Evaluation**

| Project | Status | Potential Interaction | VECs/VSCs Potentially Affected by Cumulative Effects |
|---|---|---|---|
| ***Marine-Based Projects and Activities*** | | | |
| Harbour dredging (maintenance and construction related) | Current and ongoing | Direct disturbance of benthic habitat; resuspension of contaminated sediment; potential conflict with marine traffic; demand for dredge spoil disposal capacity | C Marine Water Quality<br>C Marine Sediment Quality<br>C Marine Benthic Habitat<br>C Transportation Infrastructure |
| Rockingham Terminal construction | Potential future project; status uncertain | Disturbance of sediment; construction noise (atmospheric and marine); addition of marine traffic | C Atmospheric Resources<br>C Marine Water Quality<br>C Marine Sediment Quality<br>C Marine Benthic Habitat<br>C Commercial Fisheries<br>C Land Use<br>C Transportation Infrastructure |
| ***Policies and Programs*** | | | |
| HRM's Source Control Program to reduce the introduction of toxic substances into wastewater | Currently being implemented by HRM Phase 1 (identification of commercial sources and in-sewer water testing) complete. Revised by-law governing discharges to sewers is due in early 2001. | Complements sewage treatment by reducing pollutants in wastewater and ultimately improving effluent quality and sludge quality from STPs | C Marine Water Quality |
| HRM's Stormwater Management Policy | Currently being developed under contract for HRM | Complements sewage treatment by reducing the amount of stormwater to be treated by STPs (and reducing overflows) and improving quality of stormwater | C Marine Water Quality |

With respect to land-based projects, potential cumulative effects may result with respect to past, present and future development activities. HHSP construction activities may interact cumulatively with other development activities (*e.g.,* building construction, transportation infrastructure redevelopment) near proposed STP sites, resulting in cumulative effects to atmospheric resources (*i.e.,* noise, dust), land use and transporation infrastructure. HRM by-laws control development activities to minimize effects of noise and traffic congestion. Adherence to applicable legislation and implementation of mitigative measures proposed for this

Project (Table 11.1) will further serve to minimize potential effects of HHSP construction and operation interacting cumulatively with nearby construction projects. Construction projects are generally well tolerated by the public assuming careful transportation planning and adherence to guidelines and other standard mitigative measures. The temporal and spatial overlap of HHSP construction and other construction projects is likely to be limited, further reducing the opportunity for cumulative effects.

Installation of centralized sewer and water services to Herring Cove may accompany the STP development which could cause induced development and associated cumulative effects including pressure on transportation infrastructure and the rural character of the community. The "Herring Cove Settlement and Servicing Strategy" (LandDesign Engineering Services 2000) incorporates future land use planning and addresses community concerns related to growth. HRM has implemented the recommendations of this study through revisions to the area Municipal Planning Strategy.

Marine-based projects and activities may interact with the Project, potentially resulting in cumulative effects on marine water, sediment quality, benthic habitat, and commercial fisheries. Cumulative effects associated with sedimentation from harbour dredging and outfall/diffuser installation are possible. However, Project-related effects on water quality, sediment quality and benthic environment are predicted to be insignificant (Section 4.2, 4.3 and 4.4). The temporal and spatial overlap with other dredging activities are likely to be limited, particularly since the outfalls are unlikely to be installed at the same time. Significant cumulative effects are therefore unlikely. The Rockingham Terminal is proposed for Bedford Basin, therefore cumulative effects with the HHSP are unlikely. Furthermore, since the HHSP is predicted to result in positive effects on marine water quality, sediment quality, and benthic environment during project operation, it is highly unlikely that the HHSP will cause adverse cumulative effects in the marine environment.

HRM's pollution prevention initiatives will interact cumulatively with the HHSP resulting in positive effects on marine water quality. In particular, the Source Control Strategy, which includes a revised wastewater by-law (By-Law W-101), complements the HHSP by reducing the amount of contaminants at the source, prior to entering the wastewater stream. This will increase the efficiency of sewage treatment facilities and improve the quality of wastewater effluent from the STP as well as improving sludge quality. HRM's stormwater plan may also have positive cumulative effects by reducing stormwater entering the collection system, potentially reducing overflow events.

In summary implementation of the mitigative measures contained in this EA Report and adherence to applicable legislation and guidelines will reduce the potential for adverse environmental effects associated with this Project. The opportunity therefore, for the Project to interact cumulatively with past, present and likely future projects to create significant adverse effects are unlikely. There is a potential for HRM Source Control and stormwater policies and programs to have positive cumulative effects with the HHSP.

# 9.0 PUBLIC CONSULTATION SUMMARY

With municipal amalgamation in 1996, the former Cities of Halifax and Dartmouth, the former Town of Bedford and the former County of Halifax became one single jurisdiction for the communities and areas surrounding Halifax Harbour. One of the early initiatives of HRM was to determine that provision of sewage treatment for the harbour would be a major priority. Following the end of the federal-provincial crown corporation HHCI and the demise of that plan, HRM Council decided that it would be up to the municipality to reactivate a regional sewage treatment plan. Council determined that a community-based approach would be the best way to obtain public support for any plan, and the initiative was designed to provide for stakeholder and public input and involvement at all phases.

**Harbour Solutions Symposium**

As an initial step in reactivating the project, HRM Council hosted a public Symposium, held November 8 - 9, 1996 at Dalhousie University, Halifax. This Symposium was intended to develop a community consensus on the preferred way to undertake a harbour project, and to consider specific related questions and issues. A Background Document was prepared outlining some elements of the history of harbour cleanup efforts, and some of the key issues to be addressed.

In soliciting participants for the Symposium, HRM used the public mailing list which had been maintained by HHCI, as well as the list of intervenors in the public hearings held as part of the environmental assessment process for the HHCI plan. Public notice was also provided through local newspapers. The Symposium was jointly organized with the Nova Scotia Department of Environment, and Environment Canada. Approximately 170 individuals attended.

A complete report on the Symposium has been published by HRM in the form of the Symposium Background and Proceedings documents. The product of the Symposium was set of 12 General Principles developed by consensus of the participants, which HRM Council subsequently adopted as a basis for moving the project forward.

**Harbour Solutions Stakeholder Advisory Committee**

While the Symposium participants agreed on a set of general principles for the project, there were a number of specific questions of a more technical nature for which the Symposium did not provide recommendations. HRM Council decided to create an Advisory Committee to more fully investigate and provide recommendations on these questions. An advertisement was placed in local newspapers to solicit expressions of interest in serving on such a committee. Applicants were asked to submit information which demonstrated one or more of the following: relevant technical expertise; past involvement with harbour issues; interest in such issues; constituency represented; and geographic area represented. While applicants were considered as individuals, an effort was made to select representation for different geographic areas, stakeholder groups, levels of government, academia, and the general public. HRM staff recommended 13 individuals to Council for membership on the Advisory Committee, to which Council added three appointees.

HRM provided independent facilitation to the Advisory Committee through a contracted facilitator. HRM also provided technical expertise through a group of consultants who worked closely with the Advisory Committee and provided them with information and analysis on the issues. The Committee decided to work through consensus processes whenever possible. The Advisory Committee produced a report which was adopted by Council with its recommendations. A final decision on the Committee recommendation regarding ownership under possible public-private partnership approaches was deferred by Council until the Request for Proposals (RFP) phase.

**WINBY Approach**

One of the key recommendations of the Advisory Committee was that Sewage Treatment Plant (STP) siting should adopt a "WINBY" ("Want It In My Backyard") approach that has successfully been used elsewhere to assist in siting sewage treatment facilities. The overall thrust of the strategy is for the communities to become aware that:

- wastewater treatment facilities can be developed and operated without negative impacts such as noise, odour, etc.; and
- facilities can be developed in such a way as to support community needs such as infrastructure, parks, access to beaches, etc.

In adopting this approach, HRM has agreed that affected communities should have input in how the STPs are designed and built, and that this should be done in a manner which, to the greatest extent feasible, integrates the STPs into the community and provides benefits to the community. HRM has identified a portion of the project budget for the purpose of community integration of the STPs, and has initiated liaison efforts with affected communities to bring the WINBY approach.

**Community Liaison Program**

The community liaison effort has been conducted primarily by a contracted consultant, Griffiths Muecke Ltd., assisted by HRM staff. The process has been adapted to each of the four communities surrounding the Dartmouth, Halifax (formerly Halifax North), Herring Cove, and former Halifax South STP sites, depending on the issues and context for each STP.

In general, once the specific STP site location had been identified and agreement in principle to purchase the land reached, key individuals within the community were informed of the upcoming announcement and were consulted on the best way to provide information to the surrounding neighborhood. Immediately after the announcement was made, a customized newsletter was delivered to each household within approximately 0.5

to 1 km surrounding the site. Three hundred to 1,000 newsletters were distributed, depending on the density of residential development. Information packages with background reports were sent to organizations and individuals with a particular interest in the project. These included community groups, residents' associations and community leaders.

The second step was to hold an advertised public open-house within two weeks of the announcement to familiarize residents with the project and the specific site in their neighbourhood. This provided an opportunity for residents to access information through reports and displays, ask questions and provide initial feedback. Follow-up meetings were organized as needed, and Harbour Solutions team members were available to answer questions. Tours of existing HRM STP facilities or presentations by STP staff have also been provided upon request, and a special telephone line has been set up to provide immediate response to requests for information.

The third step (in the case of Dartmouth and Halifax) has been to organize a Community Liaison Committee (CLC) for each area. The core of the two CLCs are pre-existing community groups with a track record of responsible activism on local issues. The representation on the CLC has been expanded to include self identified and peer-appointed members representing the broader interests of the community. Both CLCs have adopted very similar Terms of Reference. The CLCs have been provided with logistical support for the activities they wish to undertake, for example the distribution of meeting minutes, organization of workshops, or public meetings. Through these meetings and/or workshop venues, and through feedback questionnaires, the CLCs are in the process of developing community views and priorities for input into the design of the STPs and site characteristics. This information may also be used as a basis for proposals for projects to be developed through community integration funding as part of the WINBY approach. They may also wish to commission studies, or solicit professional advice as part of their responsibilities.

Input from these Committees has been reflected in the RFP provided to the short-listed project proponents, in the areas of odour and noise control, buffer zones and associated amenities, STP building design, and general site characteristics. In both cases, the community reaction has been supportive of the Halifax Harbour Solutions project in general, and accepting of the necessity for treatment plants, with particular concerns expressed.

Once the principal matters of concern with respect to the site have been addressed, the CLCs will take the lead in identifying community integration projects in the immediate area surrounding the site which can provide long term benefit to the area.

In the case of the former Halifax South STP, a public open house was held, and residents and community groups contacted, for their information. Major commercial/institutional interests in the area have been similarly contacted. A particular issue for Halifax South which persists, in the updated Concept Plan (i.e., 3 STPs), is the necessity of a pumping station at Chain Rock, within Point Pleasant Park. The Park Advisory

Committee has been informed, and their proposed views on pumping station location and design incorporated into the RFP.

A site for the Herring Cove/Mainland South STP has not yet been announced. A reference site for the purposes of Project tendering and environmental assessment has been identified at Hospital Point in the Herring Cove area. However, the community has taken an active interest in the project, and have expressed concerns over development changes which may occur in their community as a result of provision of central sewer service. Sewage from Mainland South presently discharges near Herring Cove, and the feasible engineering solutions involve an STP in the Herring Cove area to treat this discharge. A number of public meetings in the community identified concerns over increased development pressures which may follow STP construction, as well as provision of central water service as a community priority because of existing well water problems. In order to address these concerns, HRM undertook a servicing study of the area in collaboration with the Herring Cove Ratepayers Association. Community leaders were actively involved in the study as members of the Steering Committee, and the study has involved a number of public meetings and workshops to obtain public input into desired development and servicing strategies for the community. The study results have aided in revising the area development plan, and in defining community interests for use of the community integration funds in Herring Cove. Once a site is announced, HRM will undertake the CLC approach described above to obtain community input on the specific STP design.

CLC representatives will have an opportunity to review and provide evaluations of proposed STP design features to HRM staff and Council.

**Public Opinion Results**

HRM contracted Corporate Research Associates in 1998 and 1999 to conduct public opinion surveying on the harbour issues. The results were consistent, and also comparable to previous surveys conducted in 1994 and 1996. Overall, there is a high level of awareness of the problems with water quality in the harbour and the resulting impacts. There is also a strong level of support for a sewage treatment solution, and a willingness to pay for such a solution.

Consistently, harbour pollution has been rated the most important environmental problem in the Metro area (over 30 percent of respondents), with over 90 percent rating water quality as only fair or poor. Between 60 percent and 70 percent have indicated that the current water quality has a moderate or major impact on their quality of life, with aesthetic, tourism, recreation, and fish/wildlife impacts consistently cited as the most important.

More than 80 percent of respondents consistently say that it is very important to develop a new sewage treatment system for the harbour. Over 70 percent indicate that they would be willing to pay an additional charge on their water bills to fund such a system, while a clear majority (56 percent) of those who pay a water bill would be willing to pay at least $100 more per year. A large majority (71 percent) feel that the federal and provincial governments also have an obligation to contribute.

Between February 21st and March 15th, 2001, Omnifacts Research undertook a telephone survey for HRM. It focussed on the neighbourhoods close to the three proposed urban STP sites. The Herring Cove site was not surveyed because the Herring Cove Ratepayers recently undertook a servicing study connected to the HHS project that involved consultation with the public.

A total of 815 people were surveyed yielding results accurate to within ±. 3.3%, 19 out of 20 times. Approximately four weeks before the survey, 2,000 - 2,300 newsletters were delivered in each of these areas to provide background information to residents.

The survey found that 81 percent of those who are aware of the Project support it. When asked about the locations, 31 percent were not concerned or didn't mind the locations; 22 percent think the sites are good or say they are pleased, and 16 percent said they are worried, angry or disgusted. In response to questions about their concerns, 32 percent had no concerns, 26 percent were concerned about odour, 17 percent were concerned about the treatment plant locations, 15 percent had other environmental concerns, 8 percent were concerned about the appearance of the plants, and 12 percent were concerned about noise or traffic. On the topic of benefits, 37 percent could not identify benefits, 20 percent thought that the treatment plant locations could be beneficial, and 19 percent mentioned cleaner beaches and a cleaner harbour

Those surveyed were questioned about the Community Integration Fund and how this potential investment in STP communities has influenced their overall perception of these plants. Thirty-one percent said that they see advantages from the sewage treatment project regardless of the Fund, 35 percent said that they feel that there are disadvantages for the community but that these are offset by the Fund, and 25 percent said that there are disadvantages which will not be offset by the Fund. The following options were suggested for spending the Community Integration Fund money:

- parkland development or outdoor recreation (23 percent)
- improving the environmental safety of the plants (11 percent)
- waterfront access (7 percent)
- general cleanup (7 percent)

**General Public Information Program**

HRM has undertaken a number of initiatives to keep the general public informed about the project, and to provide the public with a means to obtain information and provide their input into the project.

Articles describing the project, and explaining the Environmental Protection Charge added to water bills, have regularly been published in the Water Talk Bulletin provided by the Halifax Regional Water Commission as a water bill insert. Articles have also been published and distributed in the Let's Waste Less Newsletter published by the HRM solid waste program, and in the HRM Recreation Catalog distributed to all HRM households. An article was also published in the United Nations Environment Program News Forum.

Meetings have been held by HRM staff with specific stakeholders groups, such as the Dalhousie Sierra Club, on request.

A general Harbour Solutions newsletter for the public has been produced, with the first issue distributed in January 2001. Two open public meetings have been held to update the community on the status of the Project, and to provide an opportunity for public questions and feedback. The first was held in Dartmouth at the Woodside Community Centre on January 14, 2001; the second was held in Halifax at the Westin Hotel on January 18, 2001.

All of the studies and reports dealing with the project which have been published by HRM have been deposited with the HRM Public Library, and with the university libraries, for public access. In addition, the HRM Harbour Solutions Office maintains a library of harbour and project reports which may be viewed by the public on request.

As part of the HRM public Web site, an extensive Harbour Solutions home page has been established (www.region.halifax.ns.ca/harboursol/index.html). This site maintains current project information and status, as well as providing access to all of the background reports and harbour studies developed for the environmental assessment process. The site also provides a mechanism for the public to submit enquiries or comments to the Project Office.

A consistent phone number for the Project Office has been established and publicized since 1996, as a contact for the public to receive information or to submit comments. HRM has developed a portable display unit for the Project, which has, at various times, been located in the HRM Storefront public service offices, in shopping malls and various meetings and conference venues, as well as open house events. In 1999, HRM hired a dedicated Public Communications Support position to develop public information and provide public liaison.

**Council Decisions**

All significant decisions regarding the Project have been made by HRM Council in public session following full debate. Council sessions are televised on the local cable channel.

**Company Public Involvement and Information Program**

Once the successful Company has been chosen to build and operate the sewage treatment system, the Company will assume primary responsibility for the Public Involvement and Information Program (PIIP) in ongoing coordination with HRM. The PIIP will be developed for the life of the Project and will consistent with HRM's objectives.

## Public Participation Timeline

Table 9.1 presents a project timeline outlining public participation events.

**Table 9.1 Project Timeline of Public Participation**

| Year | Public Participation Event |
|---|---|
| 1996 | C Amalgamated Council makes commitment to Harbour Solutions Project<br>C Harbour Solutions Symposium<br>    C advertised invitation in papers for participants (open to public)<br>    C event dates and venue advertised<br>    C direct contact with mailing list from 1993 HHCI public panel hearings<br>    C independent (non-HRM) Co-Chairs and Facilitators<br>    C Principles adopted by HRM Council as basis for moving ahead<br>    C Background and Proceedings reports distributed to public libraries, Universities and by request to public<br>C Consistent phone number established for project office |
| 1997 | C Council appoints Harbour Solutions Advisory Committee to address remaining issues<br>    C advertised invitation in papers for applications for membership<br>    C independent (non-HRM) Facilitator<br>    C technical support provided by independent consultants<br>C HRM conducts public opinion surveying, showing strong public support for project (willingness to pay) |
| 1998 | C Council adopts Solutions Advisory Committee recommendations<br>C WINBY (Want It In My Back Yard) approach adopted to design and develop project in ways acceptable to affected communities<br>C Committee and consultant reports distributed to public libraries, Universities and by request to public |
| 1999 | C Project office hires public information officer, and retains public liaison consultant<br>C Project information publicized through:<br>    C Water Talk (water bill inserts)<br>    C Recreation Catalog<br>    C Let's Waste Less Newsletter<br>    C UNEP News Forum<br>C Harbour Solutions web site established, containing:<br>    C background information<br>    C all published HHSP reports<br>    C environmental assessment<br>    C record of Council decisions<br>    C notices and press releases<br>    C process and project status<br>    C contact names and numbers, opportunity to submit comments<br>C Public meetings in Herring Cove to discuss the project, funding and possible sites |

| **Table 9.1 Project Timeline of Public Participation** | |
|---|---|
| **Year** | **Public Participation Event** |
| 1999 & 2000 | - Three candidate STP sites announced (Halifax North, Dartmouth, Halifax South)<br>- Independent consultants provide community liaison and information service<br>- Distribution door-to-door of letters and information packages to local residents<br>- Direct contact with identifiable community groups and leaders<br>- Public meetings to provide information and solicit public input<br>- Meeting minutes distributed to participants<br>- Tours of Mill Cove treatment plant provided<br>- Involvement of district HRM Councillors, MLAs and MPs<br>- Creation of community liaison committee (peer-appointed, self-identified members) for each site<br>- Ongoing involvement of public and committees through workshops, meetings, newsletters<br>- Results of community input provided to short-listed consortia<br>- Community input used in preparing RFP criteria and technical requirements<br>- Continued information through public display and information handouts<br>    - HRM Storefronts<br>    - Shopping Malls<br>    - meetings, workshops, conferences and public venues<br>- Servicing study of Herring Cove area undertaken to address community concerns; extensive involvement of Ratepayers Association in Steering Committee, focus groups, chairing public meetings<br>- Public meetings and workshops held to obtain public input on Herring Cove servicing issues |
| 2001 | - Further distribution of Project newsletters<br>- Article published in the HRM Naturally Green newsletter |

# 10.0 ENVIRONMENTAL MANAGEMENT FRAMEWORK

The Company will submit to HRM for review, two Environmental Management Plans (EMPs); one for the construction period, and the second for the operating period. The EMPs will be structured as a project Environmental Management System (EMS) that will be consistent with the ISO 14001:1996(E) standard. The EMPs will provide a structured process for the achievement of continual improvement in environmental performance. The EMPs will be suitable for periodic third-party audits by a qualified auditor.

The EMP will include, but not be limited to:

- an Environmental Protection Plan (EPP) that includes mitigative measures specific to major sites and activities; and
- an Emergency Response and Contingency Plan that will address the potential for upset conditions and accidental events potentially affecting environmental or socioeconomic conditions (*e.g.,* mechanical malfunction leading to a failure of odour control, untreated sewage being discharged to the harbour, fires and spills).

The EMP will include the Company's Environmental Policy, and contain procedures to identify significant environmental aspects and relevant environmental objectives and targets. It will describe management programs to reach these objectives. The EMP will also contain procedures for implementation and operation, checking and corrective action, and management review of the EMP. The Company will identify all relevant regulations and guidelines in the EMPs, as well as relevant industry standards and codes of practice.

Mitigative measures and monitoring requirements specified the EA (refer to Section 11 for summary) and regulatory conditions of approval will also be incorporated into the EMPs. In general, the EMPs will be written in a style that is suitable for application by subcontractors and inspectors on site.

# 11.0 SUMMARY AND CONCLUSIONS

Over 150 million litres of untreated sewage currently enter Halifax Harbour each day. This sewage discharge is expected to increase substantially in the future as the population of HRM grows. These sewage discharges have resulted in poor water quality along the shorelines, widespread bacterial contamination, and poor aesthetics along the Halifax and Dartmouth waterfronts due to particulates, floatables, and odour.

HRM proposes to develop a regional sewage treatment system to treat raw sewage entering Halifax Harbour. The Halifax Harbour Solutions Project (HHSP) consists of the construction and operation of three sewage treatment plants (STPs) (Halifax, Dartmouth, and Herring Cove) and associated collection systems that will provide advanced primary treatment with UV disinfection. Sewage sludge will be managed at a central facility for a beneficial end use. The STPs will be designed, built and may be operated by a Company selected by HRM Council through a tendering process, while the collection systems will be built by the Company but operated by HRM.

This environmental assessment was prepared to satisfy requirements of the *Canadian Environmental Assessment Act* for a screening level assessment of the HHSP concept plan. This assessment focused on environmental and socioeconomic issues of greatest concern, known as Valued Environmental Components (VECs) and Valued Socioeconomic Components (VSCs), respectively. VECs/VSCs were identified through a scoping process (Section 3) which included, but was not limited to, a review of the previous environmental assessment of the Halifax Harbour Clean-up Project. The following VECs and VSCs were selected for the assessment:

- Atmospheric Resources;
- Marine Water Quality;
- Marine Sediment Quality;
- Marine Benthic Habitat;
- Terrestrial Resources;
- Commercial Fishery;
- Archaeological and Heritage Resources;
- Land Use;
- Transportation Infrastructure; and
- Public Health.

Each of the five VECs and five VSCs selected for the assessment were evaluated for potential interactions between the VEC/VSC and planned Project activities (Section 4 and 5). Mitigative measures have been recommended to reduce or eliminate potentially adverse effects. Table 11.1 summarizes the mitigative measures, and monitoring and follow-up recommended for each VEC/VSC.

**Table 11.1 Summary of Mitigation, Monitoring and Follow-up Requirements**

| VEC/VSC | Mitigation | Monitoring and Follow-up |
|---|---|---|
| Atmospheric Resources (noise and odour) | Construction<br>C Standard dust control procedures<br>C Timing restrictions on construction activities<br>Operation<br>C Odour control equipment at pumping stations and STPs<br>C STP and pumping station design features to minimize noise emissions<br>C Timing restrictions on vehicle movements | Operation<br>C Continuous odour monitoring at STP air discharge<br>C Compliance noise monitoring<br>C Acoustic and vibration monitoring as part of routine equipment maintenance program |
| Marine Water Quality | Construction<br>C None required<br>Operation<br>C Engineered diffusers to promote dispersion of effluent | Operation<br>C Adherence to NSDEL effluent limits<br>C Regulatory agencies will assist in evaluation of need for follow-up studies and environmental effects and compliance monitoring. |
| Marine Sediment Quality | Construction<br>C Land disposal of any dredged sediments<br>Operation<br>C None required | Post-Construction<br>C Regulatory agencies will assist in evaluation of need for follow-up studies and environmental effects and compliance monitoring. |
| Marine Benthic Habitat | Construction<br>C Compliance with DFO Guidelines<br>Operation<br>C None required | Post-Construction<br>C Regulatory agencies will assist in evaluation of need for follow-up studies and environmental effects and compliance monitoring |
| Terrestrial Resources | Construction<br>C Schedule construction activities, to the extent possible, to occur outside of bird breeding season at Herring Cove STP site<br>C Retain natural vegetation around the Herring Cove STP for wildlife habitat<br>C Adhere to regulatory blasting guidelines<br>C Perform remedial action as necessary to restore any damaged wells<br>Operation<br>C Compliance with Composting Facility Guidelines (NSDOE 1998) for sludge management facility | Pre-Construction<br>C Conduct rare plant survey at Herring Cove STP site prior to clearing<br>C Conduct rare plant and breeding bird survey at sludge management facility prior to clearing<br>C Conduct well water survey to identify and characterize water wells in proximity to construction activities |

| Table 11.1 Summary of Mitigation, Monitoring and Follow-up Requirements | | |
|---|---|---|
| **VEC/VSC** | **Mitigation** | **Monitoring and Follow-up** |
| Commercial Fisheries | Construction<br>C Avoidance of fishing seasons for marine components<br>C Compliance with DFO Guidelines<br>Operation<br>C None required | Post-Construction<br>C Regulatory agencies will assist in evaluation of need for follow-up studies and environmental effects and compliance monitoring |
| Archaeological and Heritage Resources | Construction<br>C Contingency plan for discovery of resources<br>C Archaeological excavation of resources which may be disturbed<br>Operation<br>C Contingency plan for discovery of previously undisturbed resources | Pre-Construction<br>C Archaeological assessment of sludge management facility site<br>C Pre-construction testing at selected locations<br><br>Construction<br>C Archaeological monitoring during construction |
| Land Use | Construction<br>C Contract incentives for rapid completion of construction<br>C Noise and dust control procedures<br>C Traffic management, including construction of dedicated access road for Dartmouth STP<br>C Replacement of DND parking if alternate Halifax site is selected<br>C Communications, planning, signage to facilitate property/business access<br>C Innovative site planning and architectural design of STPs<br>C Early notification to existing occupants at and near STP sites<br>C Site selection and design of sludge composting facility to Composting Facility Guidelines<br>Operation<br>C Odour and noise control at CSOs, pumping stations, and STPs as required<br>C Community Integration Fund projects in host communities<br>C Adherence to Composting Facility Guidelines and CCME Guidelines for Compost Quality | Operation<br>C HRM and other regulatory officials will determine need for monitoring and follow-up |

| **Table 11.1 Summary of Mitigation, Monitoring and Follow-up Requirements** | | |
|---|---|---|
| **VEC/VSC** | **Mitigation** | **Monitoring and Follow-up** |
| Transportation Infrastructure | <u>Construction</u><br>C Plan and operate work areas in accordance with the *Construction and Work Area Manual*<br>C Advance public notification<br>C Timing of construction activities during non-peak traffic periods<br>C Maintain two through lanes for peak flow direction in high traffic areas<br>C Conduct rail crossing according to applicable guidelines<br>C Construct dedicated access road for Dartmouth STP site<br>C Consultations with DND to maintain access to Dockyard<br>C Consultations with DND regarding potential traffic impacts on DND roadways associated with alternate Halifax site; traffic management/communications<br>C Notification of marine construction in Notice to Mariners<br>C Consultations with Harbourmaster and Coast Guard regarding construction of outfalls/diffusers<br><u>Operation</u><br>C Use of approved truck routes where necessary<br>C Use of dedicated access road to Dartmouth STP<br>C Possible restriction of trucks to off-peak hours in congested areas | <u>Pre-construction</u><br>C Follow-up meetings with the Harbourmaster, Queens Harbourmaster and Coast Guard regarding finalized locations of outfalls and diffusers<br>C Follow-up with Harbourmaster concerning possible relocation of Anchorage #3 |
| Public Health | <u>Construction</u><br>C None required<br><u>Operation</u><br>C Adherence to Composting Facility Guidelines and CCME Guidelines for Compost Quality | <u>Operation</u><br>C Compliance monitoring for faecal coliform to ensure effluent meets NSDEL requirements<br>C Compliance monitoring at sludge composting facility<br>C VOC analysis of treated sewage effluent and air discharges from STPs |

Adverse residual environmental effects (*i.e.*, after all recommended mitigative measures have been applied) for all the VECs/VSCs are predicted to be non-significant for routine Project-related construction and operation activities. There may be a significant adverse effect to atmospheric resources (odour) in the unlikely event of failure of the STP odour control system. There could also be a significant adverse effect to marine water quality in the unlikely event that untreated effluent enters the Northwest Arm through the CSO at Chain Rock. However, either of these effects would be temporary and localized, and unlikely to occur due to system redundancy, contingency and emergency response planning, and operational maintenance and monitoring procedures.

There is predicted to be positive effects for several VECs and VSCs as a result of Project operation. The primary objective of the Project, improvement of harbour water quality, will be achieved and will also result in numerous long term positive effects to various environmental and socioeconomic components related to Halifax Harbour and surrounding communities. Marine sediment quality, benthic habitat and commercial fisheries will also have positive effects from Project operation. In addition to aesthetic and odour improvements, sewage treatment and associated UV disinfection will greatly reduce the introduction of sewage related human pathogens currently entering the harbour, thereby reducing risks associated with existing exposure to untreated sewage, positively affecting public health and harbour-related land uses. A positive effect has also been identified for archaeological and heritage resources due to the potential for increased knowledge gained during Project investigations and monitoring. With respect to terrestrial resources, there will be a positive effect on groundwater resources due to the potential provision of municipal water supply in Herring Cove as a Community Integration Fund project. Freshwater resources in Herring Cove (*i.e.*, MacIntosh Run) will also realize a positive effect from Project operation as sewage overflow events from Roach's Pond pumping station will be reduced.

Table 11.2 summarizes the residual environmental effects for each VEC/VSC for Project construction and operation, and malfunctions and accidents. Abandonment or replacement is not considered in the assessment since the decommissioning of STPs or sewage collection systems is not anticipated to occur (Section 2.9)

**Table 11.2 Summary of Residual Environmental Effects**

| VEC/VSC | Activity | | |
|---|---|---|---|
| | Construction | Operation | Malfunctions and Accidents |
| Atmospheric Resources | N | N, P | S (unlikely) |
| Marine Water Quality | N | N, P | S (unlikely) |
| Marine Sediment Quality | N | N, P | N |
| Marine Benthic Habitat | N | N, P | N |
| Terrestrial Resources | N | N, P | N |
| Commercial Fisheries | N | N, P | N |
| Archaeological and Heritage Resources | N | N, P | N |
| Land Use | N | N, P | N |

| Table 11.2 Summary of Residual Environmental Effects | | | |
|---|---|---|---|
| **VEC/VSC** | **Activity** | | |
| | **Construction** | **Operation** | **Malfunctions and Accidents** |
| Transportation Infrastructure | N | N | N |
| Public Health | N | N, P | N |
| Key: S = Significant adverse residual effect; N = Non-significant adverse residual effect; P = Positive residual effect | | | |

In summary, construction and operation of the Project is not likely to have any significant adverse effects on the environment. HHSP will produce significant environmental benefits as well as potential health and economic benefits related to improved opportunities for tourism and recreation. HRM's image as an environmentally and socially responsible community will improve significantly among residents and visitors.

## 12.0 ASSESSMENT DECISION AND COURSE OF ACTION

On the basis of this screening, each of the Responsible Authorities of the project have reached the following decision:

________ The project (taking into account appropriate mitigation measures) is not likely to cause significant adverse environmental effects - project can be supported. *Section 20.1(a)*.

_______ The project (taking into account appropriate mitigation measures) is likely to cause significant adverse environmental effects that cannot be justified in the circumstances- project will not be supported. *Section 20.1(b)*.

_______ It is uncertain whether the project will cause significant adverse environmental effects (taking into account appropriate mitigation measures) - project deferred to the Minister of the Environment for referral to a Mediator or a Panel. *Section 20.1(c)(i)*.

________ Project is likely to cause significant adverse environmental effects (taking into account appropriate mitigation measures) and it is uncertain whether the effects can be justified in the circumstances - project deferred to the Minister of Environment for referral to a Mediator or a Panel. *Section 20.1(c)(ii)*.

_______ Public concerns warrant a reference to the Minister of Environment for referral to a Mediator or a Panel. *Section 20.1(c)(iii)*.

## 13.0 SCREENING CERTIFICATE

This document summarizes the results of an environmental assessment related to the Halifax Harbour Solutions Project that has been performed and completed by the Responsible Authorities in accordance with the *Canadian Environmental Assessment Act*.

Prepared by: ______________________________ Date: ______________________

Approved by: ______________________________ Date: ______________________

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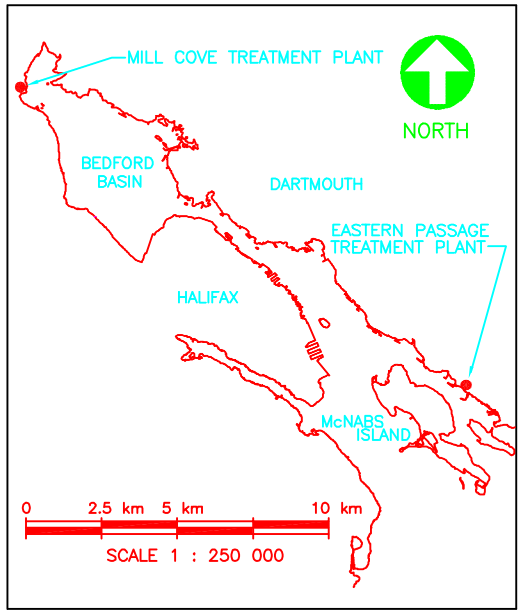
# APPENDIX A

# EXISTING SEWER OUTFALLS OVERFLOWS

**Table A.1 Private Outfalls - Summary of Wastewater Flows**

| Development | Outfalls | Average Wastewater Flow $m^3/d$ |
|---|---|---|
| Ocean Terminals | 15 | 22.2 |
| NSPI - Terminal Road | 2 | 3.4 |
| Cunard & Co. | 1 | 2.8 |
| Eastern Canada Towing | 2 | 0.4 |
| Dept. of Fisheries | 2 | 10.4 |
| Cable Wharf | 2 | 0.3 |
| Fisherman's Market | 1 | 3.2 |
| CFB Halifax Dockyard | 12 | 56.6 |
| HDIL Halifax Shipyards | 6 | 69 |
| Richmond Terminals | 4 | 3.7 |
| Shannon Park | 2 | 752 |
| NSPI - Tufts Cove | 1 | 5 |
| Defence Research | 1 | 10.7 |
| CFB Halifax Dockyard Annex | 5 | 50.4 |
| HDIL Dartmouth Marine Slips | 5 | 17.5 |
| Coast Guard | 2 | 9 |
| Nova Scotia Hospital | 1 | 675 |
| Irving Oil Depot | 1 | 3.5 |
| TOTALS | 65 | 1695 |

Source: Metro Engineering Inc. 1993




KEYPLAN and
EXISTING TREATMENT PLANTS

LEGEND

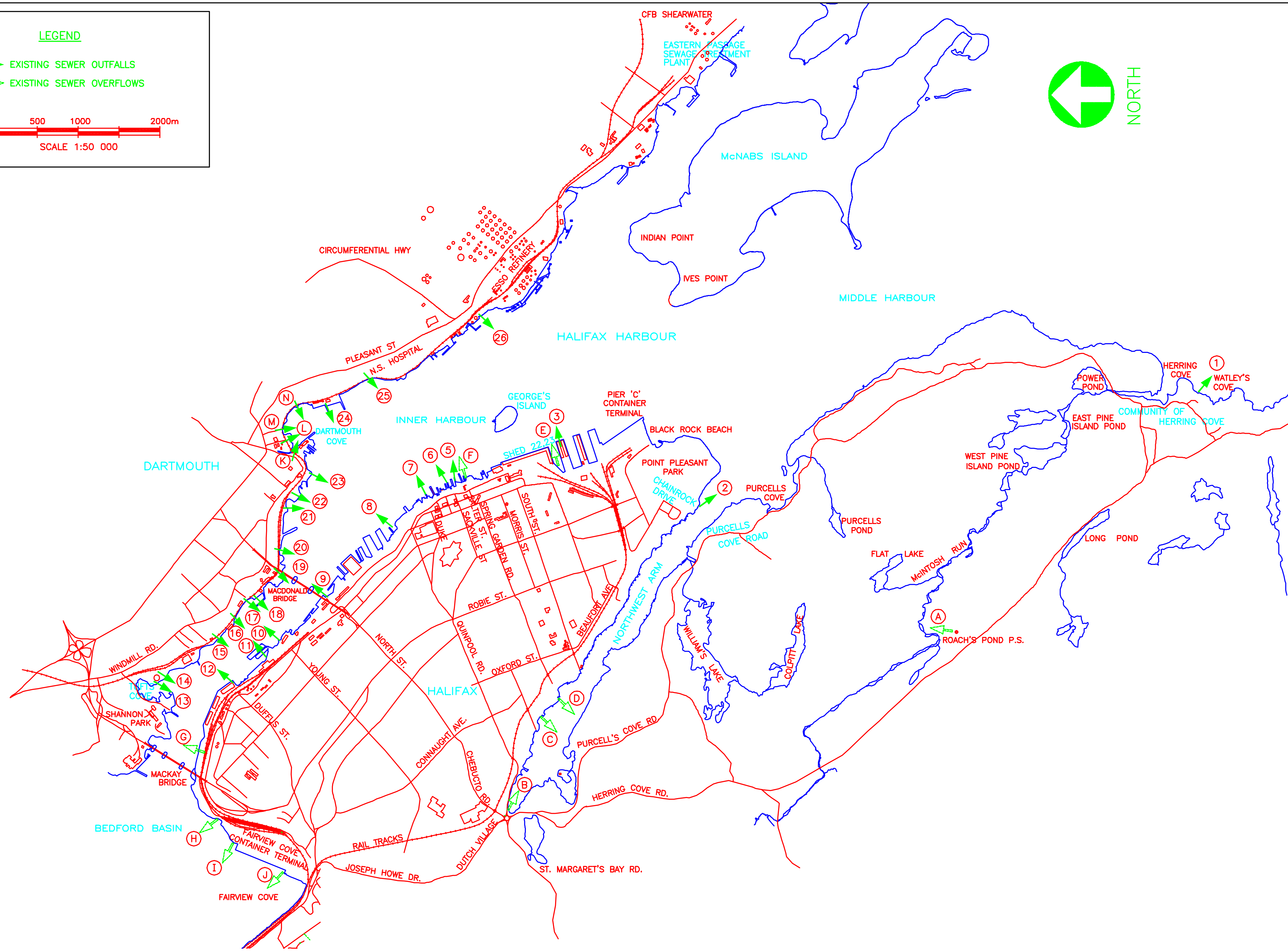
- EXISTING SEWER OUTFALLS
- EXISTING SEWER OVERFLOWS

0 500 1000 2000m

SCALE 1:50 000

| OUTFALL No. | LOCATION/DESCRIPTION |
|---|---|
| 1 | HERRING COVE |
| 2 | CHAIN ROCK DRIVE |
| 3 | PIER 'A' |
| 5 | SACKVILLE STREET |
| 6 | N.S. MUSEUM OF THE ATLANTIC |
| 7 | DUKE STREET |
| 8 | UPPER WATER STREET |
| 9 | NORTH STREET (HALIFAX) |
| 0 | YOUNG STREET |
| 11 | HANOVER STREET |
| 12 | DUFFUS STREET |
| 13 | BURNSIDE |
| 14 | FERGUSON ROAD |
| 15 | WALLACE STREET EXTENSION |
| 16 | GROVE STREET |
| 17 | JAMIESON STREET |
| 18 | BROOKSIDE AVENUE |
| 19 | LYLE STREET |
| 20 | BEST STREET |
| 21 | PARK AVENUE |
| 22 | NORTH STREET (DARTMOUTH) |
| O/F | KING STREET |
| O/F | CANAL STREET |
| O/F | MAITLAND STREET |
| O/F | OLD FERRY ROAD |
| 23 | DARTMOUTH COVE CONSOLIDATION |
| 24 | TUPPER STREET |
| 25 | CUISACK STREET |
| 26 | MELVA STREET |
| A | ROACH'S POND (SPS) |
| B | ARMDALE SEWER / SPS |
| C | JUBILEE ROAD (RETENSION TANK) |
| D | COBURG ROAD |
| E | PIER 'A' |
| F | SACKVILLE STREET |
| G | KENCREST |
| H,I & J | FAIRVIEW COVE (3) |
| K | KING STREET |
| L | CANAL STREET |
| M | MAITLAND STREET |
| N | OLD FERRY ROAD |

Source : HHCI 1993, updated 2001.
Note : Does not include private, federal or institutional outfalls.




# HALIFAX HARBOUR SOLUTIONS PROJECT

## EXISTING MUNICIPAL SEWER OUTFALLS AND OVERFLOWS

APP'D_____ 13960HG/Phase6027/13960-P6027-FA1.dwg 2001/08/02 Dwn By: v.a.h.

# APPENDIX B

# HHCI AND HHSP PROJECT DESCRIPTION COMPARISON

| **Table B.1 Overview of Key Differences Between Halifax Harbour Sewage Treatment Projects (HHCI and HHSP)** | | | |
|---|---|---|---|
| **Element** | **Halifax Harbour Cleanup Project** | **Halifax Harbour Solutions Project** | **Comments** |
| ***Collection System*** | | | |
| Design Capacity | C Normal design flow will be 3.8 x Average Dry Weather Flow (ADWF)<br>C Collection system will be 25 km long of which 75% will be tunneled. System includes interceptor sewers, tunnels, pumping stations, and CSOs to intercept wastewater from 39 existing outfalls<br>C Includes 1 major pumping station at the single STP and 4 secondary pumping stations<br>C 2 large "mine head" shafts for tunnels | C Normal design flow will be 4 x ADWF, 75% of total annual flow will be captured and conveyed to treatment facility<br>C Collector system will be approximately 17 km with approximately 22 % tunneled<br>C Includes 10 major pumping stations (includes 1 at each STP) to collect wastewater from isolated areas to major collector system | C Includes approximately 8 km less collection system length, with 53% less tunneling<br>C Current project involves 5 more pumping stations<br>C More surface disturbance associated with trenching, but less associated with minehead shafts |
| CSOs | C Preliminary treatment to remove floatables and 25 % suspended solids (vortex concentrators) at 14 sites; treatment by sedimentation within consolidation tunnels is proposed at Lr. Water Street and Dartmouth Cove<br>C Disinfection will be provided at the 2 Northwest Arm CSOs<br>C 75% of the raw sewage and stormwater currently discharged into the Harbour from existing outfalls will be intercepted and conveyed to the treatment plant | C CSOs (approximately 15-20) will be equipped with screens or underflow baffles to remove floatables, and disinfected, if required, to meet water quality objectives | C CSO disinfection (e.g. NW Arm) is unresolved (EA/Public issues)<br>C More CSOs under current project with possible land use and water quality implications<br>C Storage at STPs or in tunnels? |

**Table B.1 Overview of Key Differences Between Halifax Harbour Sewage Treatment Projects (HHCI and HHSP)**

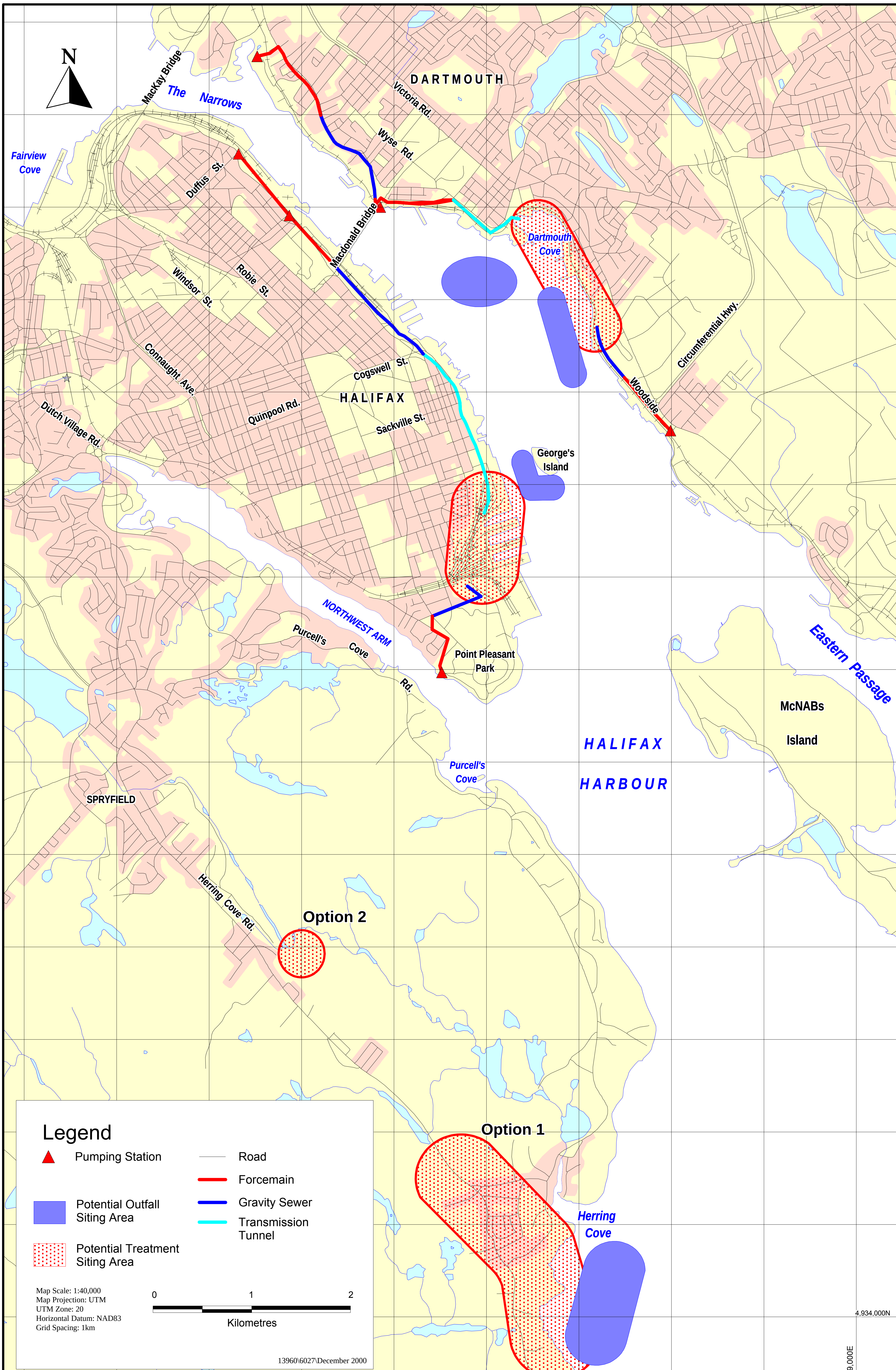
| Element | Halifax Harbour Cleanup Project | Halifax Harbour Solutions Project | Comments |
|---|---|---|---|
| | | ***Sewage Treatment Plant*** | |
| Location and size | C Single large regional STP on an artificial island ("Ives Island") approximately 9.5 ha at Ives Cove, 30 m off north end of McNabs Island<br>C One smaller plant in Herring Cove area to service Mainland South | C 3 STPs including 1 in Halifax, 1 in Dartmouth, and 1 in Mainland South (Herring Cove) | C Larger number of plants=smaller size of STPs except for Mainland South<br>C STPs closer to developed areas potentially affecting land use and raising host community concerns<br>C Less likely to affect an area perceived as parkland (i.e., McNabs Island)<br>C Phasing of project could reduce construction-related impacts |
| Facility design/Expansion capability | C The STP/OFS would be completely enclosed. Space included for doubling initial primary treatment capacity. Upgrading to secondary treatment would require island expansion<br>C Extensive buffers from developed land uses<br>C Odour and noise control<br>C Aesthetics considered in architecture and landscape | C Plant will be "compact" advanced primary type plant in Halifax and Dartmouth. A compact or conventional advanced primary plant will be used for Mainland South depending on site<br>C STPs will be totally enclosed systems to provide noise and odour control<br>C Buildings shall be designed to provide for future expansion and possible upgrade to secondary treatment of all facilities<br>C STPs shall be designed to be attractive and blend into surrounding area | C Less buffering from developed areas in Halifax Peninsula and Dartmouth |
| Treatment level / Disinfection method | C Primary treatment for large STP<br>C Chlorine disinfection for effluent | C Advanced primary treatment for all STPs<br>C UV disinfection | C Advanced primary improves level of treatment<br>C UV disinfection reduces concern with residual chlorine |

**Table B.1 Overview of Key Differences Between Halifax Harbour Sewage Treatment Projects (HHCI and HHSP)**

| Element | Halifax Harbour Cleanup Project | Halifax Harbour Solutions Project | Comments |
|---|---|---|---|
| Outfall design and location | C Tunneled outfall, west-southwest of Ives Point, with a three section diffuser<br>C Outfall for Mainland South STP includes diffuser in vicinity of Watleys Cove | C Each STP to have a marine outfall complete with diffusers which may require extension or alteration over time as flows increase<br>C Diffusers located offshore generally in vicinity of STP in areas of sufficient depth and circulation and avoiding navigation concerns. | C Increasing the number of outfalls will result in increased number of affected areas, but with less concentrated impacts on water quality<br>C Except possibly for Mainland South outfall, all other outfalls are located in areas previously unevaluated by EA<br>C Specific areas require oceanographic, geotechnical, habitat and archaeological evaluation |
| ***Sludge Management*** | | | |
| | C Oil-from-Sludge (OFS) process<br>C Ash must be disposed of in approved manner | C Onsite sludge dewatering and stabilization<br>C Attaining pH >12 would result in product that could be used for land application, site rehabilitation, or composting on a year round basis | C Current process requires more offsite disposal capacity (ash vs. compost)<br>C Different types of air emissions generated (OFS vs. composting) |

# APPENDIX C

# SEWAGE TREATMENT CONCEPT PLAN ALTERNATIVES



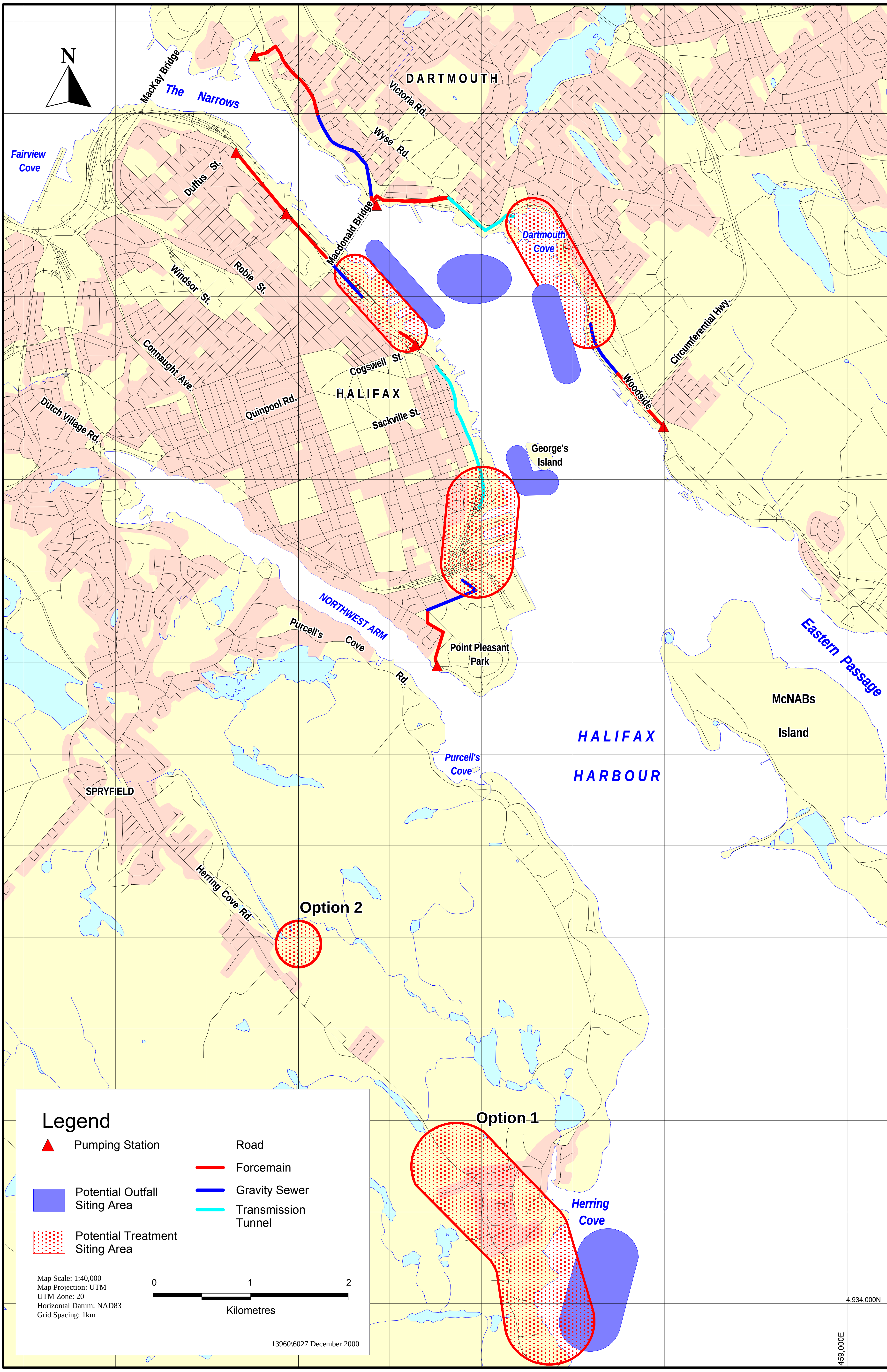

**Halifax Harbour Solutions Project**

Alternative A

Three Sewage Treatment Plants

Jacques Whitford Environment Limited

HALIFAX REGIONAL MUNICIPALITY



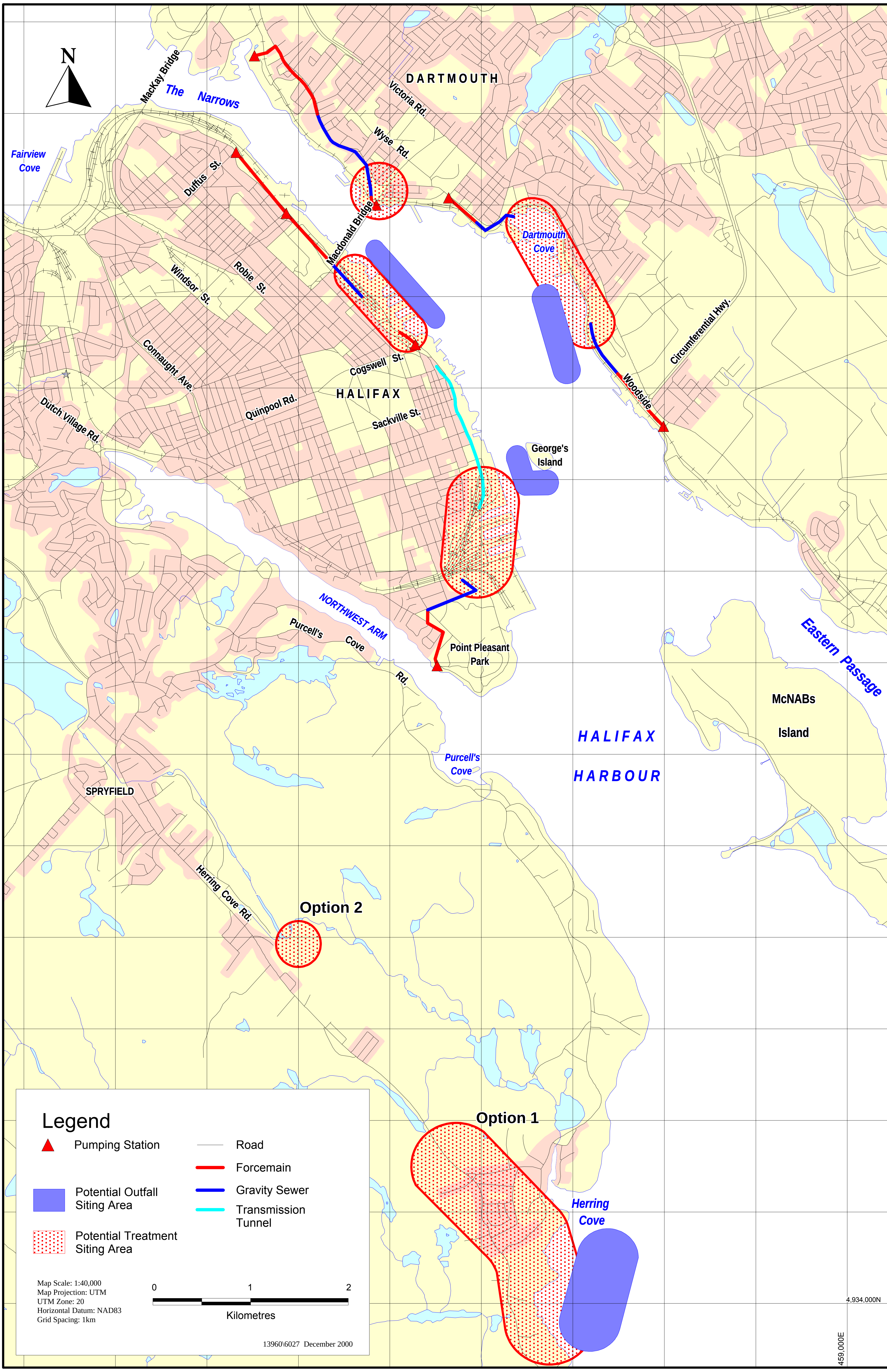

**Halifax Harbour Solutions Project**

Alternative B

Four Sewage Treatment Plants

Jacques Whitford Environment Limited

HALIFAX REGIONAL MUNICIPALITY

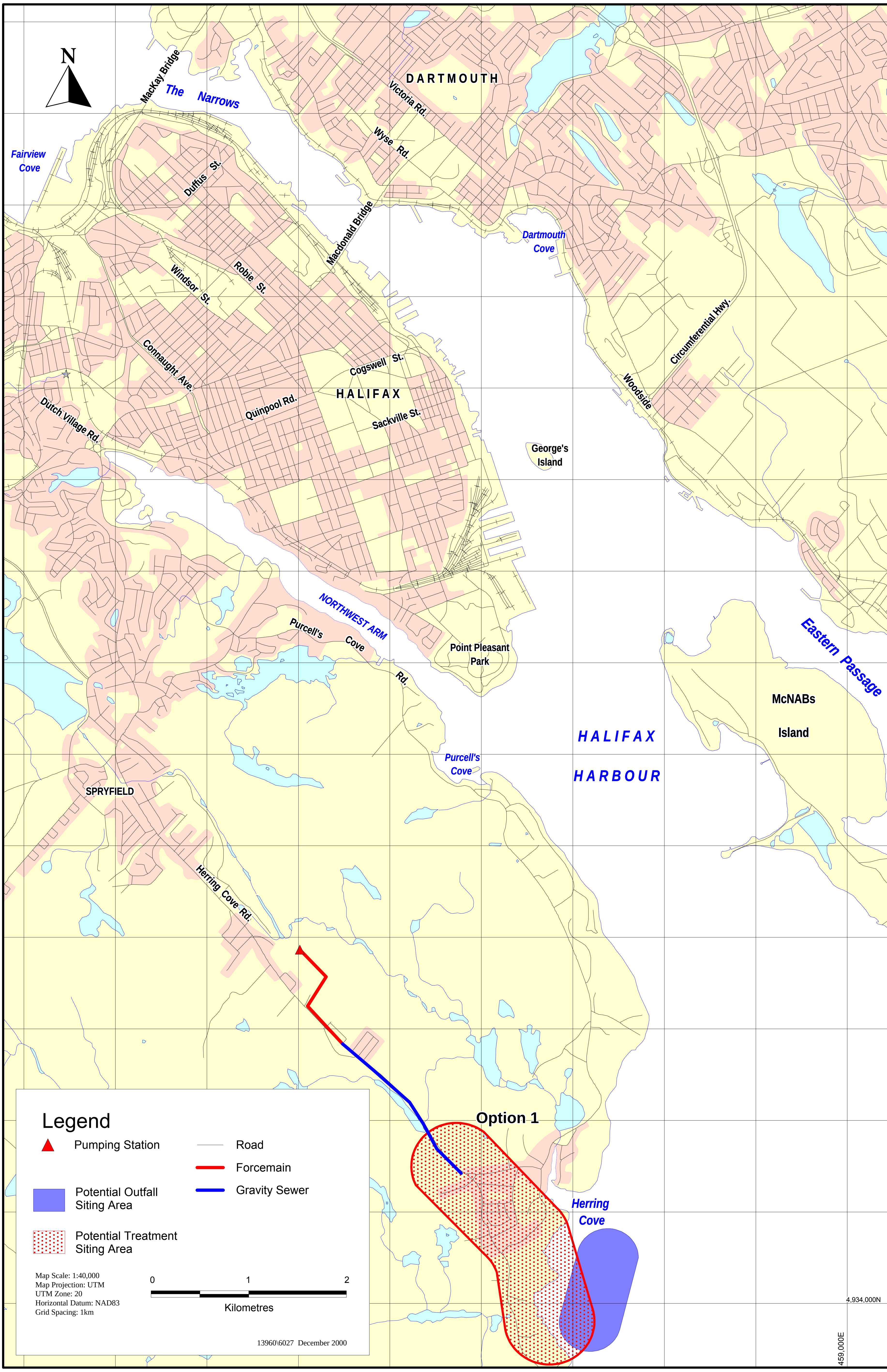



**Halifax Harbour Solutions Project**

Alternative C
Five Sewage Treatment Plants

Jacques Whitford Environment Limited

HALIFAX REGIONAL MUNICIPALITY

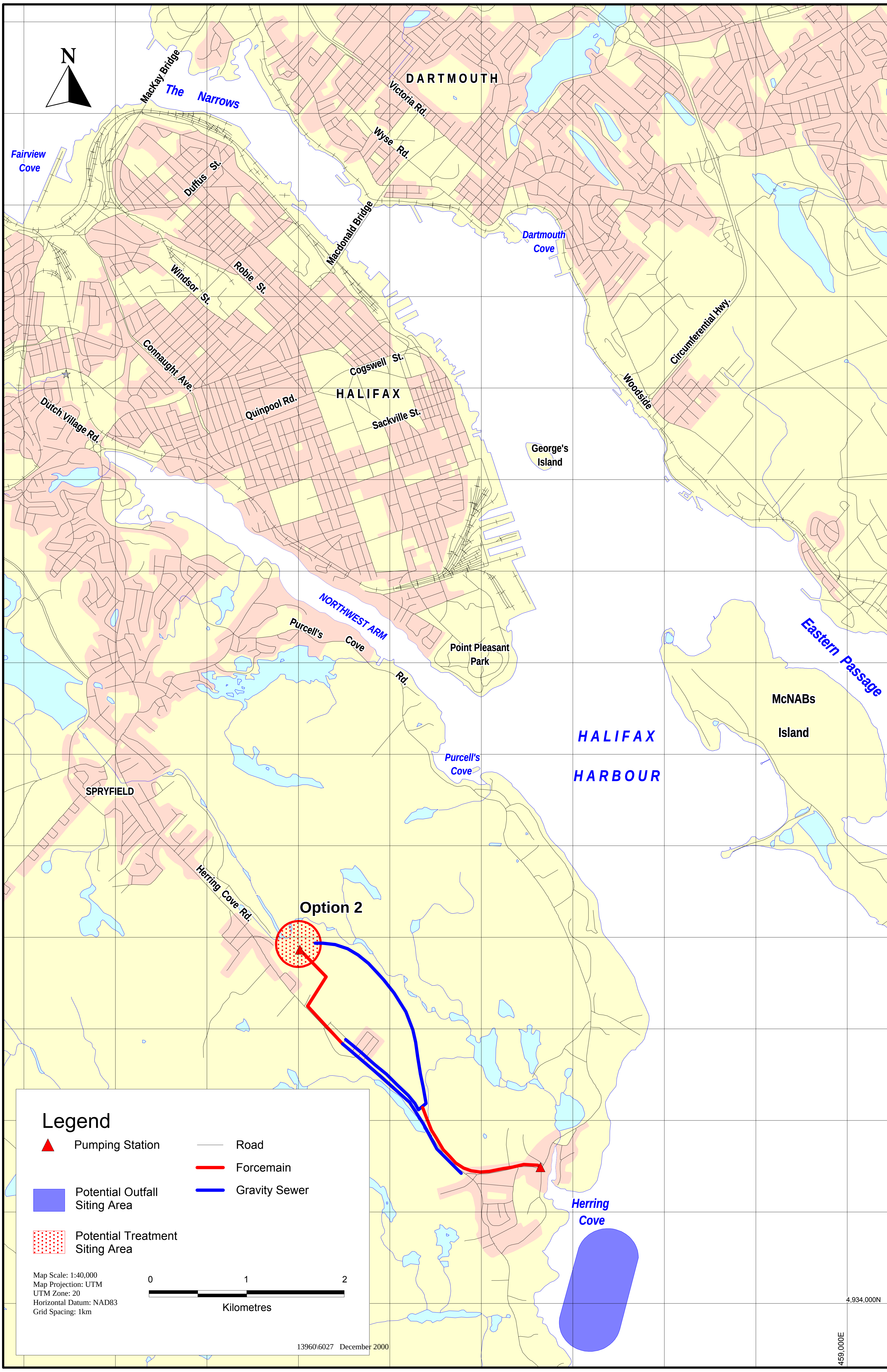



Jacques Whitford Environment Limited

**Halifax Harbour Solutions Project**

Mainland South - Option 1

HALIFAX REGIONAL MUNICIPALITY




Jacques Whitford Environment Limited

**Halifax Harbour Solutions Project**

Mainland South - Option 2

HALIFAX REGIONAL MUNICIPALITY

# APPENDIX D

# WASTEWATER DISCHARGE BY-LAW (W-101)

# HALIFAX REGIONAL MUNICIPALITY
# BY-LAW - W-101

## RESPECTING DISCHARGE INTO PUBLIC SEWERS

### 1 - Short Title

1(1) This By-Law shall be known as By-Law Number W-101, and may be cited as the "Wastewater Discharge By-Law".

### 2 - Definitions

2(1) In this By-Law:

(a) "biochemical oxygen demand" means the quantity of oxygen utilized, expressed in milligrams per litre, in the biochemical oxidation of matter within a 120 hour period at a temperature of 20 degrees centigrade;

(b) "blow down" means the discharge of recirculating non-contact cooling water for the purpose of discharging materials contained in the water;

(b) "chemical oxygen demand" means the quantity of oxygen utilized in the chemical oxidation of organic matter under standard laboratory procedure, expressed in milligrams per litre;

(c) "combined sewer" means a sewer intended to function simultaneously as a storm sewer and a sanitary sewer;

(d) "combustible liquid" means a liquid that has a flash point not less than 37.8 degrees Celsius and not greater than 93.3 degrees Celsius;

(e) "cooling water" means water that is used in a process for the purpose of removing heat and that has not, by design, come into contact with any raw material, intermediate product, waste product, or finished product, but does not include blow down water.

(f) "discharge" means to discharge, release, permit or cause to be discharged into the municipal wastewater facilities or stormwater system;

(g) “discharger” means the owner, occupant or a person who has charge, management or control of effluent, sewage, stormwater, uncontaminated water or any combination thereof, which is discharged to the municipal wastewater facilities;

(h) “Engineer” means the Municipal Engineer for the Halifax Regional Municipality and includes a person acting under the supervision and direction of the Engineer;

(i) “fuel” includes alcohol, gasoline, naphtha, diesel fuel, fuel oil or any other ignitable substance intended for use as a fuel;

(j) “hauled industrial wastewater” means any industrial wastewater transported to and deposited into any location in the municipal wastewater facilities.

(k) “industrial, commercial or institutional” includes or pertains to industry, manufacturing, commerce, trade, business, or institutions, as distinguished from domestic or residential;

(l) “leachate” includes any liquid that has percolated through solid waste and has extracted dissolved or suspended materials from it, including the liquid produced from the decomposition of waste materials and liquid that has entered the waste material from external sources including surface drainage, rainfall and groundwater.

(m) “municipality” means the Halifax Regional Municipality;

(n) “pathological waste” includes those fluids or materials which may contain pathogens of human or animal origin;

(o) “pesticides” includes any substance that is a pest control product within the meaning of the “Pest Control Products Act” (Canada) or a fertilizer within the meaning of the “Fertilizers Act” (Canada) that contains a pest control product;

(p) “phenolic compounds” means hydroxyl derivatives of benzene and its condensed nuclei;

(q) “sanitary sewer” means a sewer receiving and carrying liquid and water-carried wastes and to which storm, surface or groundwaters are not intentionally admitted;

(r) “sewage” means the combination of liquid and water-carried wastes from buildings, containing animal, vegetable or mineral matter in suspension or solution, together with such groundwater, surface water or stormwater as might be present;

(s) “sewer” means a pipe or conduit for carrying sewage, groundwater, stormwater or surface runoff, and includes all sewer drains, storm sewers, clearwater sewers, storm drains and combined sewers vested in, or under the control of, the municipality;

(t) “solvent extractable matter” includes grease or oils from animal, vegetable, mineral or synthetic sources;

(u) "Standard Methods" means Standard Methods for the examination of water and wastewater by the utilization of analytical and examination procedures provided in the edition current at the time of testing, published jointly by the American Public Health Association and the American Water Works Association or any publication by or under the authority of the Canadian Standards Association for the testing of water and waterworks to determine water quality standards;

(v) “storm sewer means a sewer that carries stormwater and surface runoff water, excluding sewage;

(w) “stormwater” means water from precipitation of all kinds, and includes water from the melting of snow and ice, groundwater discharge and surface water;

(x) “Stormwater system” means a method or means of carrying stormwater including, But not limited to, those ditches, swales, sewers retention ponds, streets or roads That are owned by the municipality;

(y) “suspended solids” means the insoluble matter suspended in wastewater that is separable by laboratory filtration:

(z) “total Kjeldahl nitrogen” means organic nitrogen;

(aa) “uncontaminated water” means potable water or any other water to which no matter has been added as a consequence of its use;

(ab) “waste radioactive substances” includes uranium, thorium, plutonium, neptunium, deuterium, their respective derivatives and compounds and such other substances as the Atomic Energy Control Board may designate as being capable of releasing ionizing radiation;

(ac) “wastewater facilities” means the structures, pipes, devices, equipment, processes or other things used, or intended, for the collection, transportation, pumping or treatment of sewage and disposal of the effluent;

(ad) "waste" means any material discharged into wastewater facilities;

(ae) "wastewater" means liquid waste containing animal, vegetable, mineral or chemical matter in solution or suspension carried from any premises;

## 3 - Prohibited Discharges to Wastewater Facilities

3(1) No person shall discharge, into wastewater facilities, sewage or wastewater which causes or may cause or results or may result in:

(a) a health or safety hazard;
(b) obstructions or restrictions to the flow in the wastewater facilities;
(c) an offensive odour to emanate from wastewater facilities, and without limiting the generality of the foregoing, sewage containing hydrogen sulphide, mercaptans, carbon disulphide, other reduced sulphur compounds, amines, or ammonia in such quantity that may cause an offensive odour;
(d) damage to wastewater facilities;
(e) interference with the operation and maintenance of wastewater facilities.
(f) a restriction of the beneficial use of sludge from the municipality's wastewater facilities.
(g) effluent from municipal wastewater facilities to be in violation of any Provincial or Federal Acts or Regulations.

3(2) No person shall discharge, into wastewater facilities, sewage or wastewater with any one or more of the following characteristics:

(a) a pH less than 5.5 or greater than 9.5;
(b) two or more separate liquid layers;
(c) a temperature greater than sixty five degrees Celsius.

3(3) No person shall discharge, into wastewater facilities, sewage or wastewater containing one or more of the following:

(a) combustible liquid;
(b) fuel;
(c) hauled sewage, hauled wastewater or leachate, except where written permission from the municipality has been obtained;
(e) ignitable waste including but not limited to, flammable liquids, solids, and/or gases, capable of causing or contributing to explosion or supporting combustion in wastewater facilities;
(f) detergents, surface–active agents or other substances that may cause excessive foaming in the wastewater facilities;
(g) sewage containing dyes or colouring materials which pass through wastewater facilities and discolour the wastewater facility or effluent;
(h) pathological waste in any quantity;
(i) material containing polychlorinated biphenyls (PCBs);
(j) pesticides;
(k) reactive materials;
(l) radioactive substances;
(m) leachate, except where the discharger has written permission from the municipality.

3(4) No person shall discharge, into wastewater facilities, sewage or wastewater containing a concentration in excess of any of the limits set out in Table 1:

**Table 1 - Concentration Limits - Wastewater Facilities**

| Substance | Milligrams Per Litre |
|---|---|
| Aluminum, Total | 50 |
| Antimony, Total | 5 |
| Arsenic, Total | 1 |
| Barium, Total | 5 |
| Benzene | 0.01 |
| Beryllium, Total | 5 |
| Biochemical Oxygen Demand | 300 |
| Bismuth, Total | 5 |
| Cadmium, Total | 1 |
| Chemical Oxygen Demand | 1000 |
| Chlorides | 1500 |
| Chloroform | 0.05 |
| Chromium, Total | 2 |

| Substance | Milligrams Per Litre |
| --- | --- |
| Cobalt, Total | 5 |
| Copper, Total | 1 |
| Cyanide, Total | 2 |
| 1,2 - Dichlorobenzene | 0.1 |
| 1,4 - Dichlorobenzene | 0.1 |
| cis - 1,2 - Dichloroethylene | 4.0 |
| Trans - 1,3 - Dichloropropylene | 0.15 |
| Ethylbenzene | 0.15 |
| Fluoride | 10 |
| Iron, Total | 50 |
| Lead, Total | 1 |
| Manganese, Total | 5 |
| Mercury, Total | 0.01 |
| Methylene chloride | 0.2 |
| Molybdenum, Total | 5 |
| Nickel, Total | 2 |
| Oil & Grease - mineral or synthetic in origin | 15 |
| Oil & Grease - animal or vegetable in origin | 150 |
| o-Xylene | 0.5 |
| Phenolic Compounds (4AAP) | 1 |
| Phosphorus, Total | 10 |
| Selenium, Total | 1 |
| Silver, Total | 2 |
| Sulphates Expressed as $SO_4$ | 1500 |
| Suspended Solids, Total | 300 |
| 1,1,2,2 - Tetrachloroethane | 1.0 |
| Tetrachloroethylene | 1.0 |
| Tin, Total | 5 |
| Titanium, Total | 5 |
| Toluene | 0.01 |
| Total Kjeldahl Nitrogen | 100 |
| Trichloroethylene | 1.0 |
| Vanadium, Total | 5 |
| Xylenes, Total | 1.5 |
| Zinc, Total | 2 |

* A reference to “Total” in this table denotes total concentrations of all forms of the metal and ion including both particulate and dissolved species.

3(5) No person shall discharge, into wastewater facilities sewage or wastewater under circumstances where water has been added for the purpose of dilution to achieve compliance with Sections 3(2) and 3(4).

3(6) No person shall discharge cooling water or uncontaminated water to wastewater facilities unless the discharge has been permitted by the municipality.

## 4 - Discharge to Stormwater System

4 (1) No person shall discharge into a stormwater system, matter which causes or may cause or may result in:

(a) a health or safety hazard;
(b) interference with the operation of a stormwater system;
(c) obstruction or restriction of a stormwater system or the flow therein;
(d) damage to the stormwater system
(f) impairment to the quality of the water in a stormwater system
(g) the quality of the water discharged from a municipal stormwater system to be in violation of Provincial or Federal Acts or Regulations.

4 (2) No person shall discharge into a stormwater system, matter which results in one or more of the following characteristics;

(a) visible sheen, film or discolouration;
(b) two or more separate layers;
(c) a pH less than 6.0 or greater than 9.5;
(d) a temperature greater than 40 degrees Celsius;

4(3) No person shall discharge into a stormwater system;

(a) hazardous waste chemicals;
(b) combustible liquids;
(c) floating debris;
(d) fuel;
(e) hauled sewage or hauled waste;
(f) pathological waste;
(g) PCB's
(h) pesticides;

(i) reactive waste;
(j) toxic waste;
(k) waste radioactive substances;

4(4) No person shall discharge into a stormwater system, matter containing a concentration, expressed in milligrams per litre, in excess of any one or more of the limits in Table 2 of this By-law entitled "Limits for Stormwater System Discharge".

4(2) The provisions of subsection 4(1) apply to the discharge of storm water runoff from industrial, commercial and institutional process areas to a stormwater system, and to any storm water discharge to which the matter prohibited by subsection 4(1) has been added for the purpose of disposing of the matter.

**Table 2 - Limits for Stormwater System Discharge**

| **Substance** | **Milligrams per litre** |
|---|---|
| Arsenic | 0.5 |
| B.E.T.X.<br>(benzine, ethyl benzine, toluene, xylene) | 0.02 |
| Biochemical Oxygen Demand | 15 |
| Cadmium | 0.015 |
| Carbon tetrachloride | 0.02 |
| Chromium | 0.02 |
| Copper | 0.03 |
| Cyanide | 0.05 |
| Fluoride | 1.5 |
| Lead | 0.05 |
| Mercury | 0.001 |
| Oil and Grease | 15 |
| Phosphorus | 0.5 |
| Selenium | 0.01 |
| Silver | 0.001 |
| Suspended Solids | 15 |
| Thallium | 0.01 |
| Trichloroethylene | 0.02 |
| Zinc | 0.30 |

**5 - Grease, Oil, Sediment, Sand Traps or Interceptors**

5(1) Grease, oil, sediment and sand traps or interceptors shall be installed in all food service establishments or operations, vehicle service facilities, and car or truck washes when, in the opinion of the municipality, such a device is necessary for the proper handling and control of wastewater being discharged to the municipal wastewater facilities.

5(2) Traps or interceptors shall be installed such that they are easily accessible for all aspects of cleaning and inspection.

5(3) Traps or interceptors shall be maintained by the owner or operator in a condition of continuous efficient operation at the owner's expense.

5(4) No retained or trapped oil, grease, sediment, sand, silt or other matter in any form shall be allowed to pass from the installed trap or interceptor into the wastewater facilities: instead removal of retained or trapped materials shall be achieved by pumping or other physical means and shall be hauled away and disposed of as required by law.

5(5) Whenever an inspection of an installed trap or interceptor results in a written notice for action on the part of the person(s) responsible for the installed device, such action shall be completed within the compliance period granted by the written notice.

5(6) The owner or operator of an establishment shall provide the municipality, upon request, with the frequency of inspection and maintenance of any installed grease, oil, sediment and sand traps or interceptors as well as information as to the disposal method employed and location of hauled waste material.

5(7) Any reasonable request for inspection by the municipality shall be granted by the owner or operator of the establishment.

## 6 - Reporting Requirements

6(1) No industrial, commercial or institutional discharger shall discharge sewage, wastewater, cooling water, uncontaminated water or any combination thereof, to wastewater facilities without first submitting to the Engineer of the municipality the following completed reports:

(a) the "Short Version of the Discharger Information Report" attached as Form 1; and

(b) the "Complete Discharger Information Report" attached as Form 2 where, in the opinion of the Engineer, the discharge may have a significant impact on the wastewater facilities, and the municipality has notified the discharger that completion of the report is required; or where the discharger has or requires an extra strength or large volume surcharge agreement with the municipality.

6(2) If a discharger has been discharging to wastewater facilities prior to the enactment of this by-law, the discharger shall comply with the requirements set out in subsection 6(1) within 30 days of receipt of written notice from the Engineer.

6(3) The discharger shall provide written notification to the municipality of any changes to the information filed pursuant to subsections 6(1) and 6(2) within 60 days of the change.

## 7 - Discharger Self-Monitoring

7(1) The discharger shall undertake the monitoring or sampling of any discharge to the wastewater facilities as may be required by the Engineer, and provide the results in accordance with written notice from the Engineer.

7(2) The obligations set out in or arising out of subsection 7(1) shall be completed at the expense of the discharger.

## 8 - Extra Strength and Volume Surcharge Agreement

8(1) Where large volumes of sewage, extra strength sewage or wastewater is discharged to wastewater facilities, the municipality may enter into a surcharge agreement with a discharger permitting exceedances of the limits set out in subsection 3(4), including, but not limited to, any one or more of the following:

(a) biochemical oxygen demand;

(b) solvent extractables - animal or vegetable in origin;

(c) total kjeldahl nitrogen;

(d) phosphorous, total;

(e) suspended solids, total; or

(f) large volumes.

8(2) The agreement may include terms and conditions under which the discharge is permitted and the method by which the municipality shall recover costs incurred by the pumping and treatment of the wastewater.

8(3) During the term of the agreement, the discharger shall be exempt from meeting the limits set out in subsection 3(4) for the parameter(s) included in the agreement, if all conditions stipulated in the agreement are met.

8(4) Notwithstanding Section 8(1), where a discharger has entered into an extra strength surcharge or large volume agreement, any anticipated change in the information provided pursuant to Section 5 must be submitted to the municipality prior to the change to allow an assessment of the impact of the change on the agreement.

8(5) The municipality may terminate the agreement at any time and the termination shall be effective within 30 days of the delivery of a written notice to the discharger's site or head office.

## 9 - Compliance Agreement

9(1) Where the discharger, at the coming into force of this by-law, is out of compliance with one or more conditions in Section 3, the municipality may enter into a compliance agreement with a discharger to provide a plan for achieving compliance with the by-law within a specified time.

9(2) The agreement shall:

(a) be for a fixed term;

(b) contain reporting requirements to the Engineer on significant stages in the progress towards compliance as determined by the municipality; and

(c) include a maximum interim limit for the parameter or parameters covered by the agreement.

9(3) During the term of the compliance agreement, the discharger shall be exempt from those parts of Section 3 specified in the compliance agreement provided that all of the conditions of the agreement are met by the discharger prior to the expiry of the agreement.

9(4) The agreement may be terminated with 48 hours notice by the municipality at any time where the terms and conditions of the agreement are not being met.

## 10 - Sampling and Analytical Requirements

10(1) Where the Engineer determines that monitoring of any discharge to the wastewater facilities is required, the owner or operator of industrial, commercial or institutional premises may be required to monitor, analyse, and report to the Engineer the results of the monitoring program at the owner's expense.

10(2) The Engineer may specify specific time periods for collection of samples and analytical requirements based on practices of the business, as required.

10(3) The Engineer may from time to time enter any premises and conduct such tests as deemed necessary.

10(4) All tests, measurements, analyses and sample handling shall be carried out in accordance with "Standard Methods" and by a laboratory certified by the Canadian Association of Environmental Laboratories.

## 11 - Control Service Access

11(1) The Engineer may require the installation of a control service access or the upgrading of an existing control service access, for each connection to the wastewater facilities for the purpose of monitoring or sampling discharges.

11(2) A control service access required under subsection 11(1) shall be:
- (a) located on the property of the discharger unless the municipality permits an alternative location;
- (b) constructed and maintained at the expense of the discharger;
- (c) accessible at all times by the municipality;
- (d) constructed in a manner which meets the standards of the municipality; and
- (e) maintained to ensure access and structural integrity.

## 12 - Penalty

12(1) Any person who contravenes any provision of this by-law shall be liable upon summary conviction for every such offence to a penalty not exceeding fifty thousand dollars ($50,000.00) or in default of payment, to imprisonment for a term not exceeding ninety days and each day that the offence continues shall constitute a new offence.

12(2) Any person alleged to have violated this bylaw, who is given notice of the alleged violation and where the said notice so provides for payment, may pay a penalty in the amount of $500.00 to the HALIFAX REGIONAL MUNICIPALITY provided that said payment is made within a period of 14 days following the day on which the alleged violation was committed, and said payment shall be in full satisfaction, releasing and discharging all penalties and imprisonments incurred by the person for said violation.

## 13 - Repeal of By-laws, Regulations and Ordinances

13(1) Halifax Regional Municipality By-Law W-100 Respecting Wastewater Discharge is hereby repealed.

# Halifax Regional Municipality Pollution Prevention Program

## Discharger Information Report
## ( Form 1 )

### 1. General Information

___________________________________________________________

(Company Name, Corporation, Owner)

______________________ ______________________

(Telephone Number) ( Fax Number)

___________________________________________________________

(Mailing address) ( Postal Code)

Location of Premises:

___________________________________________________________

(Street Name, Number, Block Number, Unit Number)

Company Officer responsible for waste effluent control:

__________________ ______________________ ______________

(Name) (Title) (Telephone Number)

## 2. Product or Service Information

(a) Number of Employees: ___________________________________________
Plant:__________________ Office:_______________________

(b) Number of shifts per day: ________Number of days per week: _____________

(c) What are your principal products produced or services rendered:

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________

(f) Provide a brief description of your manufacturing or service activities:

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________

## 3. Waste Characteristics and Disposal

(a) Consumption of water:

_________________________________________________________________

(Please provide a recent copy of water billing records)

(b) Please list the types and volumes of chemicals used in your manufacturing process and/or stored on site.

Chemicals: Quantities:

| Chemicals: | Quantities: |
|---|---|
| | |
| | |
| | |
| | |
| | |

(c) Please list the type of chemicals, cooling water or other waste materials that are discharged to the sanitary sewer.

_______________________________________________

_______________________________________________

_______________________________________________

_______________________________________________

_______________________________________________

(d) Is your wastewater subjected to any type of treatment before discharge into the sewer system? Please describe the treatment provided to the wastewater.

_______________________________________________

_______________________________________________

_______________________________________________

_______________________________________________

_______________________________________________

(e) Has your company sampled and analysed wastewater that is discharged to the sewer system? If yes, please provide details and attach a copy of any available sample information.

_______________________________________________

_______________________________________________

_______________________________________________

_______________________________________________

Name of person submitting report:

______________________________________________

(Name)

______________________________________________

(Title)

______________________________________________

(Date of Completion)

**Halifax Regional Municipality Pollution Prevention Program**

**Discharger Information Report**
**(Form 2)**

## 1. General Information

______________________________________
(Company Name, Corporation, Owner)

______________________________ ______________________________
(Telephone Number) (Fax Number)

____________________________________________________________
(Mailing address) (Postal Code)

Location of Premises:

____________________________________________________________
(Street Name, Number, Block Number, Unit Number)

Company Officer responsible for waste effluent control:

____________________ ________________________ ______________
(Name) (Title) (Telephone Number)

## 2. Product or Service Information

(a) What are your principal products produced or services rendered:

____________________________________________________________
____________________________________________________________
____________________________________________________________

(f) Provide a brief description of your manufacturing or service activities:

_______________________________________________________________

_______________________________________________________________

_______________________________________________________________

_______________________________________________________________

(c) Standard Industrial or Canadian Codes (SIC) of those products produced:

___________________ ______________________ ____________________

___________________ ______________________ ____________________

Indicate if these are ( ) SICs, or Canadian ( ) SICs.

(d) Provide a brief description of the process(es) used in the manufacturing or servicing:

_______________________________________________________________

_______________________________________________________________

_______________________________________________________________

_______________________________________________________________

_______________________________________________________________

(e) Number of employees:

Plant: __________________ Office: ____________________

(f) Number of shifts per day:________ Number of shifts per week: _________

(g) Please indicate if major processes are:

( ) Batch ( ) Continuous ( ) Both

(h) Is the production subject to seasonal variation: ( ) yes ( ) no

If yes indicated, briefly describe your seasonal production cycle:

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

## 3. Waste Characteristics

(a) List all sources of water supply:

Municipal water __________________________________

Private well water __________________________________

Hauled water __________________________________

Other sources (Describe) __________________________________

(b) Type of waste water discharged: ( please check all that apply)

( ) Sanitary sewage Estimated volume:________________$m^3$/day

( ) Non-contact cooling water Estimated volume:________________$m^3$/day

( ) Contact cooling water Estimated volume:________________$m^3$/day

( ) Process water Estimated volume:________________$m^3$/day

( ) Others Estimated volume:________________$m^3$/day

(c) Wastewater is discharged to: ( please check all that apply)

| Location | Estimated Volume |
| --- | --- |
| (   ) Sanitary # 1 | ____________________$m^3$/day |
| (   ) Sanitary # 2 | ____________________$m^3$/day |
| (   ) Storm sewer # 1 | ____________________$m^3$/day |
| (   ) Storm sewer # 2 | ____________________$m^3$/day |
| (   ) Surface water, pond, creek, river etc. | ____________________$m^3$/day |
| (   ) Storage tank | ____________________$m^3$/day |
| (   ) Ground water or well | ____________________$m^3$/day |

(   ) Liquid waste hauler  -   please indicate company used and disposal site if known.

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

**4. Pre-treatment and Disposal**

(a) Pre-treatment devices or processes used for treating wastewater or sludges before discharge to the sewer system. ( Please check as many as is appropriate):

( ) Air floatation
( ) Centrifuge
( ) Chemical Precipitation
( ) Chlorination
( ) Cyclone
( ) Filtration
( ) Flow Equalization
( ) Grease or Oil Separation,
type:______________________
( ) Grease Trap
( ) Grit Removal
( ) Ion Exchange
( ) Neutralization, Ph correction
( ) Ozonation
( ) Reverse Osmosis

( ) Screening
( ) Sedimentation
( ) Septic Tank
( ) Solvent Separation
( ) Spill Protection
( ) Sump
( ) Biological Treatment
type:___________________________
( ) Rainwater Diversion or Storage
type:___________________________
( ) Other Chemical Treatment
________________________________
( ) Other treatment
type:___________________________
( ) No Pre-treatment Provided

(b) Describe in detail the treatment process for your waste streams:

_______________________________________________________________
_______________________________________________________________
_______________________________________________________________
_______________________________________________________________
_______________________________________________________________
_______________________________________________________________

(c) Provide a flow diagram of your Pre-treatment Process in the space below:

(d) Provide a description of the identified pre-treatment facilities and operating data

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

(e) Describe how solids are handled, stored and disposed.

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

(f) Describe any current operational problems or required shutdowns of pre-treatment facilities that may affect the quality of wastewater discharged to the sewer system.

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

(g) Is sludge generated from the pre-treatment process: (  ) yes   (  ) no

If yes, please describe the treatment and disposal method for sludge removal,

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

(h) Do you recover any chemicals from your wastewater: (   ) yes   (   ) no
If yes, please explain

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

## 5. Pollutant Information ( Sewer Discharge)

(a) Please indicate in the appropriate location whether the chemical parameter is known, or suspected to be present in each waste stream leaving your facility.

### Sewer Discharge Characteristics

| Parameter | Known present | Suspected present | Concentration (mg/l) |
|---|---|---|---|
| Antimony | | | |
| Arsenic | | | |
| Bismuth | | | |
| BOD | | | |
| Cadmium | | | |
| Chromium | | | |
| Cobalt | | | |
| Copper | | | |
| Cyanide | | | |
| Kjeldahl | | | |
| Lead | | | |
| Manganese | | | |
| Mercury | | | |

| | | | |
|---|---|---|---|
| Molybdenum | | | |
| Nickel | | | |
| Oil/Grease (A/V) | | | |
| Oil/Grease (M/S) | | | |
| Phenolics | | | |
| Phosphorus | | | |
| Selenium | | | |
| Silver | | | |
| Tin | | | |
| Titanium | | | |
| TSS | | | |
| Vanadium | | | |
| Zinc | | | |

## **6. Pollutant Information ( No discharge)**

(a) List pollutants or chemicals that have the potential to enter either sanitary or storm sewers due to accidental spills, machinery malfunctions or process upsets:

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

(b) Does your Company have any existing agreements with the Municipality, former municipalities or the Province regarding wastewater discharged to the sanitary or storm sewers?

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

(c) Does the Company have any flow measurement or sampling equipment available?

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

(d) Has the Company ever conducted sampling and analysis of wastewater discharged to either the sanitary or storm sewer system? If so, please provide as an attachment to this report any copies of analysis that are available.

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

Name of person submitting report:

_____________________________________________

(Name)

_____________________________________________

(Title)

_____________________________________________

(Date of Completion)

Done and passed in Council this 17th day of July, 2001

______________________________

MAYOR

______________________________

MUNICIPAL CLERK

I, Vi Carmichael, Municipal Clerk for the Halifax Regional Municipality, hereby certify that the above-noted by-law was passed at a meeting of the Halifax Regional Council held on, July 17, 2001.

______________________________

Vi Carmichael, Municipal Clerk

**By-Law W-101**

| | |
|---|---|
| Notice of Motion: | June 19, 2001 |
| First Reading: | June 26, 2001 |
| "Notice of Intent" Publication: | June 30, 2001 |
| Second Reading: | July 17, 2001 |
| Approval of Minister of Housing & Municipal Affairs: | N/A |
| Effective: | July 21, 2001 |

# APPENDIX E

# NSDOE COMPOSTING FACILITY GUIDELINES (MARCH 1998)

# NOVA SCOTIA DEPARTMENT OF THE ENVIRONMENT
# COMPOSTING FACILITY GUIDELINES

# NOVA SCOTIA DEPARTMENT OF THE ENVIRONMENT
# COMPOSTING FACILITY GUIDELINES

## 1.0 GENERAL

### 1.1 Purpose

(a) The purpose of these guidelines is to provide for the proper environmental management of composting facilities.

(b) These guidelines also provide guidance as to the requirements to obtain an approval to construct and operate a composting facility.

(c) Refer to Schedule "A" for the definition of terms used in these guidelines.

(d) Final assessment of applications for the construction and operation of a composting facility will be made on a case by case basis.

(e) For further information respecting these guidelines, contact the Regional/District office of the Nova Scotia Department of the Environment where the site is located.

### 1.2 Applicable Documentation

These guidelines should be used in conjunction with the following:

(i) *Solid Waste Resource Management Strategy (1995)*;
(ii) *Environment Act*, S.N.S. 1994-95, c.1, Part X;
(iii) *Solid Waste-Resource Management Regulations* ;
(iv) *Activities Designation Regulations*; and
(v) *Approvals Procedure Regulations.*

### 1.3 Applicability

(a) These guidelines apply to all composting facilities requiring approval under Section 27 of the *Solid Waste-Resource Management Regulations*, which states, "No person shall construct, operate, expand or modify a facility which can process more than 60 cubic metres annually of finished compost without obtaining approval from the Minister".

(b) These guidelines do not apply to:

(i) backyard composting; and
(ii) generally accepted farming activities.

## 2.0 APPLICATION FOR APPROVALS

### 2.1 Application

(a) Prior to construction of a composting facility, an approval must be granted by the Department pursuant to Section 27 of the Nova Scotia *Solid Waste-Resource Management Regulations.*

(b) Applications for approval to construct, operate, expand or modify a composting facility must be accompanied by a letter from the municipal unit where the facility is to be located stating that the facility meets zoning, planning restrictions and such other by-laws as may exist.

(c) Unless specifically exempted by the administrator, the applicant is to provide all information necessary to satisfy the requirements of each of the following sections.

## 3.0 LEAF AND YARD WASTE COMPOSTING FACILITIES UNDER 10 000 TONNES

### 3.1 General

Section 3 of the guidelines applies to composting facilities which process only leaf and yard waste and utilize up to a maximum of 10 000 tonnes annually of feedstock.

### 3.2 Facility Design and Construction

(a) The composting facility shall incorporate the following requirements:

- (i) systems shall be designed to minimize odour generation;
- (ii) measures shall be taken to control/treat leachate and storm runoff and prevent groundwater contamination;
- (iii) a groundwater and surface water monitoring plan shall be approved by the Department; and,
- (iv) by-products, including residuals, must be removed from the site in a timely manner and disposed of in a manner acceptable to the Department. The storage of these by-products shall not result in any vector, odour or litter problems.

(b) The composting facility shall have the following separation distances:

- (i) the distance between the active area and the nearest foundation of an off-site structure used for commercial, industrial, residential of institutional purposes shall be a minimum of 100 metres;

(ii) the distance between the active area and the nearest property boundary shall be a minimum of 30 metres;

(iii) the distance between the active area and the nearest watercourse or water body, including salt water, shall be a minimum of 30 metres;

(iv) under certain circumstances, separation distances may be increased or decreased after consultation with the Department depending on factors such as environmental controls and local conditions; and,

(v) a separation distance may be decreased by the Department pursuant to clause (iv) provided that written consent is obtained by the applicant from all the property owners within the affected area.

## 4.0 IN-VESSEL COMPOSTING FACILITIES

### 4.1 General

Section 4 of the guidelines applies to all in-vessel composting facilities.

### 4.2 Receiving and Tipping Area

(a) The receiving and tipping area shall be underlain by an impermeable pad, the surface of which shall be concrete or asphalt. All drainage from the impermeable pad shall be collected for treatment or for return to the process.

(b) The receiving and tipping area shall be in an enclosed structure.

### 4.3 Composting Area

(a) The composting area shall be designed to fully contain the compostable organic material and all leachate which may be generated.

(b) The containment system shall be impermeable, the surface of which shall be constructed of concrete, asphalt, steel or other material as approved by the Department.

(c) All drainage from the composting area shall be collected for treatment or for return to the process.

### 4.4 Curing Area

(a) The curing area shall be underlain by an impermeable pad, the surface of which shall be concrete or asphalt.

(b) All drainage from the impermeable pad shall be collected for treatment or for return to the process.

(c) All curing areas shall utilize permanent roof structures and/or proven management techniques to control moisture and minimize odour and leachate generation.

### 4.5 Leachate Management Systems

(a) A leachate management system shall be developed which consists of infrastructure and monitoring systems designed to collect, monitor, control, and treat leachate prior to being discharged into the surrounding environment. The system shall:

  (i) have a leachate collection and removal network in the active area;
  (ii) function year round; and,
  (iii) have a means of monitoring all treated leachate discharges.

(b) The discharge standards for all liquid effluent shall be based on the background water quality in the receiving water, identified current and projected uses of the receiving water and the Canadian Water Quality Guidelines (CRREM 1987 as amended from time to time) for protection of these defined water uses. Additionally, liquid effluent shall not be acutely lethal as determined by the suite of Biological Test Methods developed by Environment Canada for this purpose.

### 4.6 Surface Water Management

(a) The applicant shall submit for approval from the Department a surface water monitoring program. The extent of surface water monitoring requirements will be based on the design of the facility.

(b) The surface water monitoring program shall be designed to do the following:

  (i) divert surface and storm water from the active areas;
  (ii) control run-off discharge from the facility;
  (iii) control erosion, sedimentation, siltation, and flooding; and
  (iv) minimize the generation of leachate.

(See Appendix 1 for an example of a typical surface water monitoring program)

### 4.7 Groundwater Management

(a) The applicant shall submit for approval from the Department a groundwater monitoring program. The extent of groundwater monitoring requirements will be based on the design of the facility. Should any of the active area not be protected from precipitation with permanently constructed roof structures, then the groundwater monitoring program shall consist of the following minimum requirements:

(i) at least one groundwater monitoring well shall be installed hydraulically above the gradient of the active area and at least three monitoring wells shall be installed hydraulically below the gradient direction;

(ii) the monitoring well system shall include a sufficient number of multi-level well nests for measurement of vertical gradients;

(iii) locations of the monitoring well(s) shall be sufficiently close to the active area to allow early detection of contamination and implementation of remedial measures; and

(iv) the monitoring well(s) are to be retained throughout the lifespan of the facility.

(See Appendix 1 for an example of a typical groundwater monitoring program)

## 4.8 Odour Control Systems

(a) Mechanical ventilation shall be provided for the composting area, areas for the storage of compostable organic feedstock and any other area containing readily putrescible materials such as the storage room for residuals.

(b) All areas referred to in clause (a) shall be under a negative atmospheric pressure in order to avoid the escape of odours.

(c) All ventilation air shall be subject to a treatment system designed to remove odours prior to release into the environment.

## 4.9 Separation Distances

(a) The distance between the active area and the nearest residential or institutional building shall be a minimum of 500 metres.

(b) The distance between the active area and the nearest commercial or industrial building shall be a minimum of 250 metres.

(c) The distance between the active area and the nearest property boundary shall be a minimum of 100 metres.

(d) Where it can be demonstrated that particular equipment will not release odours generated from the composting process into the surrounding environment, the distance between the equipment and the nearest property boundary shall be a minimum of 30 metres.

(e) The distance between the active area and the nearest watercourse or water body, including salt water, shall be a minimum of 30 metres.

(f) Under certain circumstances, separation distances may be increased or decreased after consultation with the Department. These will depend on factors such as environmental controls (including odour control) and local conditions.

(g) A separation distance may be decreased by the Department pursuant to clause (f) provided that written consent is obtained by the applicant from all property owners within the required separation distances.

## 5.0 OPEN WINDROW COMPOSTING FACILITIES

### 5.1 General

Section 5 of the guidelines applies to all open windrow composting facilities except leaf and yard waste composting facilities covered under section 3.0.

### 5.2 Receiving and Tipping Area

(a) The receiving and tipping area shall be underlain by an impermeable pad, the suface of which shall be concrete or asphalt. All drainage from the impermeable pad shall be collected for treatment or for return to the process.

(b) The receiving and tipping area shall be in an enclosed structure.

### 5.3 Composting Area

(a) The composting area shall be underlain by an impermeable pad, the surface of which shall be concrete or asphalt. All drainage from the impermeable pad shall be collected for treatment or for return to the process.

(b) All composting areas shall utilize permanent roof structures and/or proven management techniques in order to control moisture and to minimize odour and leachate generation.

### 5.4 Curing Area

(a) The curing area shall be underlain by an impermeable pad, the surface of which shall be concrete or asphalt.

(b) All drainage from the impermeable pad shall be collected for treatment or for return to the process.

(c) All curing areas shall utilize permanent roof structures and/or proven management techniques to control moisture and to minimize odour and leachate generation.

## 5.5 Leachate Management Systems

(a) A leachate management system shall be developed which consists of infrastructure and monitoring systems designed to collect, monitor, control, and treat leachate prior to being discharged into the surrounding environment. The system shall:

(i) have a leachate collection and removal network in the active area;
(ii) function year round;
(iii) have a means of monitoring all treated leachate discharges; and
(iv) the system must record both instantaneous and total flow volumes.

(b) The discharge standards for all liquid effluent shall be based on the background water quality in the receiving water, identified current and projected uses of the receiving water and the Canadian Water Quality Guidelines (CRREM 1987 as amended from time to time) for protection of these defined water uses. Additionally, liquid effluent shall not be acutely lethal as determined by the suite of Biological Test Methods developed by Environment Canada for this purpose.

## 5.6 Surface Water Management

Surface water management systems shall be designed to do the following:

(a) divert surface and storm water from the active areas;
(b) control run-off discharge from the facility;
(c) control erosion, sedimentation, siltation, and flooding; and
(d) minimize the generation of leachate.

(See Appendix 1 for an example of a typical surface water monitoring program)

## 5.7 Groundwater Management

(a) To ensure that groundwater is adequately protected, each facility shall include a groundwater monitoring program.

(b) The groundwater monitoring program shall consist of the following:

(i) at least one groundwater monitoring well shall be installed hydraulically above the gradient of the active area and at least three monitoring wells shall be installed hydraulically below the gradient direction;

(ii) the monitoring well system shall include a sufficient number of multi-level well nests for measurement of vertical gradients;

(iii) locations of the monitoring wells shall be sufficiently close to the active area to allow early detection of contamination and implementation of remedial measures; and,

(iv) the monitoring wells are to be retained throughout the lifespan of the facility.

(See Appendix 1 for an example of a typical groundwater monitoring program)

## 5.8 Odour Control

(a) Facilities shall provide to the Department detailed management techniques for the control of odours from the composting process.

(b) All open windrow facilities which include more than 1000 tonnes annually of food waste in their feedstock or exceed 10 000 tonnes annually of total feedstock, shall provide atmospheric dispersion modelling to determine the potential for odour at the property boundary and other receptors near the facility.

(c) The modelling shall categorize the compounds which could result in odour and shall establish odour concentrations at the property boundaries and other receptors. These baseline odour concentrations shall meet the satisfaction of the Department and shall be used in testing for odours after the facility is in operation.

## 5.9 Separation Distances

(a) The distance between the active area and the nearest structure, including residential, institutional, commercial or industrial buildings, shall be a minimum of 500 metres. Where the facility includes more than 1000 tonnes annually of food waste in its feedstock, or exceeds 10 000 tonnes annually of total feedstock, then the minimum separation distance shall be a minimum of 1000 metres.

(b) The distance between the active area and the nearest property boundary shall be a minimum of 100 metres.

(c) The distance between the active area and the nearest watercourse or water body, including salt water, shall be a minimum of 30 metres.

(d) Under certain circumstances, separation distances may be increased or decreased after consultation with the Department. These will depend on factors such as environmental controls (including odour control) and local conditions.

(e) A separation distance may be decreased by the Department pursuant to clause (d) provided that written consent is obtained by the applicant from all property owners within the affected area.

## 6.0 COMPOSTING FACILITY OPERATION

### 6.1 General Requirements

(a) Section 6 of the guidelines applies to all composting facilities regardless of the size and type of feedstock processed.

(b) The objective of all composting facilities shall be to incorporate all compostable organic feedstock into the composting process the same day that it is delivered to the site. If some feedstock is not incorporated into the process in the same day, except leaf and yard waste feedstocks only, then it shall be stored in an enclosed area with a mechanical system for the capture and treatment of odorous emissions.

(c) The composting facility shall have constant supervision during the hours that the facility is open.

(d) The composting facility shall accept only the feedstock identified in the approval.

(e) Any residual products associated with the composting operation shall be disposed of in a manner acceptable to the Department.

(f) Litter shall be controlled on the entire site.

(g) Exposed areas shall be stabilized to prevent erosion and sedimentation.

(h) Dust shall be controlled to Departmental requirements for particulate emissions.

(I) Vectors shall be controlled in accordance with a control plan approved by the Department.

(j) Signs shall be placed at the entrance to the site indicating the name of the facility, hours of operation, emergency contact, and the materials acceptable at the site.

### 6.2 Operation and Maintenance Manual

(a) An Operation and Maintenance Manual shall be submitted for approval from the Department and shall include the following:

(i) record drawings and specifications for the composting facility;
(ii) a copy of the approval including Terms and Conditions of the approval for the composting facility;
(iii) a complete description of the operational practices and procedures;
(iv) measures to control and monitor the aeration of the compost to ensure that the oxygen content in the compost material is sufficient to prevent the composting mass from becoming anaerobic;
(v) measures to control the aeration, blending and mixing of the compost to minimize odorous emissions from the composting operation as well as raw material and compost storage;
(vii) monitoring programs including sampling protocols, locations and frequency for monitoring wells, leachate treatment and storm water management systems; and
(viii) contingency plans.

(b) The Operation and Maintenance Manual shall be left on site at all times and shall be available for inspection during operating hours.

### 6.3 Contingency Plans

(a) Contingency plans shall identify all reasonably foreseeable emergencies including a fire, explosion, leachate leakage or spills and shall describe appropriate response to prevent an adverse affect on the surrounding environment.

(b) The applicant shall provide contingency plans addressing problems associated with vectors, groundwater contamination, equipment failure, and odour generation and complaints.

### 6.4 Reports and Records

(a) The type and frequency of monitoring and reporting requirements shall be specified in the terms and conditions of the approval.

(b) The applicant shall submit for approval from the Department an annual report which shall include the following information:

(i) liquid effluent (leachate) monitoring both pre-treatment and post-treatment including:
   (a) flow volumes; and
   (b) leachate quality;
(ii) surface water monitoring and groundwater monitoring quality data;
(iii) feedstock flow including:
   (a) types of materials accepted at the composting facility for the period;
   (b) quantities of materials accepted at the composting facility for the period;
   (c) quantities of materials composted; and
   (d) quantities of materials rejected and sent for disposal;
(iv) compost quality testing results; and,
(v) complaint records.

(c) The applicant shall record and respond to complaints regarding the composting operation from the neighbouring public. Each complaint and associated measures shall be recorded in a log book including:

   (i) a description of the complaint and the date and time it was received by the applicant;
   (ii) wind direction, wind speed, temperature, humidity and other atmospheric conditions at the time of the occurance which resulted in a complaint; and,
   (iii) a description of the measures taken to address the cause of the complaint.

## 7.0 COMPOST CLASSIFICATION AND USE

### 7.1 Compost Classification

(a) All compost will be classified in accordance with the criteria identified in the Canadian Council of Ministers of the Environment (CCME) document "Guidelines for Compost Quality" dated March 1996 as amended from time to time. The compost must meet all criteria as established for foreign matter, maturity, pathogens and trace elements. See Schedule “B” for table of trace elements.

(b) Testing of the compost quality shall be completed for every 1000 tonnes of compost produced or every three months and conducted in accordance with the minimum testing procedures identified in Section 4 of the CCME Guidelines.

(c) Compost which meets the criteria established in the CCME Guidelines as Category B shall be classified in accordance with metal concentrations, product maturity, amount of foreign matter, organic matter content, pH and salinity.

(d) Compost which is tested and classified as a hazardous or special waste shall be handled and treated in accordance with the requirements of the *Act.*

### 7.2 Compost Use

(a) Compost which meets the criteria established in the CCME Guidelines as Category A may be used in accordance with the uses stated in the CCME Guidelines for Category A.

(b) Use of compost which meets the criteria established in the CCME Guidelines as Category B will be related to the sensitivity of the proposed receiving environment, the various feedstock used to produce the compost and the quality of the final product. Approval for the use of this compost shall include use on forest lands, landfills, highway medians and land reclamation projects such as quarries and disposal site restorations. This compost cannot be used on food crops.

## 8.0 REPEAL OF DOCUMENT

This document replaces the document entitled *Composting Guidelines* issued December, 1993.

Dated at Halifax, Nova Scotia, this __________ day of __________________________, 1998.

______________________________
Peter C. Underwood
Deputy Minister
Department of the Environment

## Schedule "A"

**Definitions:**

(a) "*Act*" means the *Environment Act*, S.N.S. 1994-95, c.1;

(b) "active area" means any area used for transfer, storage, disposal, separation, processing or treatment of compostable material including the tipping area, the composting area and the curing pad;

(c) "administrator" means a person appointed by the Minister pursuant to Section 21 of the *Act*;

(d) "approval" means an approval pursuant to Section 27 of the *Solid Waste-Resource Management Regulations*;

(e) "backyard composting" means composting at a residential dwelling unit of organic solid waste, including grass clippings, leaves or food waste, where

(i) the waste is generated by the residents of the dwelling unit or neighbouring dwelling units or both; and,
(ii) the annual production of compost does not exceed 60 cubic metres;

(f) "biosolids" means organic materials which originated as settled matter in facilities treating municipal or industrial liquid wastes and may be used as feedstock for composting operations;

(g) "compost" means a product of composting which is used or sold for use as a soil amendment, artificial topsoil or growing medium or for some other application to land;

(h) "composting" means the biological decomposition of organic materials, substances or objects under controlled circumstances to a condition sufficiently stable for nuisance-free storage and for safe use in land applications;

(i) "composting area" means an area where organic material undergoes the rapid initial stage of composting;

(j) "composting facility" means a solid waste-resource management facility where composting occurs;

(k) "compostable organic material" means vegetative matter, food processing waste, landscaping, garden and horticultural wastes, kitchen scraps, feed processing wastes, and other organic wastes which can be readily composted in composting facilities;

(l) "curing area" means an area where organic material that has undergone the rapid initial stage of composting is further stabilized into a mature finished compost;

(m) “Department” means the Nova Scotia Department of the Environment;

(n) “food waste” means any residual vegetative waste other than leaf and yard materials or woody materials and residual waste of animal origin including meat, fish, bones, carcasses or shells other than manure or biosolids from residential, industrial, commercial or institutional sources;

(o) "foreign matter" means any matter resulting from human intervention and made of organic or inorganic components including metal, glass, synthetic polymers (e.g., plastic and rubber) that may be present in compost but foreign matter does not include mineral soils, woody material, and rocks;

(p) "in-vessel composting" means any composting method in which composting materials are contained in an enclosed reactor, vessel or building and which utilizes forced ventilation with treatment of ventilation air for odour reduction;

(q) "leaf and yard waste" means vegetative matter resulting from gardening, horticulture, landscaping or land clearing operation, including materials such as tree and shrub trimmings, plant remains, grass clippings, leaves, trees and stumps, but excludes construction and demolition debris or contaminated organic matter;

(r) "open windrow composting" means composting in which compostable organic material is open to the atmosphere during the composting process and includes windrow composting in a building but where there is no treatment of ventilation air for odour reduction;

(s) "vector" means a carrier organism that is capable of transmitting a pathogen from one facility or waste source to another source, facility, product or organism including rodents, insects and birds.

**Schedule “B”**

**Concentrations of trace elements in compost*:**

| | **CATEGORY A** | **CATEGORY B** |
|---|---|---|
| **Trace Elements** | **Maximum Concentration within Product (mg/kg dry weight)** | **Maximum Concentration within Product (mg/kg dry weight)** |
| Arsenic (As) | 13 | 75 |
| Cadmium (Cd) | 3 | 20 |
| Cobalt (Co) | 34 | 150 |
| Chromium (Cr) | 210 | 1060** |
| Copper (Cu) | 100 | 760** |
| Mercury (Hg) | 0.8 | 5 |
| Molybdenum (Mo) | 5 | 20 |
| Nickel (Ni) | 62 | 180 |
| Lead (Pb) | 150 | 500 |
| Selenium (Se) | 2 | 14 |
| Zinc (Zn) | 500 | 1850 |

* See CCME Guideline for maximum cumulative additions to soil.
** See CCME Guideline for further description of these values.

# APPENDIX 1

## TYPICAL SURFACE AND GROUNDWATER MONITORING PROGRAM

### 1.0 SITE ASSESSMENT AND DESIGN

### 1.1 Hydrogeologic Assessment

Prior to the establishment or expansion of a site, a report shall be prepared by the owner containing plans, specifications, and descriptions of the hydrogeologic conditions of the site, adjacent and nearby properties, and the regional area in which the site is located, including, at a minimum, the following;

.1 a general description of geologic and hydrogeologic conditions occurring at the site, and adjacent and other properties within 1000 m of the site. This description should identify any unstable soils or bedrock, indicate the location and nature of any boundaries to groundwater movement, and characterize the significance of groundwater resources and the use made of these resources;

.2 a detailed hydrogeologic investigation of the site which establishes soil, rock, and groundwater conditions;

.3 an interpretation of the results of the detailed hydrogeologic investigation of the site, including plans, specifications, and descriptions; and

.4 an assessment of the suitability of the site considering the regional, local, and site specific hydrogeologic conditions, the design of the site, and the contingency plans for the control of leachate.

### 1.2 Surface Water Assessment

Prior to the establishment or expansion of a site, a report shall be prepared by the owner containing plans, specifications, and descriptions of the surface water conditions of the site, adjacent and nearby properties, and the regional area in which the site is located, including, at a minimum, the following:

.1 a description of the local surface water features occurring at the site, and adjacent and other properties within 1000 m of the site. This description shall include, but not be limited to, flood plains, natural watercourses, waterbodies (including salt water) drainage paths and boundaries, streamflows, surface water quality, and sources of water supply. The description shall also extend further than 1000 m to be sufficiently large to assess the range and extent of potential effects;

.2 a detailed surface water investigation of the site to assess water quality, quantity, and habitat conditions of the surface water features identified on site, including existing and potential surface water uses;

.3 an interpretation of the results of the detailed surface water investigation of the site, including plans, specifications, and descriptions; and

.4 an assessment of the suitability of the site considering the regional, local, and site specific surface water conditions, the design of the site, and the contingency plan for the control of leachate.

## 2.0 OPERATION AND MONITORING

### 2.1 Groundwater Monitoring

A program for monitoring groundwater quality and quantity shall be carried out by the owner and shall include, at a minimum, the following:

.1 Representative samples of groundwater within the site shall be:

a) obtained annually from groundwater monitoring facilities and be analyzed for the parameters listed in column 1 of Schedule 1; and

b) obtained quarterly from groundwater monitoring facilities and be analyzed for the parameters listed in column 2 of Schedule 1.

.2 Where requested by property owners or occupants, representative samples of groundwater shall be obtained from domestic wells located within 500 m of the site at a frequency of 1 sample per well per year and these groundwater samples shall be analyzed for the parameters listed in column 2 of Schedule 1.

.3 The results of analysis of a water sample collected under Subsection 2.1.2 shall be provided to the Department and the owner or occupant of the property with the domestic well from which the sample was obtained, within 60 days of obtaining the sample.

.4 The results of analysis of all water samples collected in the groundwater monitoring program, together with an assessment of these results shall be provided to the Department in an annual report, and where the assessment indicates a significant increase in contaminant concentrations, within 60 days of obtaining the sample and 5 days of making the assessment.

.5 The parameters to be monitored may be amended where the owner prepares a report showing alternative parameters should be monitored, based on the type of process at the site.

## 2.2 Surface Water Monitoring

A program for monitoring surface water quality, quantity, and biological features shall be carried out by the owner and shall include, at a minimum, the following:

.1 Representative samples of surface water being discharged from the site and of any waterbody, including upstream control locations, which may be affected by leachate, stormwater runoff, or sediment from the site , shall be:

a) obtained semi-annually, and be analyzed for the parameters listed in column 3 of Schedule 1 and for other parameters of concern identified in the surface water assessment; and

b) obtained quarterly and be analyzed for the parameters listed in column 4 of Schedule 1.

.2 Annual monitoring of biological features to assess the composition and any changes to the benthic community present in any waterbody, located downstream of storm water discharges, that may be affected by leachate, stormwater runoff, or sediment from the site.

.3 The results and assessment of the results of the surface water monitoring shall be provided to the Department in an annual report, and where the assessment indicates an increase in contaminant concentrations exceeding the natural variability exhibited by baseline and operational monitoring data, within 60 days of obtaining the sample and 5 days of making the assessment.

.4 The parameters to be monitored may be amended where the owner prepares a report showing alternative parameters should be monitored, based on the type of process at the site.

Schedule 1
Groundwater, Leachate and Surface Water Monitoring Parameters

| | Parameter | | | |
|---|---|---|---|---|
| Parameter Group | Column 1 | Column 2 | Column 3 | Column 4 |
| | Comprehensive List for Groundwater and Leachate | Indicator List for Groundwater and Leachate | Comprehensive List for Surface Water | Indicator List for Surface Water |
| | Alkalinity | Alkalinity | Alkalinity | Alkalinity |
| | Ammonia | | Ammonia | Ammonia |
| | Arsenic | | Arsenic | |
| | Barium | | Barium | |
| | Boron | | Boron | |
| | Cadmium | Cadmium | Cadmium | |
| | Calcium | Calcium | | |
| | Chloride | Chloride | Chloride | Chloride |
| | Chromium | | Chromium | |
| | Conductivity | Conductivity | Conductivity | Conductivity |
| | Copper | | Copper | |
| | Iron | Iron | Iron | |
| | Lead | Lead | Lead | |
| | Magnesium | Magnesium | | |
| | Manganese | | | |
| | Mercury | | Mercury | |
| | Nitrate | Nitrate | Nitrate | Nitrate |

| | Parameter | | | |
|---|---|---|---|---|
| Parameter Group | Column 1 | Column 2 | Column 3 | Column 4 |
| | Comprehensive List for Groundwater and Leachate | Indicator List for Groundwater and Leachate | Comprehensive List for Surface Water | Indicator List for Surface Water |
| | Nitrite | | Nitrite | Nitrite |
| | Total Kjeldahl Nitrogen | | Total Kjeldahl Nitrogen | Total Kjeldahl Nitrogen |
| | pH | pH | pH | pH |
| | Total Phosphorus | | Total Phosphorus | Total Phosphorus |
| | Potassium | Potassium | | |
| | Sodium | Sodium | | |
| | Suspended Solids | Suspended Solids | Suspended Solids | Suspended Solids |
| | Total Dissolved Solids | Total Dissolved Solids | Total Dissolved Solids | Total Dissolved Solids |
| | Sulphate | Sulphate | Sulphate | Sulphate |
| | Zinc | | Zinc | |
| Volatile Organics | | | | |
| | Benzene | | Benzene | |
| | 1, 4 Dichlorobenzene | | 1, 4 Dichlorobenzene | |
| | Dichloromethane | | Dichloromethane | |
| | Toluene | | Toluene | |
| | Vinyl Chloride | | | |

| | Parameter | | | |
|---|---|---|---|---|
| Parameter Group | Column 1 | Column 2 | Column 3 | Column 4 |
| | Comprehensive List for Groundwater and Leachate | Indicator List for Groundwater and Leachate | Comprehensive List for Surface Water | Indicator List for Surface Water |
| Other Organics | | | | |
| | | | Biochemical Oxygen Demand ($BOD_5$) | Biochemical Oxygen Demand ($BOD_5$) |
| | Chemical Oxygen Demand | Chemical Oxygen Demand | Chemical Oxygen Demand | Chemical Oxygen Demand |
| | Dissolved Organic Carbon | Dissolved Organic Carbon | Total Organic Carbon | |
| | Phenol | | Phenol | Phenol |
| | | | Tannins/Lignins | |
| Field Parameters | | | | |
| | | | Temperature | Temperature |
| | pH | pH | pH | pH |
| | Conductivity | Conductivity | Conductivity | Conductivity |
| | | | Dissolved Oxygen | Dissolved Oxygen |
| | | | Flow | Flow |

# APPENDIX F

# MARINE BENTHIC HABITAT AND SEDIMENT CHARACTERIZATION DATA

| Table F.1 Marine Sediment Chemistry at Karlsen Wharf/Casino Area (Halifax) | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **Units** | **EQL** | **HN1** | **HN2** | **HN3** | **Ocean Disposal Guidelines** |
| Cadmium | mg/kg | 0.3 | **4.7** | **0.6** | **0.6** | 0.6 |
| Copper | mg/kg | 2.0 | **290** | **87** | **81** | 81 |
| Lead | mg/kg | 0.5 | **1000** | **310** | **280** | 66 |
| Zinc | mg/kg | 2.0 | **1100** | **260** | **210** | 160 |
| Mercury | mg/kg | 0.01 | **5.3** | **0.91** | **1.5** | 0.75 |
| Total Organic Carbon | g/kg | 0.1 | 112.0 | 20.6 | 49.3 | |
| Total Inorganic Carbon | g/kg | 0.1 | 26.6 | 5.4 | 13.1 | |
| gravel | % | 0.1 | nd | nd | nd | |
| sand | % | 0.1 | 27.7 | 6.8 | 25.0 | |
| silt | % | 0.1 | 45.6 | 68.3 | 47.9 | |
| clay | % | 0.1 | 26.8 | 24.9 | 27.0 | |
| Benzene | mg/kg | 0.025 | nd | nd | 0.255 | |
| Toluene | mg/kg | 0.025 | nd | nd | 0.634 | |
| Ethylbenzene | mg/kg | 0.025 | nd | nd | 0.168 | |
| Xylenes | mg/kg | 0.05 | nd | nd | 1.39 | |
| Total Petroleum Hydrocarbons | mg/kg | 32.5 | **8230** | **1290** | nd | 10.0 |
| Total PAHs | mg/kg | 0.05 | **270.1** | **81.65** | **1044.3** | 2.5 |
| PCBs | µg/kg | 10.0 | **3870** | 98 | nd | 100 |
| DDE | µg/kg | 10.0 | 77.4 | nd | nd | 100 |
| DDT | µg/kg | 10.0 | nd | nd | nd | 100 |
| DDD | µg/kg | 10.0 | nd | nd | nd | 100 |

* PCB is Aroclor 1260; TPH is lube oil fraction
Bolded text shows exceedances of the Interim Contaminant Testing Guidelines for Ocean Disposal

| Table F.2 Marine Sediment Chemistry at Woodside (Dartmouth) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Units** | **EQL** | **D1** | **D2** | **D3** | **D4** | **Ocean Disposal Guidelines** |
| Cadmium | mg/kg | 0.3 | 0.5 | 0.3 | **0.7** | 0.4 | 0.6 |
| Copper | mg/kg | 2.0 | 72 | 19 | 68 | 58 | 81 |
| Lead | mg/kg | 0.5 | **140** | 16 | **160** | **150** | 66 |
| Zinc | mg/kg | 2.0 | 150 | 59 | **180** | **160** | 160 |
| Mercury | mg/kg | 0.01 | 1.1 | 0.04 | **0.97** | **0.85** | 0.75 |
| Total Organic Carbon | g/kg | 0.1 | 47 | 31.3 | 45.5 | 26.9 | |
| Total Inorganic Carbon | g/kg | 0.1 | 13 | 2.4 | 6.0 | 0.2 | |
| gravel | % | 0.1 | nd | 60.5 | nd | nd | |
| sand | % | 0.1 | 23.5 | 17.6 | 8.3 | 6.3 | |
| silt | % | 0.1 | 50.2 | 15.3 | 61.6 | 61.5 | |
| clay | % | 0.1 | 26.3 | 6.6 | 30.1 | 32.2 | |
| Benzene | mg/kg | 0.025 | nd | nd | nd | nd | |
| Toluene | mg/kg | 0.025 | nd | nd | nd | nd | |
| Ethylbenzene | mg/kg | 0.025 | nd | nd | nd | nd | |
| Xylenes | mg/kg | 0.05 | nd | nd | nd | nd | |
| Total Petroleum Hydrocarbons | mg/kg | 32.5 | **2120** | **1830** | **2440** | **1950** | 10.0 |
| Total PAHs | mg/kg | 0.05 | **17.19** | **18.82** | **14.2** | **9.19** | 2.5 |
| PCBs | µg/kg | 10.0 | **143** | **63.3** | **95.3** | **164** | 100 |
| DDE | µg/kg | 10.0 | nd | nd | nd | nd | 100 |
| DDT | µg/kg | 10.0 | nd | nd | nd | nd | 100 |
| DDD | µg/kg | 10.0 | nd | nd | nd | nd | 100 |

* PCB is Aroclor 1260; TPH is lube oil fraction
Bolded text shows exceedances of the Interim Contaminant Testing Guidelines for Ocean Disposal

| Table F.3 Sediment Chemistry at Hospital Point (Herring Cove) | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | Units | EQL | Diffuser Area | 100 m North | 100 m South | Ocean Disposal Limits |
| Cadmium | mg/kg | 0.3 | nd | nd | nd | 0.6 |
| Copper | mg/kg | 2.0 | 11 | 11 | 14 | 81.0 |
| Zinc | mg/kg | 2.0 | 46 | 42 | 49 | 160.0 |
| Lead | mg/kg | 0.5 | 19 | 17 | 19 | 66.0 |
| Mercury | mg/kg | 0.01 | 0.04 | 0.03 | 0.04 | 0.75 |
| Total Organic Carbon | g/kg | 0.1 | 5.6 | 6.7 | 7.9 | |
| Total Inorganic Carbon | g/kg | 0.1 | 6.5 | 5.5 | 5.0 | |
| gravel | % | 0.1 | nd | nd | nd | |
| sand | % | 0.1 | 54.6 | 46.5 | 26.3 | |
| silt | % | 0.1 | 36.5 | 44.3 | 62.5 | |
| clay | % | 0.1 | 8.9 | 9.2 | 11.3 | |
| Benzene | mg/kg | 0.025 | nd | nd | nd | |
| Toluene | mg/kg | 0.025 | nd | nd | nd | |
| Ethylbenzene | mg/kg | 0.025 | nd | nd | nd | |
| Xylenes | mg/kg | 0.05 | nd | nd | nd | |
| Total Petroleum Hydrocarbons | mg/kg | 32.5 | **66.3** | **42.2** | **62.3** | 10.0 |
| Total PAHs | mg/kg | 0.05 | nd | nd | 0.65 | 2.5 |
| PCBs | µg/kg | 10.0 | nd | nd | nd | 100 |
| DDE | µg/kg | 10.0 | nd | nd | nd | 100 |
| DDT | µg/kg | 10.0 | nd | nd | nd | 100 |
| DDD | µg/kg | 10.0 | nd | nd | nd | 100 |

* TPH is lube oil fraction
Bolded text shows exceedances of the Interim Contaminant Testing Guidelines for Ocean Disposal

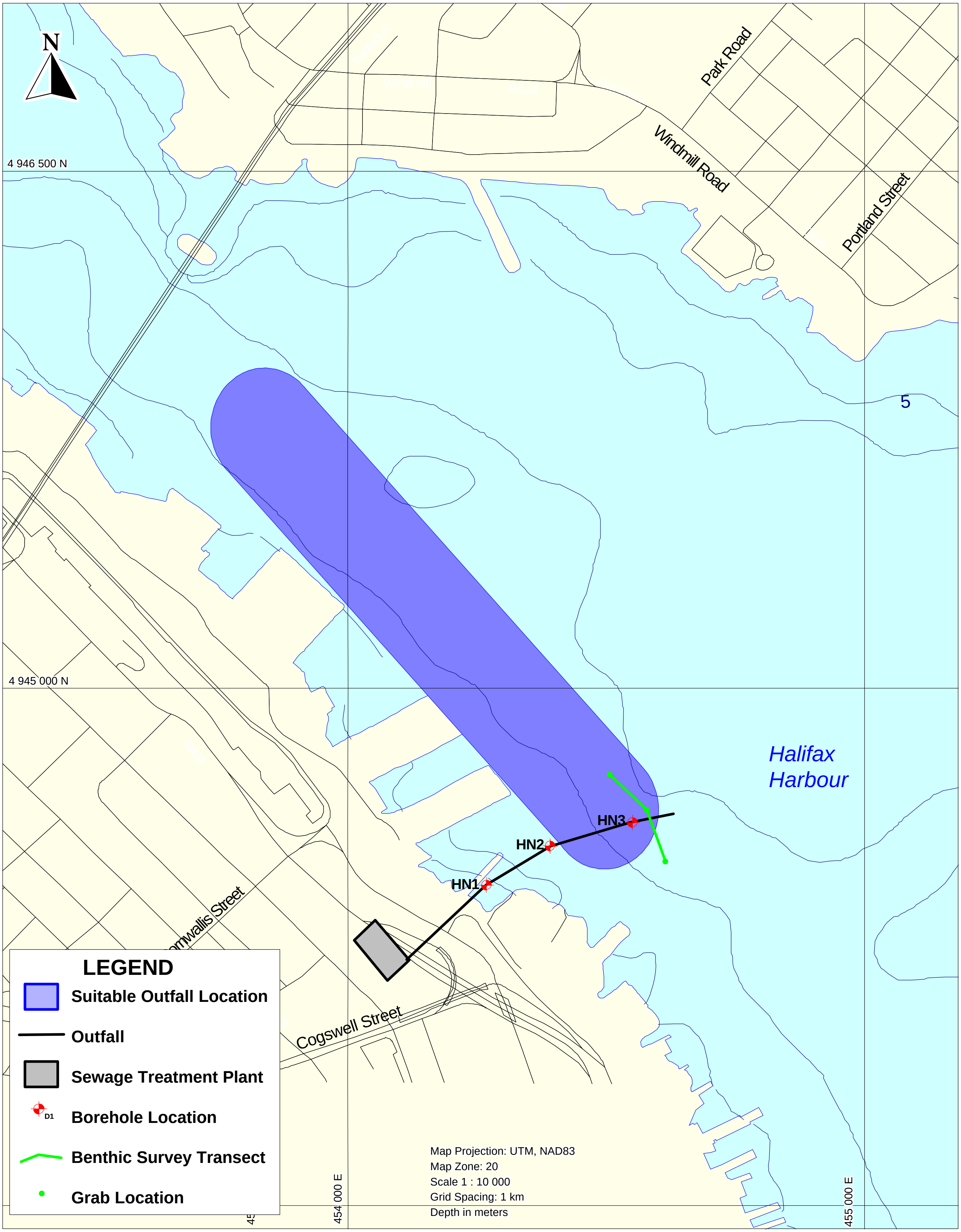



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Figure F.1
Halifax Outfall/Diffuser Location

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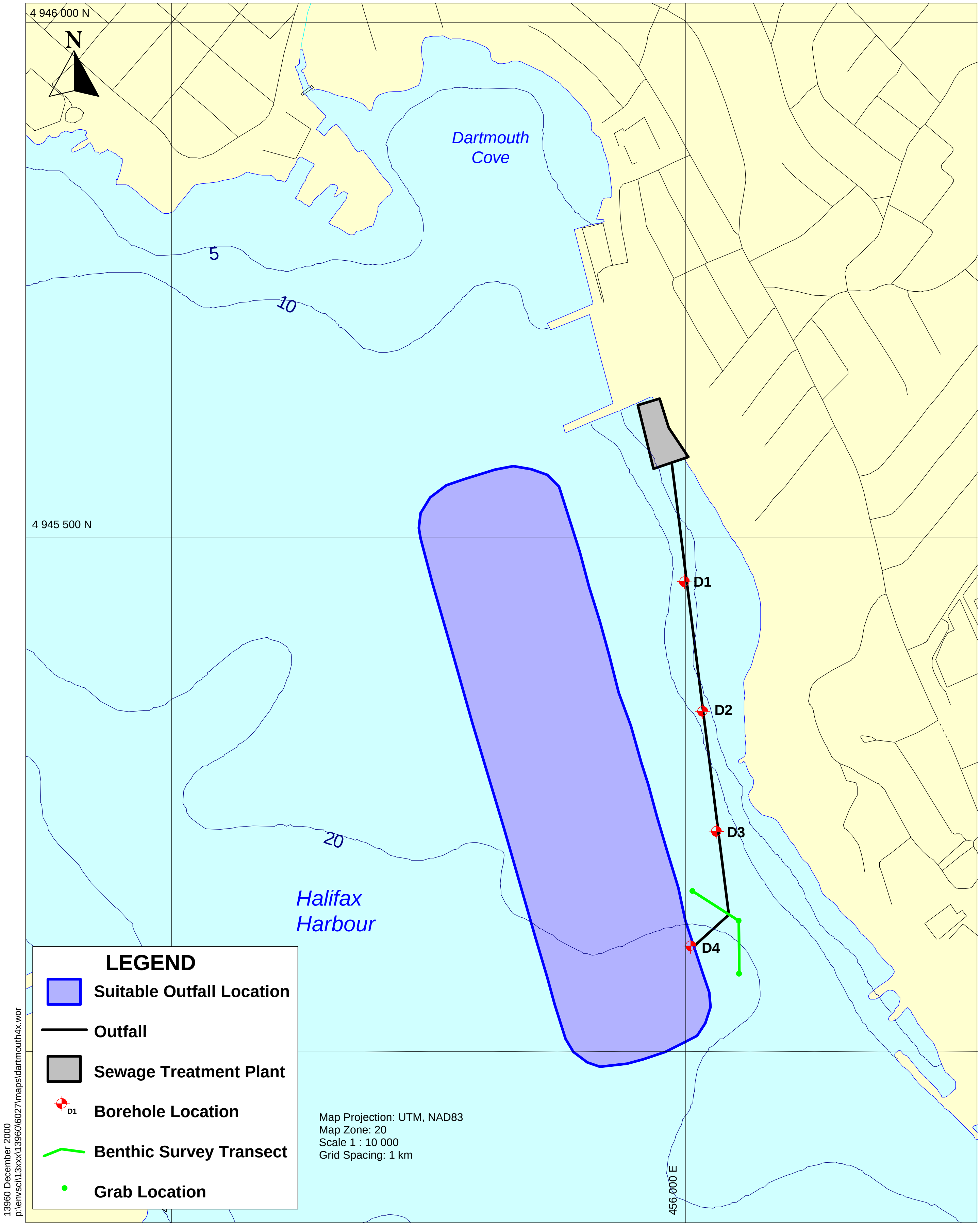


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Figure F.2

Dartmouth Outfall/Diffuser Location

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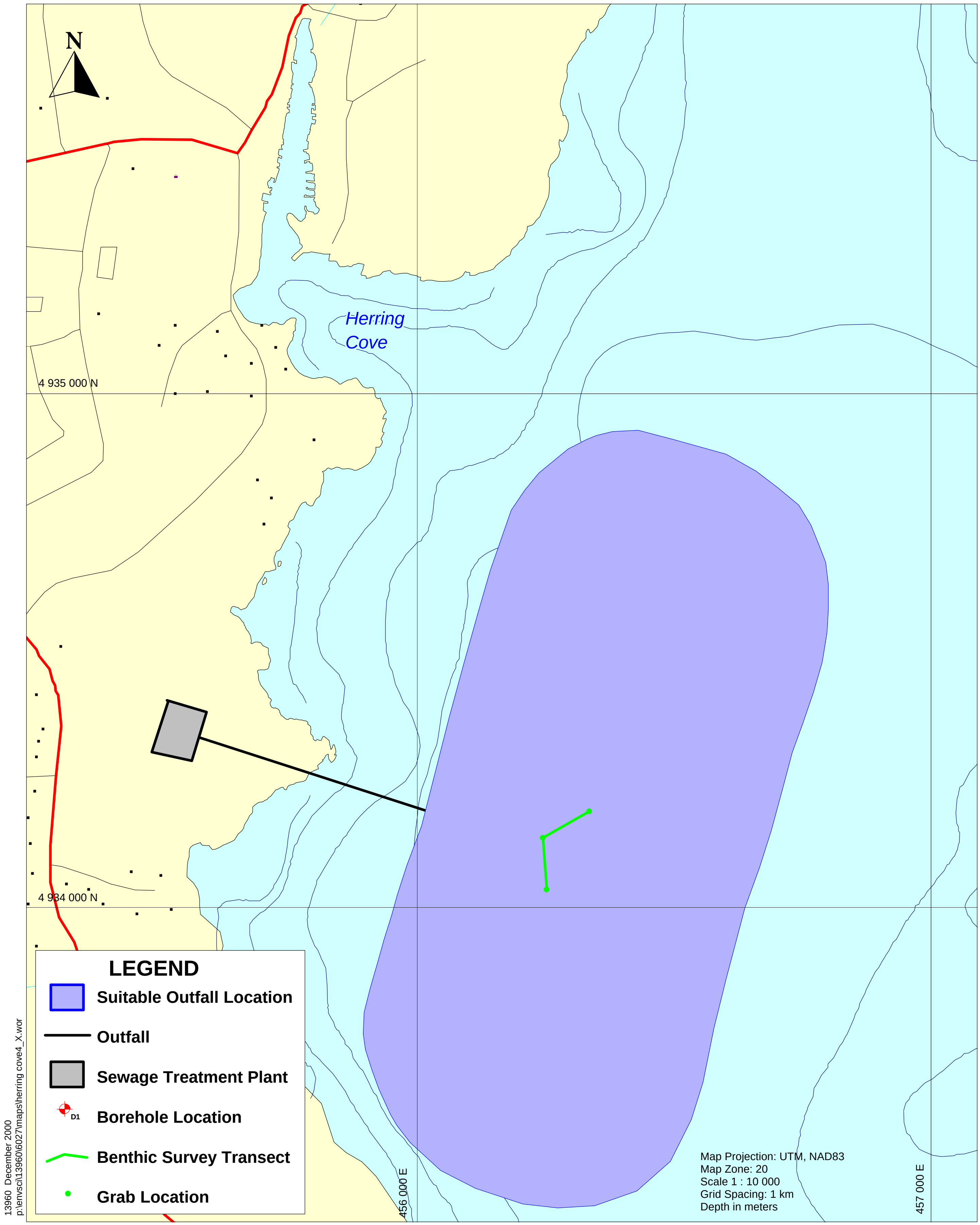


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Figure F.3
Herring Cove Outfall/Diffuser Location

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Photo 1: Benthic Habitat at Hospital Point


Photo 2: Benthic Habitat at Hospital Point

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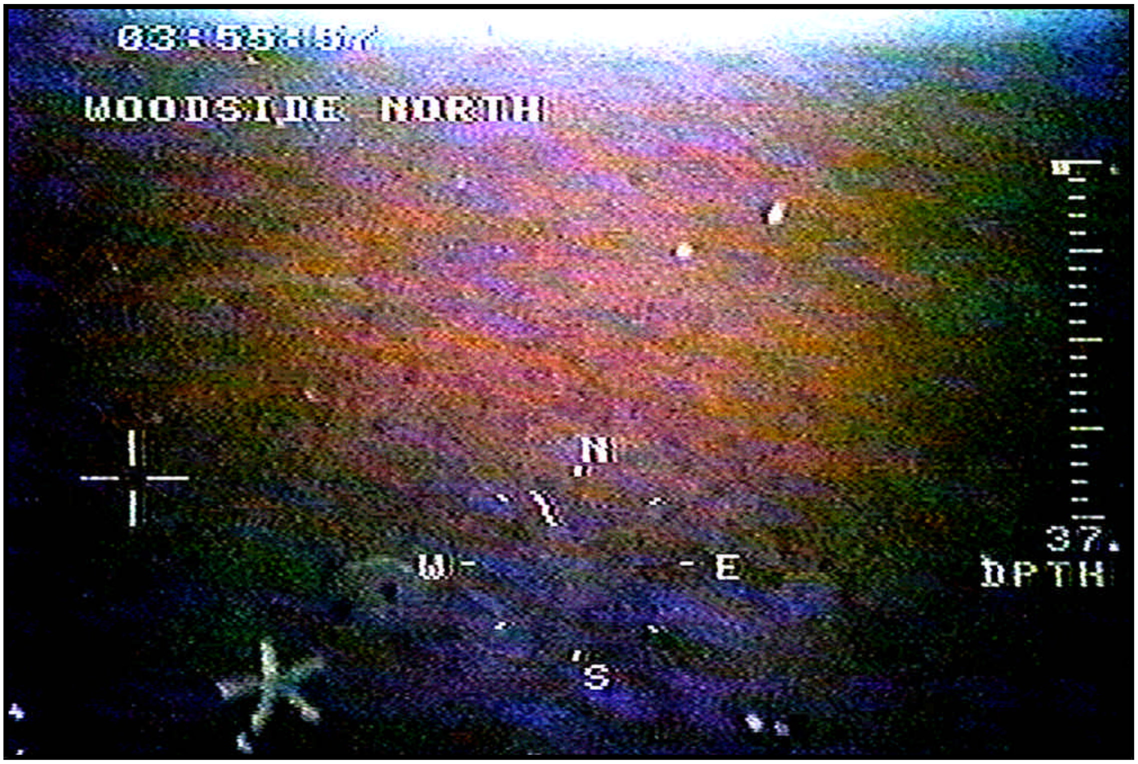


Photo 3: Benthic Habitat at Dartmouth (off NS Hospital)


Photo 4 : Benthic Habitat at Halifax (off Casino)

# APPENDIX G

# ANALYTICAL DATA FROM WASTEWATER CHARACTERIZATION OF DISCHARGES TO HALIFAX HARBOUR

**Table 5-2: Analytical Results - Roaches Pond**

| Parameter | EQL | Units | Roaches Pond-01<br>June 14 - June 15<br>11:40am - 11:40am | Roaches Pond-02<br>June 15 - June 16<br>11:40am - 11:40am | Roaches Pond-03<br>June 16 - June 17<br>11:40am - 11:40am |
|---|---|---|---|---|---|
| pH | 0.1 | Units | 6.8 | 7.1 | 7 |
| Carbonaceous BOD | 2 | mg/L | 110 | 99 | 96 |
| Total Suspended Solids | 0.5 | mg/L | 77 | 101 | 75 |
| Volatile Suspended Solids | 0.3 | mg/L | 71 | 91 | 68 |
| Total Oil & Grease | 5 | mg/L | - | 23.4 | - |
| Aluminum | 10 | ug/L | - | 490 | - |
| Antimony | 2 | ug/L | - | nd | - |
| Arsenic | 2 | ug/L | - | nd | - |
| Barium | 5 | ug/L | - | 28 | - |
| Beryllium | 5 | ug/L | - | nd | - |
| Boron | 5 | ug/L | - | 51 | - |
| Cadmium | 0.3 | ug/L | - | 0.2 | - |
| Chromium | 2 | ug/L | - | nd | - |
| Cobalt | 1 | ug/L | - | nd | - |
| Copper | 2 | ug/L | - | 35 | - |
| Iron | 20 | ug/L | - | 610 | - |
| Lead | 0.5 | ug/L | - | 2 | - |
| Manganese | 2 | ug/L | - | 130 | - |
| Molybdenum | 2 | ug/L | - | nd | - |
| Nickel | 2 | ug/L | - | 2 | - |
| Selenium | 2 | ug/L | - | nd (2) | - |
| Silver | 0.5 | ug/L | - | nd | - |
| Strontium | 5 | ug/L | - | 56 | - |
| Thallium | 0.1 | ug/L | - | nd | - |
| Tin | 2 | ug/L | - | nd | - |
| Uranium | 0.1 | ug/L | - | 0.2 | - |
| Vanadium | 2 | ug/L | - | nd | - |
| Zinc | 2 | ug/L | - | 54 | - |
| Mercury | 0.05 | ug/L | - | nd | - |

EQL = Estimated Quantitation Limit for Routine Analysis
nd = not detected above standard EQL
nd () = not detected at the elevated EQL specified due to matirx interference or sample pre-dilution
- = Parameter not requested in sample

**Table 5-4: Analytical Results - Point Pleasant Park**

| Parameter | EQL | Units | Point Pleasant-01 | Point Pleasant-02 | Point Pleasant-03 |
|---|---|---|---|---|---|
| Sample ID / Date Period | | | June 7 - June 8 11:10am - 11:10am | June 8 - June 9 11:10am - 11:10am | June 9 - June 10 11:10am - 11:10am |
| pH | 0.1 | Units | 6.9 | 6.7 | 6.8 |
| Carbonaceous BOD | 2 | mg/L | 110 | 54 | 87 |
| Total Suspended Solids | 0.5 | mg/L | 60 | 51 | 80 |
| Volatile Suspended Solids | 0.3 | mg/L | 53 | 44 | 67 |
| Total Oil & Grease | 5 | mg/L | - | - | 14.3 |
| Aluminum | 10 | ug/L | - | - | 730 |
| Antimony | 2 | ug/L | - | - | nd |
| Arsenic | 2 | ug/L | - | - | 2 |
| Barium | 5 | ug/L | - | - | 26 |
| Beryllium | 5 | ug/L | - | - | nd |
| Boron | 5 | ug/L | - | - | 300 |
| Cadmium | 0.3 | ug/L | - | - | 0.2 |
| Chromium | 2 | ug/L | - | - | nd |
| Cobalt | 1 | ug/L | - | - | 2 |
| Copper | 2 | ug/L | - | - | 31 |
| Iron | 20 | ug/L | - | - | 930 |
| Lead | 0.5 | ug/L | - | - | 4.1 |
| Manganese | 2 | ug/L | - | - | 190 |
| Molybdenum | 2 | ug/L | - | - | nd |
| Nickel | 2 | ug/L | - | - | 6 |
| Selenium | 2 | ug/L | - | - | nd (10) |
| Silver | 0.5 | ug/L | - | - | nd |
| Strontium | 5 | ug/L | - | - | 390 |
| Thallium | 0.1 | ug/L | - | - | nd |
| Tin | 2 | ug/L | - | - | nd |
| Uranium | 0.1 | ug/L | - | - | 0.1 |
| Vanadium | 2 | ug/L | - | - | nd |
| Zinc | 2 | ug/L | - | - | 60 |
| Mercury | 0.05 | ug/L | - | - | 0.18 |

EQL = Estimated Quantitation Limit for Routine Analysis
nd = not detected above standard EQL
nd () = not detected at the elevated EQL specified due to matirx interference or sample pre-dilution
- = Parameter not requested in sample

Table 5-8: Analytical Results - Bell Road

| Parameter | EQL | Units | Bell Rd-01 June 21 - June 22 7:00pm - 7:00pm | Bell Rd-02 June 22 - June 23 7:00pm - 7:00pm | Bell Road-03 June 23 - June 24 7:00pm - 7:00pm |
|---|---|---|---|---|---|
| pH | 0.1 | Units | 6.9 | 6.7 | 6.7 |
| Carbonaceous BOD | 2 | mg/L | 130 | 91 | 100 |
| Total Suspended Solids | 0.5 | mg/L | 109 | 78 | 71 |
| Volatile Suspended Solids | 0.3 | mg/L | 94 | 71 | 63 |
| Total Oil & Grease | 5 | mg/L | 18.8 | - | - |
| Aluminum | 10 | ug/L | 550 | - | - |
| Antimony | 2 | ug/L | nd | - | - |
| Arsenic | 2 | ug/L | 5 | - | - |
| Barium | 5 | ug/L | 46 | - | - |
| Beryllium | 5 | ug/L | nd | - | - |
| Boron | 5 | ug/L | 90 | - | - |
| Cadmium | 0.3 | ug/L | 0.2 | - | - |
| Chromium | 2 | ug/L | 13 | - | - |
| Cobalt | 1 | ug/L | nd | - | - |
| Copper | 2 | ug/L | 37 | - | - |
| Iron | 20 | ug/L | 2500 | - | - |
| Lead | 0.5 | ug/L | 7.7 | - | - |
| Manganese | 2 | ug/L | 120 | - | - |
| Molybdenum | 2 | ug/L | 7 | - | - |
| Nickel | 2 | ug/L | 5 | - | - |
| Selenium | 2 | ug/L | nd (2) | - | - |
| Silver | 0.5 | ug/L | 2.8 | - | - |
| Strontium | 5 | ug/L | 71 | - | - |
| Thallium | 0.1 | ug/L | nd | - | - |
| Tin | 2 | ug/L | nd | - | - |
| Uranium | 0.1 | ug/L | nd | - | - |
| Vanadium | 2 | ug/L | nd | - | - |
| Zinc | 2 | ug/L | 79 | - | - |
| Mercury | 0.05 | ug/L | 0.1 | - | - |

EQL = Estimated Quantitation Limit for Routine Analysis
nd = not detected above standard EQL
nd () = not detected at the elevated EQL specified due to matirx interference or sample pre-dilution
- = Parameter not requested in sample

**Table 5-10: Analytical Results - Tufts Cove**

| Parameter | EQL | Units | Tufts Cove-01<br>June 28 - June 29<br>9:05am - 9:05am | Tufts Cove-02<br>June 29 - June 30<br>9:05am - 9:05am | Tufts Cove-03<br>June 30 - July 01<br>9:05am - 9:05am |
|---|---|---|---|---|---|
| pH | 0.1 | Units | 6.5 | 6.7 | 6.5 |
| Carbonaceous BOD | 2 | mg/L | 160 | 180 | 150 |
| Total Suspended Solids | 0.5 | mg/L | 113 | 114 | 93 |
| Volatile Suspended Solids | 0.3 | mg/L | 91 | 100 | 80 |
| Total Oil & Grease | 5 | mg/L | - | - | 29.6 |
| Aluminum | 10 | ug/L | - | - | 450 |
| Antimony | 2 | ug/L | - | - | nd (20) |
| Arsenic | 2 | ug/L | - | - | nd (20) |
| Barium | 5 | ug/L | - | - | 110 |
| Beryllium | 5 | ug/L | - | - | nd (50) |
| Boron | 5 | ug/L | - | - | 87 |
| Cadmium | 0.3 | ug/L | - | - | nd (1) |
| Chromium | 2 | ug/L | - | - | nd (20) |
| Cobalt | 1 | ug/L | - | - | nd (10) |
| Copper | 2 | ug/L | - | - | 120 |
| Iron | 20 | ug/L | - | - | 1700 |
| Lead | 0.5 | ug/L | - | - | 14 |
| Manganese | 2 | ug/L | - | - | 170 |
| Molybdenum | 2 | ug/L | - | - | nd (20) |
| Nickel | 2 | ug/L | - | - | nd (20) |
| Selenium | 2 | ug/L | - | - | nd (10) |
| Silver | 0.5 | ug/L | - | - | 150 |
| Strontium | 5 | ug/L | - | - | 50 |
| Thallium | 0.1 | ug/L | - | - | nd (1) |
| Tin | 2 | ug/L | - | - | nd (20) |
| Uranium | 0.1 | ug/L | - | - | nd (1) |
| Vanadium | 2 | ug/L | - | - | nd (20) |
| Zinc | 2 | ug/L | - | - | 150 |
| Mercury | 0.05 | ug/L | - | - | 0.12 |

EQL = Estimated Quantitation Limit for Routine Analysis
nd = not detected above standard EQL
nd () = not detected at the elevated EQL specified due to matirx interference or sample pre-dilution
- = Parameter not requested in sample

Table 5-12: Analytical Results - Jamieson Street

| Parameter | EQL | Units | Jamieson St-01<br>June 21 - June 22<br>11:00am - 11:00am | Jamieson St-02<br>June 22 - June 23<br>11:00am - 11:00am | Jamieson St-03<br>June 23 - June 24<br>11:00am - 11:00am |
|---|---|---|---|---|---|
| pH | 0.1 | Units | 6.7 | 6.9 | 6.8 |
| Carbonaceous BOD | 2 | mg/L | 74 | 130 | 40 |
| Total Suspended Solids | 0.5 | mg/L | 61 | 87 | 67 |
| Volatile Suspended Solids | 0.3 | mg/L | 55 | 81 | 60 |
| Total Oil & Grease | 5 | mg/L | 9.6 | - | - |
| Aluminum | 10 | ug/L | 460 | - | - |
| Antimony | 2 | ug/L | nd | - | - |
| Arsenic | 2 | ug/L | 2 | - | - |
| Barium | 5 | ug/L | 22 | - | - |
| Beryllium | 5 | ug/L | nd | - | - |
| Boron | 5 | ug/L | 52 | - | - |
| Cadmium | 0.3 | ug/L | 0.4 | - | - |
| Chromium | 2 | ug/L | nd | - | - |
| Cobalt | 1 | ug/L | nd | - | - |
| Copper | 2 | ug/L | 41 | - | - |
| Iron | 20 | ug/L | 550 | - | - |
| Lead | 0.5 | ug/L | 2.2 | - | - |
| Manganese | 2 | ug/L | 220 | - | - |
| Molybdenum | 2 | ug/L | nd | - | - |
| Nickel | 2 | ug/L | 4 | - | - |
| Selenium | 2 | ug/L | nd (2) | - | - |
| Silver | 0.5 | ug/L | nd | - | - |
| Strontium | 5 | ug/L | 50 | - | - |
| Thallium | 0.1 | ug/L | nd | - | - |
| Tin | 2 | ug/L | nd | - | - |
| Uranium | 0.1 | ug/L | nd | - | - |
| Vanadium | 2 | ug/L | nd | - | - |
| Zinc | 2 | ug/L | 56 | - | - |
| Mercury | 0.05 | ug/L | 0.06 | - | - |

EQL = Estimated Quantitation Limit for Routine Analysis
nd = not detected above standard EQL
nd () = not detected at the elevated EQL specified due to matirx interference or sample pre-dilution
- = Parameter not requested in sample

**Table 5-14: Analytical Results - Chamber#1**

| Parameter | EQL | Units | Chamber1-01 | Chamber 1-02 | Chamber 1-03 |
|---|---|---|---|---|---|
| | | Sample ID | Chamber1-01 | Chamber 1-02 | Chamber 1-03 |
| | | Date Period | June 14 - June 15 12:00pm - 12:00pm | June 15 - June 16 12:00pm 12:00pm | June 16 - June 17 12:00pm - 12:00pm |
| pH | 0.1 | Units | 6.9 | 7 | 6.9 |
| Carbonaceous BOD | 2 | mg/L | 160 | 150 | 140 |
| Total Suspended Solids | 0.5 | mg/L | 133 | 104 | 117 |
| Volatile Suspended Solids | 0.3 | mg/L | 121 | 94 | 104 |
| Total Oil & Grease | 5 | mg/L | - | 12.3 | - |
| Aluminum | 10 | ug/L | - | 510 | - |
| Antimony | 2 | ug/L | - | nd | - |
| Arsenic | 2 | ug/L | - | nd | - |
| Barium | 5 | ug/L | - | 20 | - |
| Beryllium | 5 | ug/L | - | nd | - |
| Boron | 5 | ug/L | - | 49 | - |
| Cadmium | 0.3 | ug/L | - | 0.4 | - |
| Chromium | 2 | ug/L | - | 3 | - |
| Cobalt | 1 | ug/L | - | nd | - |
| Copper | 2 | ug/L | - | 42 | - |
| Iron | 20 | ug/L | - | 600 | - |
| Lead | 0.5 | ug/L | - | 2.5 | - |
| Manganese | 2 | ug/L | - | 95 | - |
| Molybdenum | 2 | ug/L | - | nd | - |
| Nickel | 2 | ug/L | - | 3 | - |
| Selenium | 2 | ug/L | - | nd (2) | - |
| Silver | 0.5 | ug/L | - | 7.5 | - |
| Strontium | 5 | ug/L | - | 44 | - |
| Thallium | 0.1 | ug/L | - | nd | - |
| Tin | 2 | ug/L | - | nd | - |
| Uranium | 0.1 | ug/L | - | 0.1 | - |
| Vanadium | 2 | ug/L | - | nd | - |
| Zinc | 2 | ug/L | - | 67 | - |
| Mercury | 0.05 | ug/L | - | 0.08 | - |

EQL = Estimated Quantitation Limit for Routine Analysis
nd = not detected above standard EQL
nd () = not detected at the elevated EQL specified due to matirx interference or sample pre-dilution
- = Parameter not requested in sample

**Table 5-16: Analytical Results - Dartmouth Cove**

| Parameter | EQL | Units | Dart. Cove-01<br>June 28 - June 29<br>9:30am - 9:30am | Dart. Cove-02<br>June 29 - June 30<br>9:30am - 9:30am | Dart. Cove-03<br>June 30 - July 01<br>9:30am - 9:30am |
|---|---|---|---|---|---|
| pH | 0.1 | Units | 6.7 | 6.8 | 6.7 |
| Carbonaceous BOD | 2 | mg/L | 110 | 130 | 130 |
| Total Suspended Solids | 0.5 | mg/L | 114 | 135 | 95 |
| Volatile Suspended Solids | 0.3 | mg/L | 95 | 117 | 78 |
| Total Oil & Grease | 5 | mg/L | - | - | 16.9 |
| Aluminum | 10 | ug/L | - | - | 870 |
| Antimony | 2 | ug/L | - | - | nd (20) |
| Arsenic | 2 | ug/L | - | - | nd (20) |
| Barium | 5 | ug/L | - | - | nd (50) |
| Beryllium | 5 | ug/L | - | - | nd (50) |
| Boron | 5 | ug/L | - | - | 71 |
| Cadmium | 0.3 | ug/L | - | - | nd (1) |
| Chromium | 2 | ug/L | - | - | nd (20) |
| Cobalt | 1 | ug/L | - | - | nd (10) |
| Copper | 2 | ug/L | - | - | 53 |
| Iron | 20 | ug/L | - | - | 1100 |
| Lead | 0.5 | ug/L | - | - | 5 |
| Manganese | 2 | ug/L | - | - | 260 |
| Molybdenum | 2 | ug/L | - | - | nd (20) |
| Nickel | 2 | ug/L | - | - | nd (20) |
| Selenium | 2 | ug/L | - | - | nd (10) |
| Silver | 0.5 | ug/L | - | - | nd (5) |
| Strontium | 5 | ug/L | - | - | 66 |
| Thallium | 0.1 | ug/L | - | - | nd (1) |
| Tin | 2 | ug/L | - | - | nd (20) |
| Uranium | 0.1 | ug/L | - | - | nd (1) |
| Vanadium | 2 | ug/L | - | - | nd (20) |
| Zinc | 2 | ug/L | - | - | 100 |
| Mercury | 0.05 | ug/L | - | - | 0.19 |

EQL = Estimated Quantitation Limit for Routine Analysis
nd = not detected above standard EQL
nd () = not detected at the elevated EQL specified due to matirx interference or sample pre-dilution
- = Parameter not requested in sample

# APPENDIX E

# NSDOE COMPOSTING FACILITY GUIDELINES (MARCH 1998)

# NOVA SCOTIA DEPARTMENT OF THE ENVIRONMENT
# COMPOSTING FACILITY GUIDELINES

# NOVA SCOTIA DEPARTMENT OF THE ENVIRONMENT COMPOSTING FACILITY GUIDELINES

## 1.0 GENERAL

## 1.1 Purpose

(a) The purpose of these guidelines is to provide for the proper environmental management of composting facilities.

(b) These guidelines also provide guidance as to the requirements to obtain an approval to construct and operate a composting facility.

(c) Refer to Schedule "A" for the definition of terms used in these guidelines.

(d) Final assessment of applications for the construction and operation of a composting facility will be made on a case by case basis.

(e) For further information respecting these guidelines, contact the Regional/District office of the Nova Scotia Department of the Environment where the site is located.

## 1.2 Applicable Documentation

These guidelines should be used in conjunction with the following:

(i) *Solid Waste Resource Management Strategy (1995)*;
(ii) *Environment Act*, S.N.S. 1994-95, c.1, Part X;
(iii) *Solid Waste-Resource Management Regulations* ;
(iv) *Activities Designation Regulations*; and
(v) *Approvals Procedure Regulations.*

## 1.3 Applicability

(a) These guidelines apply to all composting facilities requiring approval under Section 27 of the *Solid Waste-Resource Management Regulations*, which states, "No person shall construct, operate, expand or modify a facility which can process more than 60 cubic metres annually of finished compost without obtaining approval from the Minister".

(b) These guidelines do not apply to:

(i) backyard composting; and
(ii) generally accepted farming activities.

## 2.0 APPLICATION FOR APPROVALS

### 2.1 Application

(a) Prior to construction of a composting facility, an approval must be granted by the Department pursuant to Section 27 of the Nova Scotia *Solid Waste-Resource Management Regulations.*

(b) Applications for approval to construct, operate, expand or modify a composting facility must be accompanied by a letter from the municipal unit where the facility is to be located stating that the facility meets zoning, planning restrictions and such other by-laws as may exist.

(c) Unless specifically exempted by the administrator, the applicant is to provide all information necessary to satisfy the requirements of each of the following sections.

## 3.0 LEAF AND YARD WASTE COMPOSTING FACILITIES UNDER 10 000 TONNES

### 3.1 General

Section 3 of the guidelines applies to composting facilities which process only leaf and yard waste and utilize up to a maximum of 10 000 tonnes annually of feedstock.

### 3.2 Facility Design and Construction

(a) The composting facility shall incorporate the following requirements:

- (i) systems shall be designed to minimize odour generation;
- (ii) measures shall be taken to control/treat leachate and storm runoff and prevent groundwater contamination;
- (iii) a groundwater and surface water monitoring plan shall be approved by the Department; and,
- (iv) by-products, including residuals, must be removed from the site in a timely manner and disposed of in a manner acceptable to the Department. The storage of these by-products shall not result in any vector, odour or litter problems.

(b) The composting facility shall have the following separation distances:

- (i) the distance between the active area and the nearest foundation of an off-site structure used for commercial, industrial, residential of institutional purposes shall be a minimum of 100 metres;

(ii) the distance between the active area and the nearest property boundary shall be a minimum of 30 metres;

(iii) the distance between the active area and the nearest watercourse or water body, including salt water, shall be a minimum of 30 metres;

(iv) under certain circumstances, separation distances may be increased or decreased after consultation with the Department depending on factors such as environmental controls and local conditions; and,

(v) a separation distance may be decreased by the Department pursuant to clause (iv) provided that written consent is obtained by the applicant from all the property owners within the affected area.

## 4.0 IN-VESSEL COMPOSTING FACILITIES

### 4.1 General

Section 4 of the guidelines applies to all in-vessel composting facilities.

### 4.2 Receiving and Tipping Area

(a) The receiving and tipping area shall be underlain by an impermeable pad, the surface of which shall be concrete or asphalt. All drainage from the impermeable pad shall be collected for treatment or for return to the process.

(b) The receiving and tipping area shall be in an enclosed structure.

### 4.3 Composting Area

(a) The composting area shall be designed to fully contain the compostable organic material and all leachate which may be generated.

(b) The containment system shall be impermeable, the surface of which shall be constructed of concrete, asphalt, steel or other material as approved by the Department.

(c) All drainage from the composting area shall be collected for treatment or for return to the process.

### 4.4 Curing Area

(a) The curing area shall be underlain by an impermeable pad, the surface of which shall be concrete or asphalt.

(b) All drainage from the impermeable pad shall be collected for treatment or for return to the process.

(c) All curing areas shall utilize permanent roof structures and/or proven management techniques to control moisture and minimize odour and leachate generation.

### 4.5 Leachate Management Systems

(a) A leachate management system shall be developed which consists of infrastructure and monitoring systems designed to collect, monitor, control, and treat leachate prior to being discharged into the surrounding environment. The system shall:

(i) have a leachate collection and removal network in the active area;
(ii) function year round; and,
(iii) have a means of monitoring all treated leachate discharges.

(b) The discharge standards for all liquid effluent shall be based on the background water quality in the receiving water, identified current and projected uses of the receiving water and the Canadian Water Quality Guidelines (CRREM 1987 as amended from time to time) for protection of these defined water uses. Additionally, liquid effluent shall not be acutely lethal as determined by the suite of Biological Test Methods developed by Environment Canada for this purpose.

### 4.6 Surface Water Management

(a) The applicant shall submit for approval from the Department a surface water monitoring program. The extent of surface water monitoring requirements will be based on the design of the facility.

(b) The surface water monitoring program shall be designed to do the following:

(i) divert surface and storm water from the active areas;
(ii) control run-off discharge from the facility;
(iii) control erosion, sedimentation, siltation, and flooding; and
(iv) minimize the generation of leachate.

(See Appendix 1 for an example of a typical surface water monitoring program)

### 4.7 Groundwater Management

(a) The applicant shall submit for approval from the Department a groundwater monitoring program. The extent of groundwater monitoring requirements will be based on the design of the facility. Should any of the active area not be protected from precipitation with permanently constructed roof structures, then the groundwater monitoring program shall consist of the following minimum requirements:

(i) at least one groundwater monitoring well shall be installed hydraulically above the gradient of the active area and at least three monitoring wells shall be installed hydraulically below the gradient direction;
(ii) the monitoring well system shall include a sufficient number of multi-level well nests for measurement of vertical gradients;
(iii) locations of the monitoring well(s) shall be sufficiently close to the active area to allow early detection of contamination and implementation of remedial measures; and
(iv) the monitoring well(s) are to be retained throughout the lifespan of the facility.

(See Appendix 1 for an example of a typical groundwater monitoring program)

## 4.8 Odour Control Systems

(a) Mechanical ventilation shall be provided for the composting area, areas for the storage of compostable organic feedstock and any other area containing readily putrescible materials such as the storage room for residuals.

(b) All areas referred to in clause (a) shall be under a negative atmospheric pressure in order to avoid the escape of odours.

(c) All ventilation air shall be subject to a treatment system designed to remove odours prior to release into the environment.

## 4.9 Separation Distances

(a) The distance between the active area and the nearest residential or institutional building shall be a minimum of 500 metres.

(b) The distance between the active area and the nearest commercial or industrial building shall be a minimum of 250 metres.

(c) The distance between the active area and the nearest property boundary shall be a minimum of 100 metres.

(d) Where it can be demonstrated that particular equipment will not release odours generated from the composting process into the surrounding environment, the distance between the equipment and the nearest property boundary shall be a minimum of 30 metres.

(e) The distance between the active area and the nearest watercourse or water body, including salt water, shall be a minimum of 30 metres.

(f) Under certain circumstances, separation distances may be increased or decreased after consultation with the Department. These will depend on factors such as environmental controls (including odour control) and local conditions.

(g) A separation distance may be decreased by the Department pursuant to clause (f) provided that written consent is obtained by the applicant from all property owners within the required separation distances.

## 5.0 OPEN WINDROW COMPOSTING FACILITIES

### 5.1 General

Section 5 of the guidelines applies to all open windrow composting facilities except leaf and yard waste composting facilities covered under section 3.0.

### 5.2 Receiving and Tipping Area

(a) The receiving and tipping area shall be underlain by an impermeable pad, the suface of which shall be concrete or asphalt. All drainage from the impermeable pad shall be collected for treatment or for return to the process.

(b) The receiving and tipping area shall be in an enclosed structure.

### 5.3 Composting Area

(a) The composting area shall be underlain by an impermeable pad, the surface of which shall be concrete or asphalt. All drainage from the impermeable pad shall be collected for treatment or for return to the process.

(b) All composting areas shall utilize permanent roof structures and/or proven management techniques in order to control moisture and to minimize odour and leachate generation.

### 5.4 Curing Area

(a) The curing area shall be underlain by an impermeable pad, the surface of which shall be concrete or asphalt.

(b) All drainage from the impermeable pad shall be collected for treatment or for return to the process.

(c) All curing areas shall utilize permanent roof structures and/or proven management techniques to control moisture and to minimize odour and leachate generation.

### 5.5 Leachate Management Systems

(a) A leachate management system shall be developed which consists of infrastructure and monitoring systems designed to collect, monitor, control, and treat leachate prior to being discharged into the surrounding environment. The system shall:

(i) have a leachate collection and removal network in the active area;
(ii) function year round;
(iii) have a means of monitoring all treated leachate discharges; and
(iv) the system must record both instantaneous and total flow volumes.

(b) The discharge standards for all liquid effluent shall be based on the background water quality in the receiving water, identified current and projected uses of the receiving water and the Canadian Water Quality Guidelines (CRREM 1987 as amended from time to time) for protection of these defined water uses. Additionally, liquid effluent shall not be acutely lethal as determined by the suite of Biological Test Methods developed by Environment Canada for this purpose.

### 5.6 Surface Water Management

Surface water management systems shall be designed to do the following:

(a) divert surface and storm water from the active areas;
(b) control run-off discharge from the facility;
(c) control erosion, sedimentation, siltation, and flooding; and
(d) minimize the generation of leachate.

(See Appendix 1 for an example of a typical surface water monitoring program)

### 5.7 Groundwater Management

(a) To ensure that groundwater is adequately protected, each facility shall include a groundwater monitoring program.

(b) The groundwater monitoring program shall consist of the following:

(i) at least one groundwater monitoring well shall be installed hydraulically above the gradient of the active area and at least three monitoring wells shall be installed hydraulically below the gradient direction;

(ii) the monitoring well system shall include a sufficient number of multi-level well nests for measurement of vertical gradients;

(iii) locations of the monitoring wells shall be sufficiently close to the active area to allow early detection of contamination and implementation of remedial measures; and,

(iv) the monitoring wells are to be retained throughout the lifespan of the facility.

(See Appendix 1 for an example of a typical groundwater monitoring program)

## 5.8 Odour Control

(a) Facilities shall provide to the Department detailed management techniques for the control of odours from the composting process.

(b) All open windrow facilities which include more than 1000 tonnes annually of food waste in their feedstock or exceed 10 000 tonnes annually of total feedstock, shall provide atmospheric dispersion modelling to determine the potential for odour at the property boundary and other receptors near the facility.

(c) The modelling shall categorize the compounds which could result in odour and shall establish odour concentrations at the property boundaries and other receptors. These baseline odour concentrations shall meet the satisfaction of the Department and shall be used in testing for odours after the facility is in operation.

## 5.9 Separation Distances

(a) The distance between the active area and the nearest structure, including residential, institutional, commercial or industrial buildings, shall be a minimum of 500 metres. Where the facility includes more than 1000 tonnes annually of food waste in its feedstock, or exceeds 10 000 tonnes annually of total feedstock, then the minimum separation distance shall be a minimum of 1000 metres.

(b) The distance between the active area and the nearest property boundary shall be a minimum of 100 metres.

(c) The distance between the active area and the nearest watercourse or water body, including salt water, shall be a minimum of 30 metres.

(d) Under certain circumstances, separation distances may be increased or decreased after consultation with the Department. These will depend on factors such as environmental controls (including odour control) and local conditions.

(e) A separation distance may be decreased by the Department pursuant to clause (d) provided that written consent is obtained by the applicant from all property owners within the affected area.

## 6.0 COMPOSTING FACILITY OPERATION

### 6.1 General Requirements

(a) Section 6 of the guidelines applies to all composting facilities regardless of the size and type of feedstock processed.

(b) The objective of all composting facilities shall be to incorporate all compostable organic feedstock into the composting process the same day that it is delivered to the site. If some feedstock is not incorporated into the process in the same day, except leaf and yard waste feedstocks only, then it shall be stored in an enclosed area with a mechanical system for the capture and treatment of odorous emissions.

(c) The composting facility shall have constant supervision during the hours that the facility is open.

(d) The composting facility shall accept only the feedstock identified in the approval.

(e) Any residual products associated with the composting operation shall be disposed of in a manner acceptable to the Department.

(f) Litter shall be controlled on the entire site.

(g) Exposed areas shall be stabilized to prevent erosion and sedimentation.

(h) Dust shall be controlled to Departmental requirements for particulate emissions.

(I) Vectors shall be controlled in accordance with a control plan approved by the Department.

(j) Signs shall be placed at the entrance to the site indicating the name of the facility, hours of operation, emergency contact, and the materials acceptable at the site.

### 6.2 Operation and Maintenance Manual

(a) An Operation and Maintenance Manual shall be submitted for approval from the Department and shall include the following:

(i) record drawings and specifications for the composting facility;
(ii) a copy of the approval including Terms and Conditions of the approval for the composting facility;
(iii) a complete description of the operational practices and procedures;
(iv) measures to control and monitor the aeration of the compost to ensure that the oxygen content in the compost material is sufficient to prevent the composting mass from becoming anaerobic;
(v) measures to control the aeration, blending and mixing of the compost to minimize odorous emissions from the composting operation as well as raw material and compost storage;
(vii) monitoring programs including sampling protocols, locations and frequency for monitoring wells, leachate treatment and storm water management systems; and
(viii) contingency plans.

(b) The Operation and Maintenance Manual shall be left on site at all times and shall be available for inspection during operating hours.

### 6.3 Contingency Plans

(a) Contingency plans shall identify all reasonably foreseeable emergencies including a fire, explosion, leachate leakage or spills and shall describe appropriate response to prevent an adverse affect on the surrounding environment.

(b) The applicant shall provide contingency plans addressing problems associated with vectors, groundwater contamination, equipment failure, and odour generation and complaints.

### 6.4 Reports and Records

(a) The type and frequency of monitoring and reporting requirements shall be specified in the terms and conditions of the approval.

(b) The applicant shall submit for approval from the Department an annual report which shall include the following information:

(i) liquid effluent (leachate) monitoring both pre-treatment and post-treatment including:
  (a) flow volumes; and
  (b) leachate quality;
(ii) surface water monitoring and groundwater monitoring quality data;
(iii) feedstock flow including:
  (a) types of materials accepted at the composting facility for the period;
  (b) quantities of materials accepted at the composting facility for the period;
  (c) quantities of materials composted; and
  (d) quantities of materials rejected and sent for disposal;
(iv) compost quality testing results; and,
(v) complaint records.

(c) The applicant shall record and respond to complaints regarding the composting operation from the neighbouring public. Each complaint and associated measures shall be recorded in a log book including:

(i) a description of the complaint and the date and time it was received by the applicant;
(ii) wind direction, wind speed, temperature, humidity and other atmospheric conditions at the time of the occurance which resulted in a complaint; and,
(iii) a description of the measures taken to address the cause of the complaint.

## 7.0 COMPOST CLASSIFICATION AND USE

### 7.1 Compost Classification

(a) All compost will be classified in accordance with the criteria identified in the Canadian Council of Ministers of the Environment (CCME) document "Guidelines for Compost Quality" dated March 1996 as amended from time to time. The compost must meet all criteria as established for foreign matter, maturity, pathogens and trace elements. See Schedule “B” for table of trace elements.

(b) Testing of the compost quality shall be completed for every 1000 tonnes of compost produced or every three months and conducted in accordance with the minimum testing procedures identified in Section 4 of the CCME Guidelines.

(c) Compost which meets the criteria established in the CCME Guidelines as Category B shall be classified in accordance with metal concentrations, product maturity, amount of foreign matter, organic matter content, pH and salinity.

(d) Compost which is tested and classified as a hazardous or special waste shall be handled and treated in accordance with the requirements of the *Act.*

### 7.2 Compost Use

(a) Compost which meets the criteria established in the CCME Guidelines as Category A may be used in accordance with the uses stated in the CCME Guidelines for Category A.

(b) Use of compost which meets the criteria established in the CCME Guidelines as Category B will be related to the sensitivity of the proposed receiving environment, the various feedstock used to produce the compost and the quality of the final product. Approval for the use of this compost shall include use on forest lands, landfills, highway medians and land reclamation projects such as quarries and disposal site restorations. This compost cannot be used on food crops.

## 8.0 REPEAL OF DOCUMENT

This document replaces the document entitled *Composting Guidelines* issued December, 1993.

Dated at Halifax, Nova Scotia, this __________ day of __________________________, 1998.

______________________________
Peter C. Underwood
Deputy Minister
Department of the Environment

**Schedule "A"**

**Definitions:**

(a) "*Act*" means the *Environment Act*, S.N.S. 1994-95, c.1;

(b) "active area" means any area used for transfer, storage, disposal, separation, processing or treatment of compostable material including the tipping area, the composting area and the curing pad;

(c) "administrator" means a person appointed by the Minister pursuant to Section 21 of the *Act*;

(d) "approval" means an approval pursuant to Section 27 of the *Solid Waste-Resource Management Regulations*;

(e) "backyard composting" means composting at a residential dwelling unit of organic solid waste, including grass clippings, leaves or food waste, where

  (i) the waste is generated by the residents of the dwelling unit or neighbouring dwelling units or both; and,
  (ii) the annual production of compost does not exceed 60 cubic metres;

(f) "biosolids" means organic materials which originated as settled matter in facilities treating municipal or industrial liquid wastes and may be used as feedstock for composting operations;

(g) "compost" means a product of composting which is used or sold for use as a soil amendment, artificial topsoil or growing medium or for some other application to land;

(h) "composting" means the biological decomposition of organic materials, substances or objects under controlled circumstances to a condition sufficiently stable for nuisance-free storage and for safe use in land applications;

(i) "composting area" means an area where organic material undergoes the rapid initial stage of composting;

(j) "composting facility" means a solid waste-resource management facility where composting occurs;

(k) "compostable organic material" means vegetative matter, food processing waste, landscaping, garden and horticultural wastes, kitchen scraps, feed processing wastes, and other organic wastes which can be readily composted in composting facilities;

(l) "curing area" means an area where organic material that has undergone the rapid initial stage of composting is further stabilized into a mature finished compost;

(m) “Department” means the Nova Scotia Department of the Environment;

(n) “food waste” means any residual vegetative waste other than leaf and yard materials or woody materials and residual waste of animal origin including meat, fish, bones, carcasses or shells other than manure or biosolids from residential, industrial, commercial or institutional sources;

(o) "foreign matter" means any matter resulting from human intervention and made of organic or inorganic components including metal, glass, synthetic polymers (e.g., plastic and rubber) that may be present in compost but foreign matter does not include mineral soils, woody material, and rocks;

(p) "in-vessel composting" means any composting method in which composting materials are contained in an enclosed reactor, vessel or building and which utilizes forced ventilation with treatment of ventilation air for odour reduction;

(q) "leaf and yard waste" means vegetative matter resulting from gardening, horticulture, landscaping or land clearing operation, including materials such as tree and shrub trimmings, plant remains, grass clippings, leaves, trees and stumps, but excludes construction and demolition debris or contaminated organic matter;

(r) "open windrow composting" means composting in which compostable organic material is open to the atmosphere during the composting process and includes windrow composting in a building but where there is no treatment of ventilation air for odour reduction;

(s) "vector" means a carrier organism that is capable of transmitting a pathogen from one facility or waste source to another source, facility, product or organism including rodents, insects and birds.

**Schedule “B”**

**Concentrations of trace elements in compost*:**

| | **CATEGORY A** | **CATEGORY B** |
|---|---|---|
| **Trace Elements** | **Maximum Concentration within Product (mg/kg dry weight)** | **Maximum Concentration within Product (mg/kg dry weight)** |
| Arsenic (As) | 13 | 75 |
| Cadmium (Cd) | 3 | 20 |
| Cobalt (Co) | 34 | 150 |
| Chromium (Cr) | 210 | 1060** |
| Copper (Cu) | 100 | 760** |
| Mercury (Hg) | 0.8 | 5 |
| Molybdenum (Mo) | 5 | 20 |
| Nickel (Ni) | 62 | 180 |
| Lead (Pb) | 150 | 500 |
| Selenium (Se) | 2 | 14 |
| Zinc (Zn) | 500 | 1850 |

* See CCME Guideline for maximum cumulative additions to soil.

** See CCME Guideline for further description of these values.

# APPENDIX 1

## TYPICAL SURFACE AND GROUNDWATER MONITORING PROGRAM

### 1.0 SITE ASSESSMENT AND DESIGN

### 1.1 Hydrogeologic Assessment

Prior to the establishment or expansion of a site, a report shall be prepared by the owner containing plans, specifications, and descriptions of the hydrogeologic conditions of the site, adjacent and nearby properties, and the regional area in which the site is located, including, at a minimum, the following;

.1 a general description of geologic and hydrogeologic conditions occurring at the site, and adjacent and other properties within 1000 m of the site. This description should identify any unstable soils or bedrock, indicate the location and nature of any boundaries to groundwater movement, and characterize the significance of groundwater resources and the use made of these resources;

.2 a detailed hydrogeologic investigation of the site which establishes soil, rock, and groundwater conditions;

.3 an interpretation of the results of the detailed hydrogeologic investigation of the site, including plans, specifications, and descriptions; and

.4 an assessment of the suitability of the site considering the regional, local, and site specific hydrogeologic conditions, the design of the site, and the contingency plans for the control of leachate.

### 1.2 Surface Water Assessment

Prior to the establishment or expansion of a site, a report shall be prepared by the owner containing plans, specifications, and descriptions of the surface water conditions of the site, adjacent and nearby properties, and the regional area in which the site is located, including, at a minimum, the following:

.1 a description of the local surface water features occurring at the site, and adjacent and other properties within 1000 m of the site. This description shall include, but not be limited to, flood plains, natural watercourses, waterbodies (including salt water) drainage paths and boundaries, streamflows, surface water quality, and sources of water supply. The description shall also extend further than 1000 m to be sufficiently large to assess the range and extent of potential effects;

.2 a detailed surface water investigation of the site to assess water quality, quantity, and habitat conditions of the surface water features identified on site, including existing and potential surface water uses;

.3 an interpretation of the results of the detailed surface water investigation of the site, including plans, specifications, and descriptions; and

.4 an assessment of the suitability of the site considering the regional, local, and site specific surface water conditions, the design of the site, and the contingency plan for the control of leachate.

## 2.0 OPERATION AND MONITORING

### 2.1 Groundwater Monitoring

A program for monitoring groundwater quality and quantity shall be carried out by the owner and shall include, at a minimum, the following:

.1 Representative samples of groundwater within the site shall be:

a) obtained annually from groundwater monitoring facilities and be analyzed for the parameters listed in column 1 of Schedule 1; and

b) obtained quarterly from groundwater monitoring facilities and be analyzed for the parameters listed in column 2 of Schedule 1.

.2 Where requested by property owners or occupants, representative samples of groundwater shall be obtained from domestic wells located within 500 m of the site at a frequency of 1 sample per well per year and these groundwater samples shall be analyzed for the parameters listed in column 2 of Schedule 1.

.3 The results of analysis of a water sample collected under Subsection 2.1.2 shall be provided to the Department and the owner or occupant of the property with the domestic well from which the sample was obtained, within 60 days of obtaining the sample.

.4 The results of analysis of all water samples collected in the groundwater monitoring program, together with an assessment of these results shall be provided to the Department in an annual report, and where the assessment indicates a significant increase in contaminant concentrations, within 60 days of obtaining the sample and 5 days of making the assessment.

.5 The parameters to be monitored may be amended where the owner prepares a report showing alternative parameters should be monitored, based on the type of process at the site.

## 2.2 Surface Water Monitoring

A program for monitoring surface water quality, quantity, and biological features shall be carried out by the owner and shall include, at a minimum, the following:

.1 Representative samples of surface water being discharged from the site and of any waterbody, including upstream control locations, which may be affected by leachate, stormwater runoff, or sediment from the site , shall be:

a) obtained semi-annually, and be analyzed for the parameters listed in column 3 of Schedule 1 and for other parameters of concern identified in the surface water assessment; and

b) obtained quarterly and be analyzed for the parameters listed in column 4 of Schedule 1.

.2 Annual monitoring of biological features to assess the composition and any changes to the benthic community present in any waterbody, located downstream of storm water discharges, that may be affected by leachate, stormwater runoff, or sediment from the site.

.3 The results and assessment of the results of the surface water monitoring shall be provided to the Department in an annual report, and where the assessment indicates an increase in contaminant concentrations exceeding the natural variability exhibited by baseline and operational monitoring data, within 60 days of obtaining the sample and 5 days of making the assessment.

.4 The parameters to be monitored may be amended where the owner prepares a report showing alternative parameters should be monitored, based on the type of process at the site.

Schedule 1
Groundwater, Leachate and Surface Water Monitoring Parameters

| | Parameter | | | |
|---|---|---|---|---|
| Parameter Group | Column 1 | Column 2 | Column 3 | Column 4 |
| | Comprehensive List for Groundwater and Leachate | Indicator List for Groundwater and Leachate | Comprehensive List for Surface Water | Indicator List for Surface Water |
| | Alkalinity | Alkalinity | Alkalinity | Alkalinity |
| | Ammonia | | Ammonia | Ammonia |
| | Arsenic | | Arsenic | |
| | Barium | | Barium | |
| | Boron | | Boron | |
| | Cadmium | Cadmium | Cadmium | |
| | Calcium | Calcium | | |
| | Chloride | Chloride | Chloride | Chloride |
| | Chromium | | Chromium | |
| | Conductivity | Conductivity | Conductivity | Conductivity |
| | Copper | | Copper | |
| | Iron | Iron | Iron | |
| | Lead | Lead | Lead | |
| | Magnesium | Magnesium | | |
| | Manganese | | | |
| | Mercury | | Mercury | |
| | Nitrate | Nitrate | Nitrate | Nitrate |

| Parameter Group | Parameter | | | |
|---|---|---|---|---|
| | Column 1 | Column 2 | Column 3 | Column 4 |
| | Comprehensive List for Groundwater and Leachate | Indicator List for Groundwater and Leachate | Comprehensive List for Surface Water | Indicator List for Surface Water |
| | Nitrite | | Nitrite | Nitrite |
| | Total Kjeldahl Nitrogen | | Total Kjeldahl Nitrogen | Total Kjeldahl Nitrogen |
| | pH | pH | pH | pH |
| | Total Phosphorus | | Total Phosphorus | Total Phosphorus |
| | Potassium | Potassium | | |
| | Sodium | Sodium | | |
| | Suspended Solids | Suspended Solids | Suspended Solids | Suspended Solids |
| | Total Dissolved Solids | Total Dissolved Solids | Total Dissolved Solids | Total Dissolved Solids |
| | Sulphate | Sulphate | Sulphate | Sulphate |
| | Zinc | | Zinc | |
| Volatile Organics | | | | |
| | Benzene | | Benzene | |
| | 1, 4 Dichlorobenzene | | 1, 4 Dichlorobenzene | |
| | Dichloromethane | | Dichloromethane | |
| | Toluene | | Toluene | |
| | Vinyl Chloride | | | |

| Parameter Group | Parameter | | | |
|---|---|---|---|---|
| | Column 1 | Column 2 | Column 3 | Column 4 |
| | Comprehensive List for Groundwater and Leachate | Indicator List for Groundwater and Leachate | Comprehensive List for Surface Water | Indicator List for Surface Water |
| Other Organics | | | | |
| | | | Biochemical Oxygen Demand ($BOD_5$) | Biochemical Oxygen Demand ($BOD_5$) |
| | Chemical Oxygen Demand | Chemical Oxygen Demand | Chemical Oxygen Demand | Chemical Oxygen Demand |
| | Dissolved Organic Carbon | Dissolved Organic Carbon | Total Organic Carbon | |
| | Phenol | | Phenol | Phenol |
| | | | Tannins/Lignins | |
| Field Parameters | | | | |
| | | | Temperature | Temperature |
| | pH | pH | pH | pH |
| | Conductivity | Conductivity | Conductivity | Conductivity |
| | | | Dissolved Oxygen | Dissolved Oxygen |
| | | | Flow | Flow |

# APPENDIX F

# MARINE BENTHIC HABITAT AND SEDIMENT CHARACTERIZATION DATA

| Table F.1 Marine Sediment Chemistry at Karlsen Wharf/Casino Area (Halifax) | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **Units** | **EQL** | **HN1** | **HN2** | **HN3** | **Ocean Disposal Guidelines** |
| Cadmium | mg/kg | 0.3 | **4.7** | **0.6** | **0.6** | 0.6 |
| Copper | mg/kg | 2.0 | **290** | **87** | **81** | 81 |
| Lead | mg/kg | 0.5 | **1000** | **310** | **280** | 66 |
| Zinc | mg/kg | 2.0 | **1100** | **260** | **210** | 160 |
| Mercury | mg/kg | 0.01 | **5.3** | **0.91** | **1.5** | 0.75 |
| Total Organic Carbon | g/kg | 0.1 | 112.0 | 20.6 | 49.3 | |
| Total Inorganic Carbon | g/kg | 0.1 | 26.6 | 5.4 | 13.1 | |
| gravel | % | 0.1 | nd | nd | nd | |
| sand | % | 0.1 | 27.7 | 6.8 | 25.0 | |
| silt | % | 0.1 | 45.6 | 68.3 | 47.9 | |
| clay | % | 0.1 | 26.8 | 24.9 | 27.0 | |
| Benzene | mg/kg | 0.025 | nd | nd | 0.255 | |
| Toluene | mg/kg | 0.025 | nd | nd | 0.634 | |
| Ethylbenzene | mg/kg | 0.025 | nd | nd | 0.168 | |
| Xylenes | mg/kg | 0.05 | nd | nd | 1.39 | |
| Total Petroleum Hydrocarbons | mg/kg | 32.5 | **8230** | **1290** | nd | 10.0 |
| Total PAHs | mg/kg | 0.05 | **270.1** | **81.65** | **1044.3** | 2.5 |
| PCBs | µg/kg | 10.0 | **3870** | 98 | nd | 100 |
| DDE | µg/kg | 10.0 | 77.4 | nd | nd | 100 |
| DDT | µg/kg | 10.0 | nd | nd | nd | 100 |
| DDD | µg/kg | 10.0 | nd | nd | nd | 100 |

* PCB is Aroclor 1260; TPH is lube oil fraction
Bolded text shows exceedances of the Interim Contaminant Testing Guidelines for Ocean Disposal

| **Table F.2 Marine Sediment Chemistry at Woodside (Dartmouth)** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Units** | **EQL** | **D1** | **D2** | **D3** | **D4** | **Ocean Disposal Guidelines** |
| Cadmium | mg/kg | 0.3 | 0.5 | 0.3 | **0.7** | 0.4 | 0.6 |
| Copper | mg/kg | 2.0 | 72 | 19 | 68 | 58 | 81 |
| Lead | mg/kg | 0.5 | **140** | 16 | **160** | **150** | 66 |
| Zinc | mg/kg | 2.0 | 150 | 59 | **180** | **160** | 160 |
| Mercury | mg/kg | 0.01 | 1.1 | 0.04 | **0.97** | **0.85** | 0.75 |
| Total Organic Carbon | g/kg | 0.1 | 47 | 31.3 | 45.5 | 26.9 | |
| Total Inorganic Carbon | g/kg | 0.1 | 13 | 2.4 | 6.0 | 0.2 | |
| gravel | % | 0.1 | nd | 60.5 | nd | nd | |
| sand | % | 0.1 | 23.5 | 17.6 | 8.3 | 6.3 | |
| silt | % | 0.1 | 50.2 | 15.3 | 61.6 | 61.5 | |
| clay | % | 0.1 | 26.3 | 6.6 | 30.1 | 32.2 | |
| Benzene | mg/kg | 0.025 | nd | nd | nd | nd | |
| Toluene | mg/kg | 0.025 | nd | nd | nd | nd | |
| Ethylbenzene | mg/kg | 0.025 | nd | nd | nd | nd | |
| Xylenes | mg/kg | 0.05 | nd | nd | nd | nd | |
| Total Petroleum Hydrocarbons | mg/kg | 32.5 | **2120** | **1830** | **2440** | **1950** | 10.0 |
| Total PAHs | mg/kg | 0.05 | **17.19** | **18.82** | **14.2** | **9.19** | 2.5 |
| PCBs | µg/kg | 10.0 | **143** | **63.3** | **95.3** | **164** | 100 |
| DDE | µg/kg | 10.0 | nd | nd | nd | nd | 100 |
| DDT | µg/kg | 10.0 | nd | nd | nd | nd | 100 |
| DDD | µg/kg | 10.0 | nd | nd | nd | nd | 100 |

* PCB is Aroclor 1260; TPH is lube oil fraction
Bolded text shows exceedances of the Interim Contaminant Testing Guidelines for Ocean Disposal

| Table F.3 Sediment Chemistry at Hospital Point (Herring Cove) | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | Units | EQL | Diffuser Area | 100 m North | 100 m South | Ocean Disposal Limits |
| Cadmium | mg/kg | 0.3 | nd | nd | nd | 0.6 |
| Copper | mg/kg | 2.0 | 11 | 11 | 14 | 81.0 |
| Zinc | mg/kg | 2.0 | 46 | 42 | 49 | 160.0 |
| Lead | mg/kg | 0.5 | 19 | 17 | 19 | 66.0 |
| Mercury | mg/kg | 0.01 | 0.04 | 0.03 | 0.04 | 0.75 |
| Total Organic Carbon | g/kg | 0.1 | 5.6 | 6.7 | 7.9 | |
| Total Inorganic Carbon | g/kg | 0.1 | 6.5 | 5.5 | 5.0 | |
| gravel | % | 0.1 | nd | nd | nd | |
| sand | % | 0.1 | 54.6 | 46.5 | 26.3 | |
| silt | % | 0.1 | 36.5 | 44.3 | 62.5 | |
| clay | % | 0.1 | 8.9 | 9.2 | 11.3 | |
| Benzene | mg/kg | 0.025 | nd | nd | nd | |
| Toluene | mg/kg | 0.025 | nd | nd | nd | |
| Ethylbenzene | mg/kg | 0.025 | nd | nd | nd | |
| Xylenes | mg/kg | 0.05 | nd | nd | nd | |
| Total Petroleum Hydrocarbons | mg/kg | 32.5 | **66.3** | **42.2** | **62.3** | 10.0 |
| Total PAHs | mg/kg | 0.05 | nd | nd | 0.65 | 2.5 |
| PCBs | µg/kg | 10.0 | nd | nd | nd | 100 |
| DDE | µg/kg | 10.0 | nd | nd | nd | 100 |
| DDT | µg/kg | 10.0 | nd | nd | nd | 100 |
| DDD | µg/kg | 10.0 | nd | nd | nd | 100 |

* TPH is lube oil fraction
Bolded text shows exceedances of the Interim Contaminant Testing Guidelines for Ocean Disposal

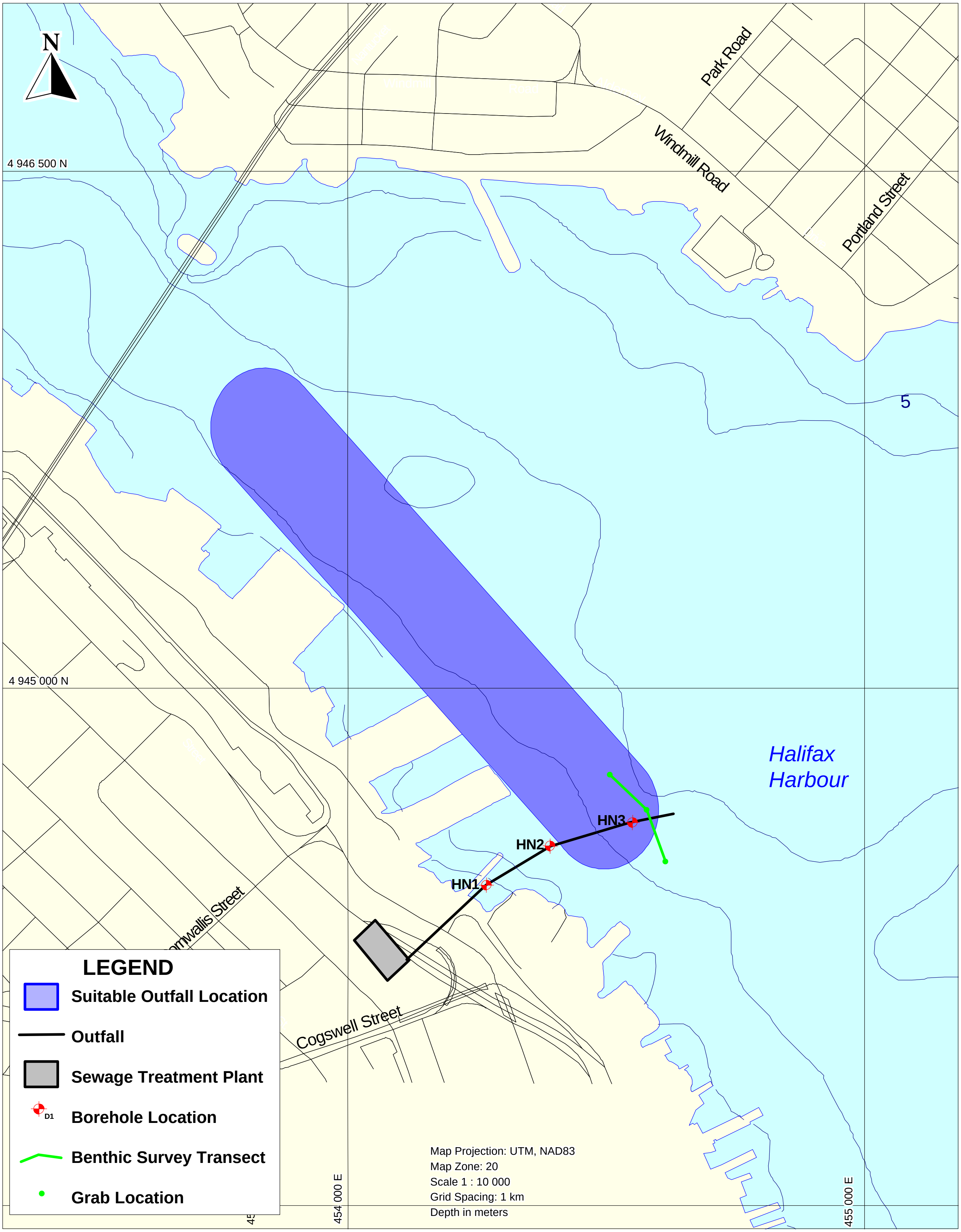


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Figure F.1
Halifax Outfall/Diffuser Location

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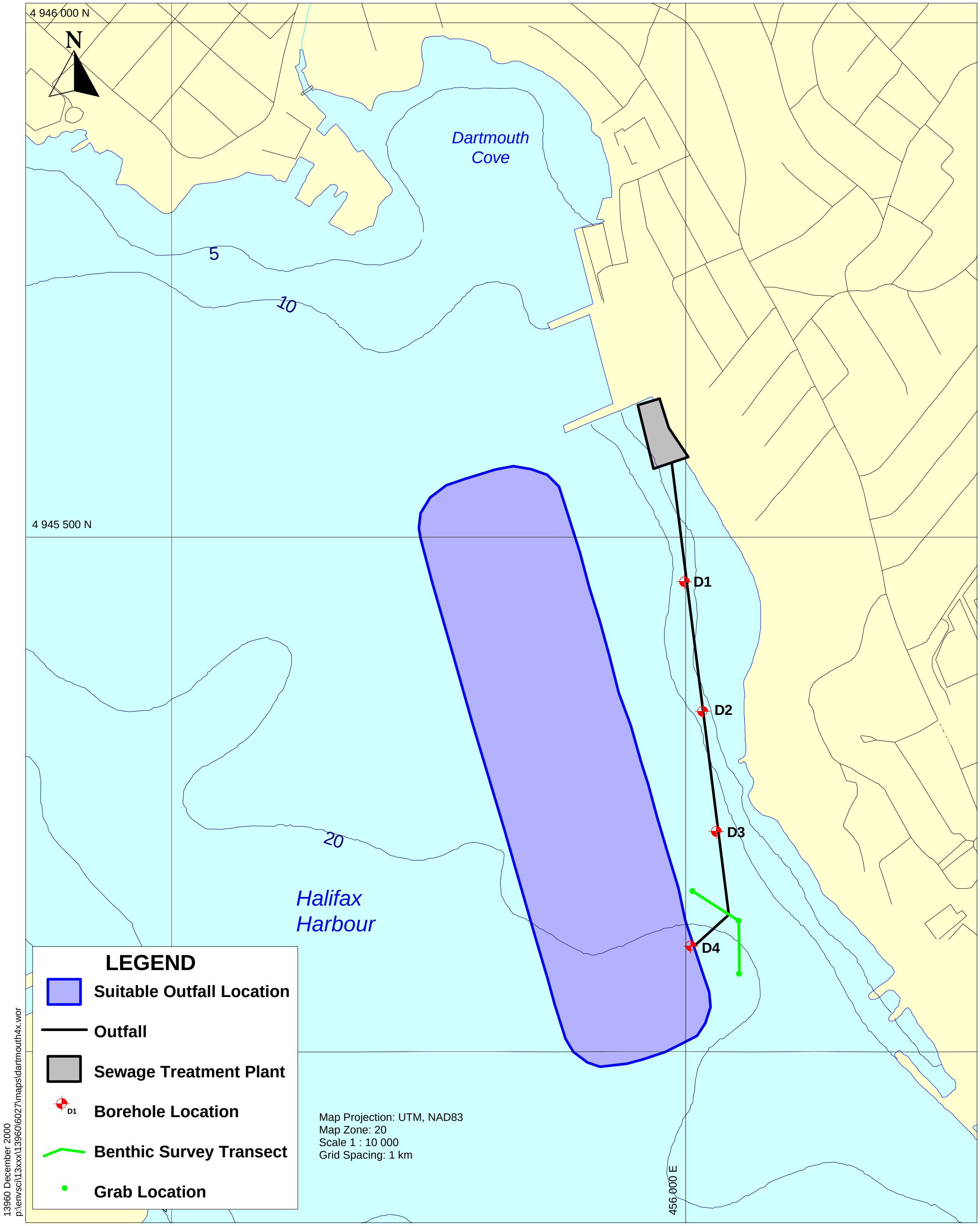


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Figure F.2

Dartmouth Outfall/Diffuser Location

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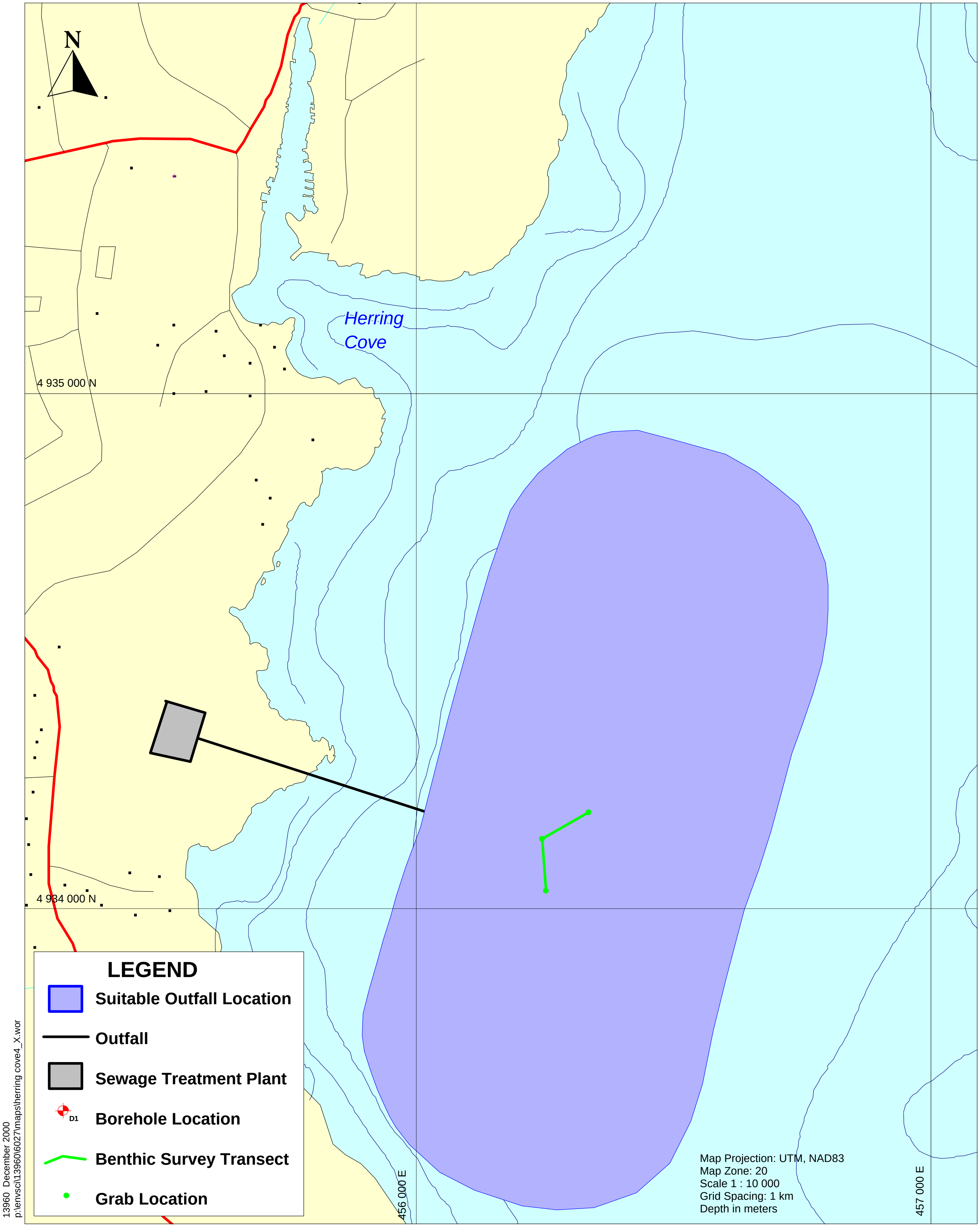


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Figure F.3
Herring Cove Outfall/Diffuser Location

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Photo 1:  Benthic Habitat at Hospital Point


Photo 2:  Benthic Habitat at  Hospital Point

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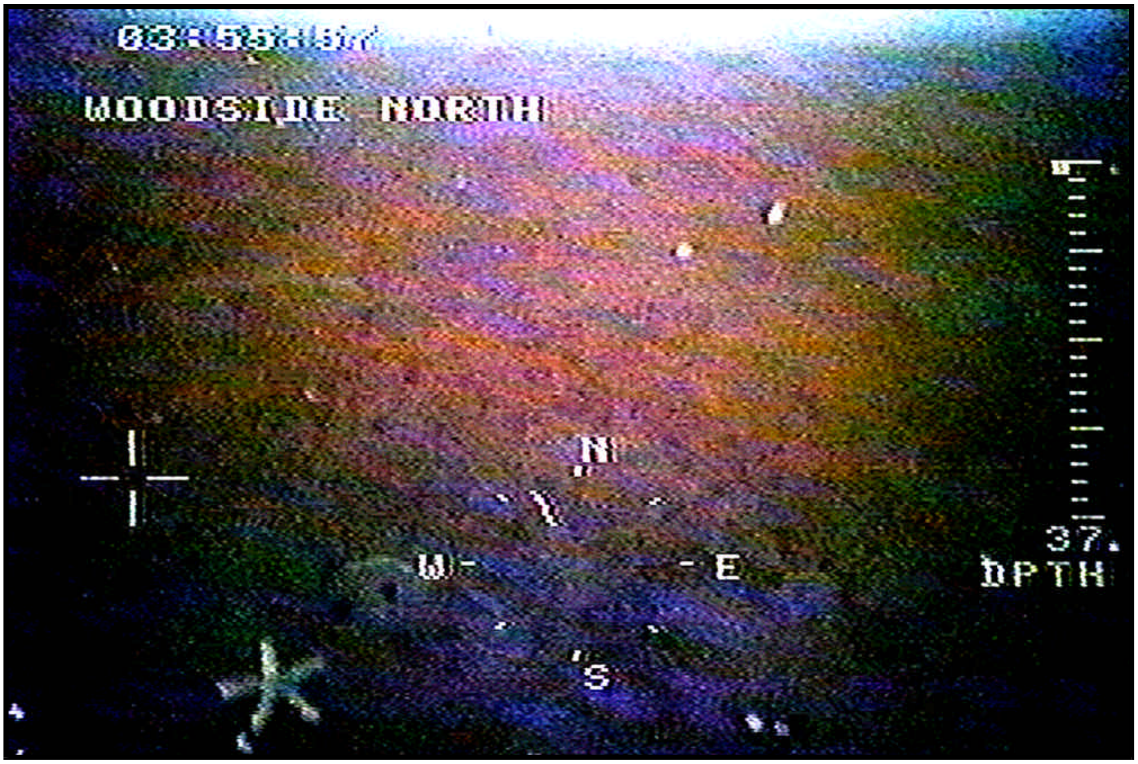


Photo 3: Benthic Habitat at Dartmouth (off NS Hospital)

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Photo 4 : Benthic Habitat at Halifax (off Casino)

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# APPENDIX G

# ANALYTICAL DATA FROM WASTEWATER CHARACTERIZATION OF DISCHARGES TO HALIFAX HARBOUR

**Table 5-2: Analytical Results - Roaches Pond**

| Parameter | EQL | Units | Roaches Pond-01 | Roaches Pond-02 | Roaches Pond-03 |
|---|---|---|---|---|---|
| Sample ID / Date Period | | | June 14 - June 15 11:40am - 11:40am | June 15 - June 16 11:40am - 11:40am | June 16 - June 17 11:40am - 11:40am |
| pH | 0.1 | Units | 6.8 | 7.1 | 7 |
| Carbonaceous BOD | 2 | mg/L | 110 | 99 | 96 |
| Total Suspended Solids | 0.5 | mg/L | 77 | 101 | 75 |
| Volatile Suspended Solids | 0.3 | mg/L | 71 | 91 | 68 |
| Total Oil & Grease | 5 | mg/L | - | 23.4 | - |
| Aluminum | 10 | ug/L | - | 490 | - |
| Antimony | 2 | ug/L | - | nd | - |
| Arsenic | 2 | ug/L | - | nd | - |
| Barium | 5 | ug/L | - | 28 | - |
| Beryllium | 5 | ug/L | - | nd | - |
| Boron | 5 | ug/L | - | 51 | - |
| Cadmium | 0.3 | ug/L | - | 0.2 | - |
| Chromium | 2 | ug/L | - | nd | - |
| Cobalt | 1 | ug/L | - | nd | - |
| Copper | 2 | ug/L | - | 35 | - |
| Iron | 20 | ug/L | - | 610 | - |
| Lead | 0.5 | ug/L | - | 2 | - |
| Manganese | 2 | ug/L | - | 130 | - |
| Molybdenum | 2 | ug/L | - | nd | - |
| Nickel | 2 | ug/L | - | 2 | - |
| Selenium | 2 | ug/L | - | nd (2) | - |
| Silver | 0.5 | ug/L | - | nd | - |
| Strontium | 5 | ug/L | - | 56 | - |
| Thallium | 0.1 | ug/L | - | nd | - |
| Tin | 2 | ug/L | - | nd | - |
| Uranium | 0.1 | ug/L | - | 0.2 | - |
| Vanadium | 2 | ug/L | - | nd | - |
| Zinc | 2 | ug/L | - | 54 | - |
| Mercury | 0.05 | ug/L | - | nd | - |

EQL = Estimated Quantitation Limit for Routine Analysis
nd = not detected above standard EQL
nd () = not detected at the elevated EQL specified due to matirx interference or sample pre-dilution
- = Parameter not requested in sample

**Table 5-4: Analytical Results - Point Pleasant Park**

| Parameter | EQL | Units | Point Pleasant-01<br>June 7 - June 8<br>11:10am - 11:10am | Point Pleasant-02<br>June 8 - June 9<br>11:10am - 11:10am | Point Pleasant-03<br>June 9 - June 10<br>11:10am - 11:10am |
|---|---|---|---|---|---|
| pH | 0.1 | Units | 6.9 | 6.7 | 6.8 |
| Carbonaceous BOD | 2 | mg/L | 110 | 54 | 87 |
| Total Suspended Solids | 0.5 | mg/L | 60 | 51 | 80 |
| Volatile Suspended Solids | 0.3 | mg/L | 53 | 44 | 67 |
| Total Oil & Grease | 5 | mg/L | - | - | 14.3 |
| Aluminum | 10 | ug/L | - | - | 730 |
| Antimony | 2 | ug/L | - | - | nd |
| Arsenic | 2 | ug/L | - | - | 2 |
| Barium | 5 | ug/L | - | - | 26 |
| Beryllium | 5 | ug/L | - | - | nd |
| Boron | 5 | ug/L | - | - | 300 |
| Cadmium | 0.3 | ug/L | - | - | 0.2 |
| Chromium | 2 | ug/L | - | - | nd |
| Cobalt | 1 | ug/L | - | - | 2 |
| Copper | 2 | ug/L | - | - | 31 |
| Iron | 20 | ug/L | - | - | 930 |
| Lead | 0.5 | ug/L | - | - | 4.1 |
| Manganese | 2 | ug/L | - | - | 190 |
| Molybdenum | 2 | ug/L | - | - | nd |
| Nickel | 2 | ug/L | - | - | 6 |
| Selenium | 2 | ug/L | - | - | nd (10) |
| Silver | 0.5 | ug/L | - | - | nd |
| Strontium | 5 | ug/L | - | - | 390 |
| Thallium | 0.1 | ug/L | - | - | nd |
| Tin | 2 | ug/L | - | - | nd |
| Uranium | 0.1 | ug/L | - | - | 0.1 |
| Vanadium | 2 | ug/L | - | - | nd |
| Zinc | 2 | ug/L | - | - | 60 |
| Mercury | 0.05 | ug/L | - | - | 0.18 |

EQL = Estimated Quantitation Limit for Routine Analysis
nd = not detected above standard EQL
nd () = not detected at the elevated EQL specified due to matirx interference or sample pre-dilution
- = Parameter not requested in sample

**Table 5-8: Analytical Results - Bell Road**

| Parameter | EQL | Units | Bell Rd-01 | Bell Rd-02 | Bell Road-03 |
|---|---|---|---|---|---|
| Sample ID | | | Bell Rd-01 | Bell Rd-02 | Bell Road-03 |
| Date Period | | | June 21 - June 22<br>7:00pm - 7:00pm | June 22 - June 23<br>7:00pm - 7:00pm | June 23 - June 24<br>7:00pm - 7:00pm |
| pH | 0.1 | Units | 6.9 | 6.7 | 6.7 |
| Carbonaceous BOD | 2 | mg/L | 130 | 91 | 100 |
| Total Suspended Solids | 0.5 | mg/L | 109 | 78 | 71 |
| Volatile Suspended Solids | 0.3 | mg/L | 94 | 71 | 63 |
| Total Oil & Grease | 5 | mg/L | 18.8 | - | - |
| Aluminum | 10 | ug/L | 550 | - | - |
| Antimony | 2 | ug/L | nd | - | - |
| Arsenic | 2 | ug/L | 5 | - | - |
| Barium | 5 | ug/L | 46 | - | - |
| Beryllium | 5 | ug/L | nd | - | - |
| Boron | 5 | ug/L | 90 | - | - |
| Cadmium | 0.3 | ug/L | 0.2 | - | - |
| Chromium | 2 | ug/L | 13 | - | - |
| Cobalt | 1 | ug/L | nd | - | - |
| Copper | 2 | ug/L | 37 | - | - |
| Iron | 20 | ug/L | 2500 | - | - |
| Lead | 0.5 | ug/L | 7.7 | - | - |
| Manganese | 2 | ug/L | 120 | - | - |
| Molybdenum | 2 | ug/L | 7 | - | - |
| Nickel | 2 | ug/L | 5 | - | - |
| Selenium | 2 | ug/L | nd (2) | - | - |
| Silver | 0.5 | ug/L | 2.8 | - | - |
| Strontium | 5 | ug/L | 71 | - | - |
| Thallium | 0.1 | ug/L | nd | - | - |
| Tin | 2 | ug/L | nd | - | - |
| Uranium | 0.1 | ug/L | nd | - | - |
| Vanadium | 2 | ug/L | nd | - | - |
| Zinc | 2 | ug/L | 79 | - | - |
| Mercury | 0.05 | ug/L | 0.1 | - | - |

EQL = Estimated Quantitation Limit for Routine Analysis
nd = not detected above standard EQL
nd () = not detected at the elevated EQL specified due to matirx interference or sample pre-dilution
- = Parameter not requested in sample

**Table 5-10: Analytical Results - Tufts Cove**

| Parameter | EQL | Units | Tufts Cove-01 | Tufts Cove-02 | Tufts Cove-03 |
|---|---|---|---|---|---|
| Sample ID / Date Period | | | June 28 - June 29 9:05am - 9:05am | June 29 - June 30 9:05am - 9:05am | June 30 - July 01 9:05am - 9:05am |
| pH | 0.1 | Units | 6.5 | 6.7 | 6.5 |
| Carbonaceous BOD | 2 | mg/L | 160 | 180 | 150 |
| Total Suspended Solids | 0.5 | mg/L | 113 | 114 | 93 |
| Volatile Suspended Solids | 0.3 | mg/L | 91 | 100 | 80 |
| Total Oil & Grease | 5 | mg/L | - | - | 29.6 |
| Aluminum | 10 | ug/L | - | - | 450 |
| Antimony | 2 | ug/L | - | - | nd (20) |
| Arsenic | 2 | ug/L | - | - | nd (20) |
| Barium | 5 | ug/L | - | - | 110 |
| Beryllium | 5 | ug/L | - | - | nd (50) |
| Boron | 5 | ug/L | - | - | 87 |
| Cadmium | 0.3 | ug/L | - | - | nd (1) |
| Chromium | 2 | ug/L | - | - | nd (20) |
| Cobalt | 1 | ug/L | - | - | nd (10) |
| Copper | 2 | ug/L | - | - | 120 |
| Iron | 20 | ug/L | - | - | 1700 |
| Lead | 0.5 | ug/L | - | - | 14 |
| Manganese | 2 | ug/L | - | - | 170 |
| Molybdenum | 2 | ug/L | - | - | nd (20) |
| Nickel | 2 | ug/L | - | - | nd (20) |
| Selenium | 2 | ug/L | - | - | nd (10) |
| Silver | 0.5 | ug/L | - | - | 150 |
| Strontium | 5 | ug/L | - | - | 50 |
| Thallium | 0.1 | ug/L | - | - | nd (1) |
| Tin | 2 | ug/L | - | - | nd (20) |
| Uranium | 0.1 | ug/L | - | - | nd (1) |
| Vanadium | 2 | ug/L | - | - | nd (20) |
| Zinc | 2 | ug/L | - | - | 150 |
| Mercury | 0.05 | ug/L | - | - | 0.12 |

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Table 5-12: Analytical Results - Jamieson Street

| Parameter | EQL | Units | Jamieson St-01<br>June 21 - June 22<br>11:00am - 11:00am | Jamieson St-02<br>June 22 - June 23<br>11:00am - 11:00am | Jamieson St-03<br>June 23 - June 24<br>11:00am - 11:00am |
|---|---|---|---|---|---|
| pH | 0.1 | Units | 6.7 | 6.9 | 6.8 |
| Carbonaceous BOD | 2 | mg/L | 74 | 130 | 40 |
| Total Suspended Solids | 0.5 | mg/L | 61 | 87 | 67 |
| Volatile Suspended Solids | 0.3 | mg/L | 55 | 81 | 60 |
| Total Oil & Grease | 5 | mg/L | 9.6 | - | - |
| Aluminum | 10 | ug/L | 460 | - | - |
| Antimony | 2 | ug/L | nd | - | - |
| Arsenic | 2 | ug/L | 2 | - | - |
| Barium | 5 | ug/L | 22 | - | - |
| Beryllium | 5 | ug/L | nd | - | - |
| Boron | 5 | ug/L | 52 | - | - |
| Cadmium | 0.3 | ug/L | 0.4 | - | - |
| Chromium | 2 | ug/L | nd | - | - |
| Cobalt | 1 | ug/L | nd | - | - |
| Copper | 2 | ug/L | 41 | - | - |
| Iron | 20 | ug/L | 550 | - | - |
| Lead | 0.5 | ug/L | 2.2 | - | - |
| Manganese | 2 | ug/L | 220 | - | - |
| Molybdenum | 2 | ug/L | nd | - | - |
| Nickel | 2 | ug/L | 4 | - | - |
| Selenium | 2 | ug/L | nd (2) | - | - |
| Silver | 0.5 | ug/L | nd | - | - |
| Strontium | 5 | ug/L | 50 | - | - |
| Thallium | 0.1 | ug/L | nd | - | - |
| Tin | 2 | ug/L | nd | - | - |
| Uranium | 0.1 | ug/L | nd | - | - |
| Vanadium | 2 | ug/L | nd | - | - |
| Zinc | 2 | ug/L | 56 | - | - |
| Mercury | 0.05 | ug/L | 0.06 | - | - |

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**Table 5-14: Analytical Results - Chamber#1**

| Parameter | EQL | Units | Chamber1-01 | Chamber 1-02 | Chamber 1-03 |
|---|---|---|---|---|---|
| | | Sample ID | Chamber1-01 | Chamber 1-02 | Chamber 1-03 |
| | | Date Period | June 14 - June 15 12:00pm - 12:00pm | June 15 - June 16 12:00pm 12:00pm | June 16 - June 17 12:00pm - 12:00pm |
| pH | 0.1 | Units | 6.9 | 7 | 6.9 |
| Carbonaceous BOD | 2 | mg/L | 160 | 150 | 140 |
| Total Suspended Solids | 0.5 | mg/L | 133 | 104 | 117 |
| Volatile Suspended Solids | 0.3 | mg/L | 121 | 94 | 104 |
| Total Oil & Grease | 5 | mg/L | - | 12.3 | - |
| Aluminum | 10 | ug/L | - | 510 | - |
| Antimony | 2 | ug/L | - | nd | - |
| Arsenic | 2 | ug/L | - | nd | - |
| Barium | 5 | ug/L | - | 20 | - |
| Beryllium | 5 | ug/L | - | nd | - |
| Boron | 5 | ug/L | - | 49 | - |
| Cadmium | 0.3 | ug/L | - | 0.4 | - |
| Chromium | 2 | ug/L | - | 3 | - |
| Cobalt | 1 | ug/L | - | nd | - |
| Copper | 2 | ug/L | - | 42 | - |
| Iron | 20 | ug/L | - | 600 | - |
| Lead | 0.5 | ug/L | - | 2.5 | - |
| Manganese | 2 | ug/L | - | 95 | - |
| Molybdenum | 2 | ug/L | - | nd | - |
| Nickel | 2 | ug/L | - | 3 | - |
| Selenium | 2 | ug/L | - | nd (2) | - |
| Silver | 0.5 | ug/L | - | 7.5 | - |
| Strontium | 5 | ug/L | - | 44 | - |
| Thallium | 0.1 | ug/L | - | nd | - |
| Tin | 2 | ug/L | - | nd | - |
| Uranium | 0.1 | ug/L | - | 0.1 | - |
| Vanadium | 2 | ug/L | - | nd | - |
| Zinc | 2 | ug/L | - | 67 | - |
| Mercury | 0.05 | ug/L | - | 0.08 | - |

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- = Parameter not requested in sample

Table 5-16: Analytical Results - Dartmouth Cove

| Parameter | EQL | Units | Dart. Cove-01 | Dart. Cove-02 | Dart. Cove-03 |
|---|---|---|---|---|---|
| Date Period | | | June 28 - June 29 9:30am - 9:30am | June 29 - June 30 9:30am - 9:30am | June 30 - July 01 9:30am - 9:30am |
| pH | 0.1 | Units | 6.7 | 6.8 | 6.7 |
| Carbonaceous BOD | 2 | mg/L | 110 | 130 | 130 |
| Total Suspended Solids | 0.5 | mg/L | 114 | 135 | 95 |
| Volatile Suspended Solids | 0.3 | mg/L | 95 | 117 | 78 |
| Total Oil & Grease | 5 | mg/L | - | - | 16.9 |
| Aluminum | 10 | ug/L | - | - | 870 |
| Antimony | 2 | ug/L | - | - | nd (20) |
| Arsenic | 2 | ug/L | - | - | nd (20) |
| Barium | 5 | ug/L | - | - | nd (50) |
| Beryllium | 5 | ug/L | - | - | nd (50) |
| Boron | 5 | ug/L | - | - | 71 |
| Cadmium | 0.3 | ug/L | - | - | nd (1) |
| Chromium | 2 | ug/L | - | - | nd (20) |
| Cobalt | 1 | ug/L | - | - | nd (10) |
| Copper | 2 | ug/L | - | - | 53 |
| Iron | 20 | ug/L | - | - | 1100 |
| Lead | 0.5 | ug/L | - | - | 5 |
| Manganese | 2 | ug/L | - | - | 260 |
| Molybdenum | 2 | ug/L | - | - | nd (20) |
| Nickel | 2 | ug/L | - | - | nd (20) |
| Selenium | 2 | ug/L | - | - | nd (10) |
| Silver | 0.5 | ug/L | - | - | nd (5) |
| Strontium | 5 | ug/L | - | - | 66 |
| Thallium | 0.1 | ug/L | - | - | nd (1) |
| Tin | 2 | ug/L | - | - | nd (20) |
| Uranium | 0.1 | ug/L | - | - | nd (1) |
| Vanadium | 2 | ug/L | - | - | nd (20) |
| Zinc | 2 | ug/L | - | - | 100 |
| Mercury | 0.05 | ug/L | - | - | 0.19 |

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nd = not detected above standard EQL
nd () = not detected at the elevated EQL specified due to matirx interference or sample pre-dilution
- = Parameter not requested in sample