

**Environmental Assessment  
Registration for the Envirosoil  
Facility: Addition of  
Stabilization/Solidification  
Technology**

Project No. 121413511



Prepared for:  
Envirosoil Limited  
PO Box 48100  
Bedford, NS B4A 3Z2

Prepared by:  
Stantec Consulting Ltd.  
102-40 Highfield Park Drive  
Dartmouth NS B0A 0A3  
Tel: (902) 468-7777  
Fax: (902) 468-9009

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# ENVIRONMENTAL ASSESSMENT REGISTRATION FOR THE ENVIROSOIL FACILITY: ADDITION OF STABILIZATION/SOLIDIFICATION TECHNOLOGY

## LIST OF ACRONYMS

ASTM	American Society for Testing and Materials
BMPs	Best Management Practices
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
C&D	Construction and Demolition
CCME	Canadian Council of Ministers of the Environment
CEAA, 2012	<i>Canadian Environmental Assessment Act, 2012</i>
EA	Environmental Assessment
EAC	Ecology Action Centre
EC	Electrical Conductivity
EQS	Environmental Quality Guidelines
ha	Hectares
HRM	Halifax Regional Municipality
KMKNO	Kwilmu'kw Maw-klusuaqn Negotiation Office
LTTD	Low Temperature Thermal Desorption
MBCA	<i>Migratory Birds Convention Act</i>
MW	Monitoring Well
NASGLP	North American Soil Geochemical Landscapes Project
NSAC	Nova Scotia Agricultural College
NSCSR	Nova Scotia Contaminated Site Regulations
NSE	Nova Scotia Environment
OSSGA	Ontario Sand, Soil and Gravel Association
PAHs	Polycyclic Aromatic Hydrocarbons
PERC	Perchloroethylene
PHC	Petroleum Hydrocarbons
S/S	Stabilization/Solidification
SAR	Sodium Adsorption Ratio
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
VCs	Valued Components
VOCs	Volatile Organic Compounds

**ENVIRONMENTAL ASSESSMENT REGISTRATION FOR THE ENVIROSOIL FACILITY: ADDITION OF STABILIZATION/SOLIDIFICATION TECHNOLOGY**

Proponent and Project Identification  
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## **1.0 Proponent and Project Identification**

### **1.1 PROPONENT INFORMATION**

**Name of the Proponent:** Envirosoil Limited  
**Postal Address:** PO Box 48100  
927 Rocky Lake Drive  
Bedford, NS B4A 3Z2  
Tel.: (902) 835-3381  
Mobile: (902) 478-2732  
Fax: (902) 832-6390

#### **Company President and/or Environmental Assessment Contact**

**Name:** Mr. Jerry Scott  
**Official Title:** General Manager  
**Address:** As Above  
**Tel.:** (902) 835-3381  
**Mobile:** (902) 478-2732  
**Fax:** (902) 832-6390

  
\_\_\_\_\_  
Signature of Company  
Mr. Jerry Scott, General Manager

13/05/15  
\_\_\_\_\_  
Date

#### **Environmental Consultant Contact**

**Name:** Ms. Kelley Fraser, MES  
**Official Title:** Project Manager  
Stantec Consulting Ltd.  
**Address:** 102 – 40 Highfield Park Drive  
Dartmouth, NS B3A 0A3  
**Tel.:** (902) 468-7777  
**Fax:** (902) 468-9009

### **1.2 PROJECT INFORMATION**

**Name of the Undertaking:** Environmental Assessment Registration for the Envirosoil Facility: Addition of Stabilization/Solidification Technology  
**Location of the Undertaking:** Bedford, Halifax County, Nova Scotia



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## 1.3 PROJECT BACKGROUND

Envirosoil Limited (Envirosoil), a member of the Municipal Group, was founded in 1992 in Bedford, Nova Scotia (Figure 1). Envirosoil designed and constructed a facility to provide a solution for the treatment and disposal of contaminated soil. The facility operates under Industrial Approval No. 2002-026440-R01 from Nova Scotia Environment (NSE) (Appendix A), which prescribes the criteria for material acceptance, treatment and reuse of treated material.

The facility initially provided bio-remediation services for contaminated soils. In 1995, permission was received to operate the Low Temperature Thermal Desorption (LTTD) unit. In 2003, an Environmental Assessment (EA) Approval was received to treat soils contaminated with perchloroethylene (PERC) from dry cleaning fluids and related products (Envirosoil 2003; Appendix A). Additional information on the facility is provided in the 2003 EA.

Envirosoil is requesting the following amendments to Industrial Approval No. 2002-026440-R01:

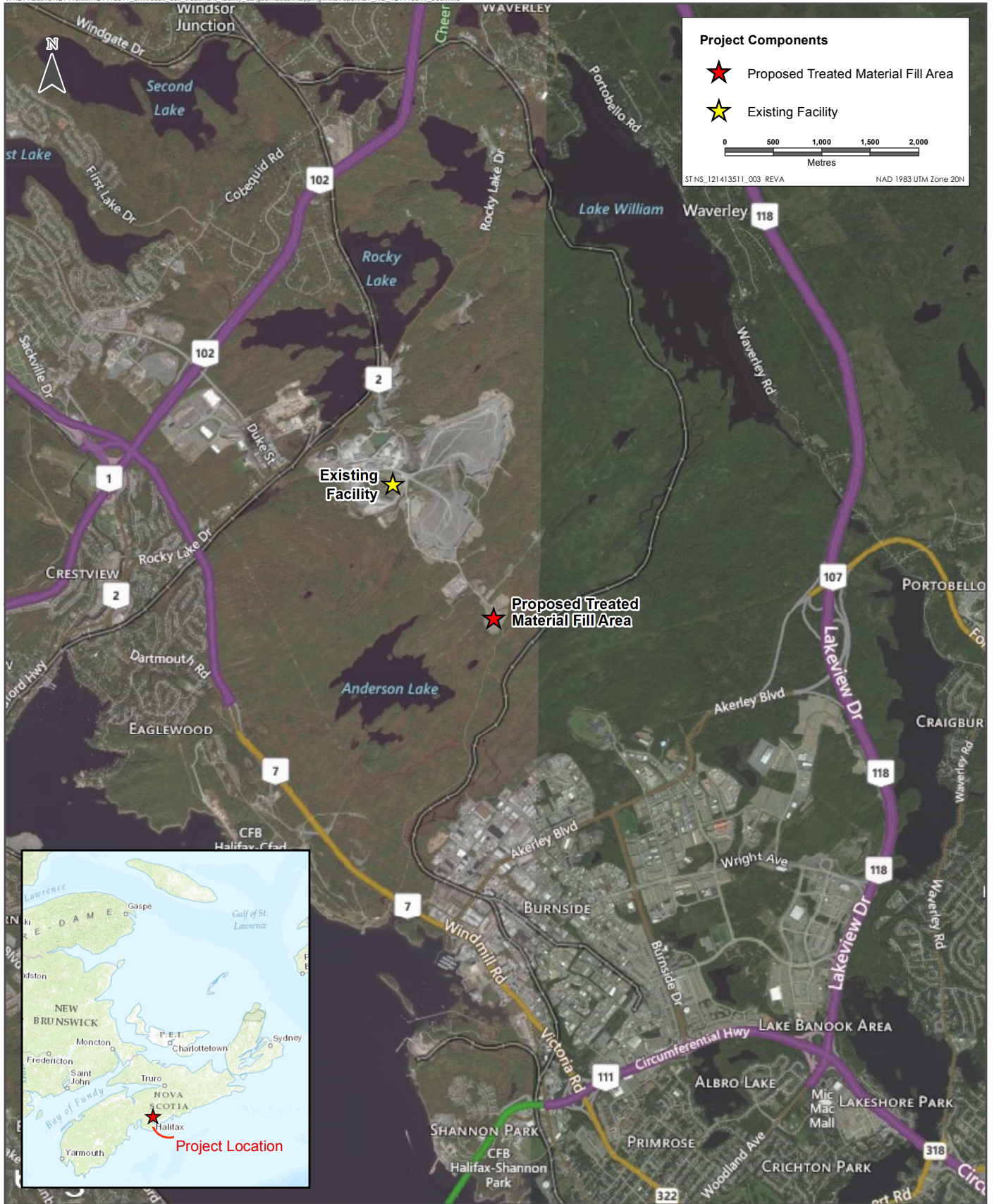
- Amendment to add Stabilization/Solidification (S/S) technology to allow treatment of materials with inorganic metals and low level organics; and
- Amendment to allow for the acceptance and treatment by S/S technology materials containing elevated levels of Electrical Conductivity (EC) and Sodium Adsorption Ratio (SAR) (or, salt impacted materials).

Because these amendments are considered modifications to the existing facility, Envirosoil is required to register this Project as a Class I Undertaking pursuant to the Nova Scotia *Environment Act* and Environmental Assessment Regulations.

NSE reviewed a preliminary project description and comments were received on the S/S technology following the technical review. These comments and questions have been addressed in the following sections.

## 1.4 GEOGRAPHIC LOCATION

The existing Envirosoil Limited facility is located in Bedford, Nova Scotia, directly across from the Bedford Industrial Park (Figure 1) at 48 Quarystone Drive (off 927 Rocky Lake Drive). The Envirosoil facility (PID #40237182) is within the confines of the active Municipal Quarry site operated by the Municipal Group of Companies, and is situated north of the main rock crushing equipment within the quarry (Figure 2). The Envirosoil facility is approximately 4 hectares (ha) in size and is accessed by existing quarry access roads that branch off from the quarry's main entrance off Rocky Lake Drive. The proposed Treated Soils Fill Area or restoration area (PID# 00267864) is located approximately 2 km southeast of the Envirosoil treatment facility, within the Municipal Quarry property boundaries (Figure 3).



Sources: Base Data - ArcGIS Online

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

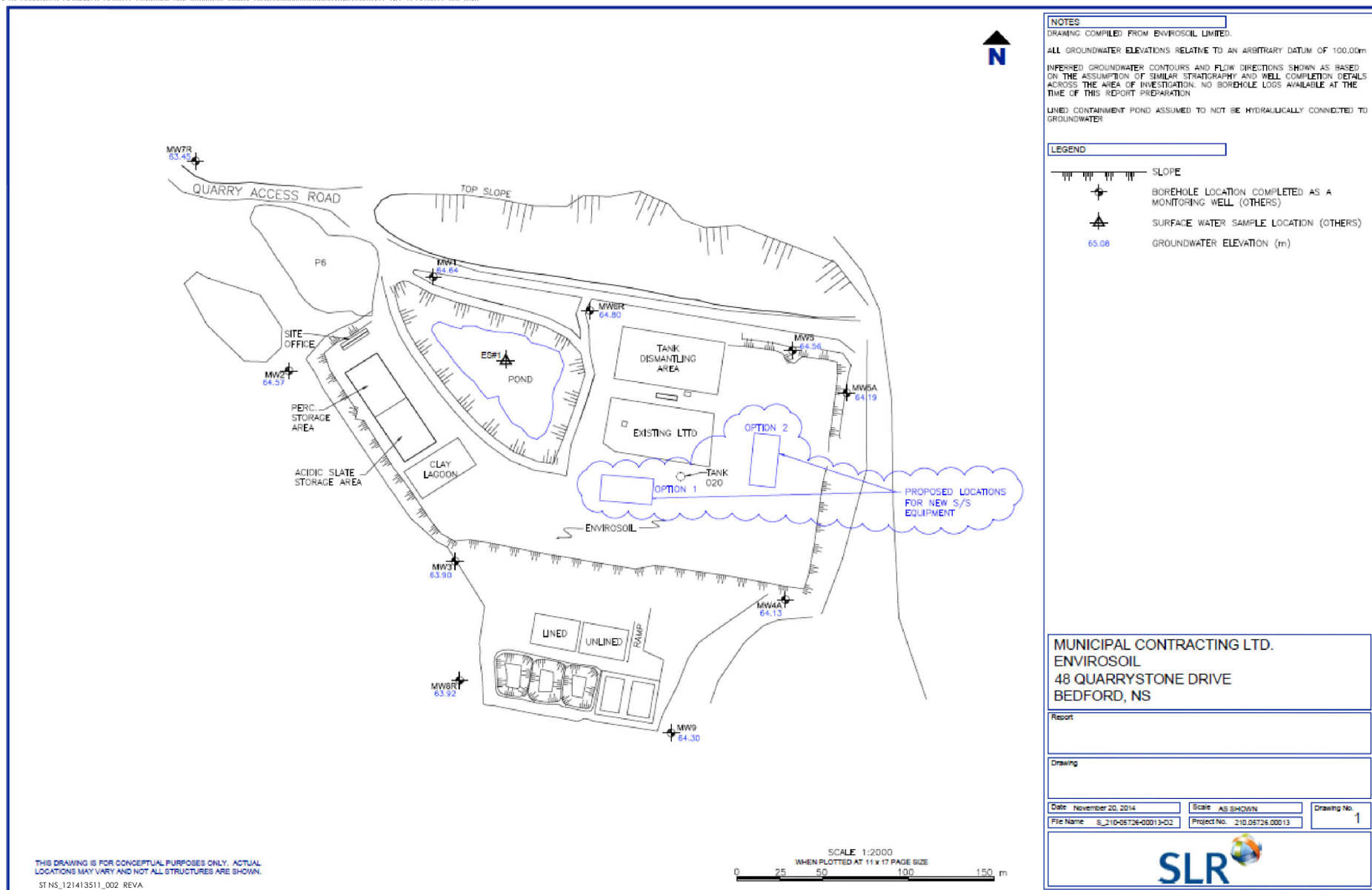
## Project Location



Environmental Assessment Registration for the Envirosoil Facility: Addition of Stabilization/Solidification Technology and Treatment of Salt Impacted Materials

Figure 1





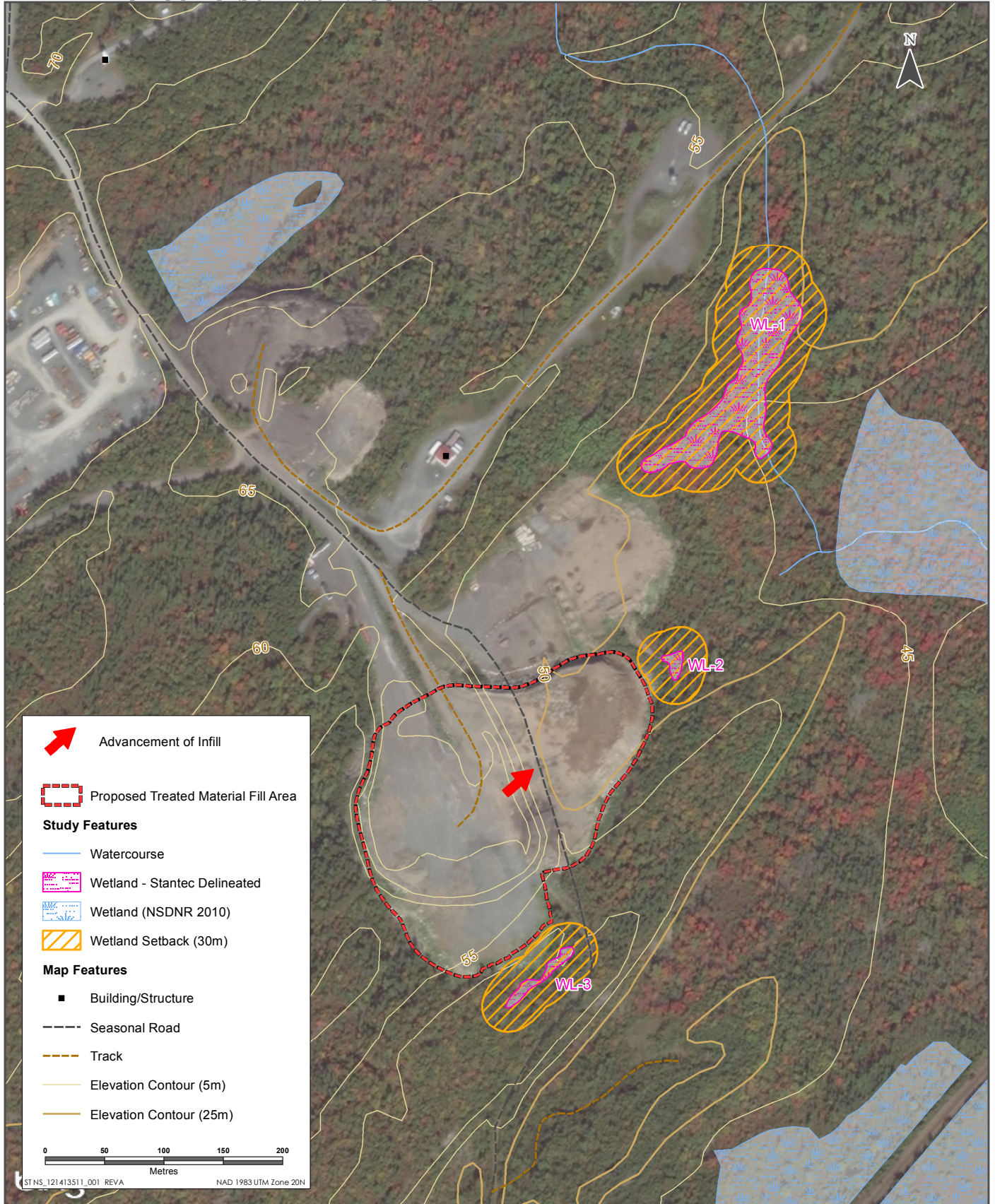
Sources: Base Data - Original drawing created by SLR, 2014



Site Plan - S/S Plant Location

Figure 2





Sources: Base Data - Nova Scotia Geomatics Centre (NSGC), Nova Scotia Topographic Database (NSTDB);  
Wetlands - Nova Scotia Dept. of Natural Resources (NSDNR), Wetland Mapping Inventory  
Imagery: Bing; Microsoft product screen shot(s) reprinted with permission from Microsoft Corporation

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

## Proposed Treated Material Fill Area



## ENVIRONMENTAL ASSESSMENT REGISTRATION FOR THE ENVIROSOIL FACILITY: ADDITION OF STABILIZATION/SOLIDIFICATION TECHNOLOGY

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The existing Envirosoil soil processing site (Figure 2) is located in a disturbed area, characterized by gravel pads, roads, and soil mounds. Much of the site is unvegetated; but native and exotic ruderal herbaceous plants such as Queen Anne's lace (*Daucus carota*) and Canada goldenrod (*Solidago canadensis*) provide cover on the soil mounds, and green alder (*Alnus viridis*) is scattered throughout the site. Although disturbed, the area has potential to provide habitat for several species of migratory birds that nest on the ground or are associated with open habitats. However, because of ongoing heavy equipment operations and other activities, species of migratory birds that are known to nest in open disturbed soils, such as common nighthawk (*Chordeiles minor*) and bank swallows (*Riparia riparia*) are unlikely to nest at the processing site. Site drainage is directed towards a settling pond, much of which is vegetated by broad-leaved cattail (*Typha latifolia*). Waterfowl, including Canada goose (*Branta canadensis*) and American Black Duck (*Anas rubripes*) were observed within the settling pond during the site visit on April 24, 2015, but are not expected to use the site for nesting purposes because of the lack of islands and vegetated areas buffering the settling pond from adjacent human activities. No other wetlands (naturally occurring or anthropogenic) are present on the site; because the settling pond lacks an outflow, it is isolated from down gradient water resources.

The Treated Soils Fill Area is located in a disturbed area characterized by exposed soils, and is elevated relative to the surrounding terrain. Upland forests of varying composition and structure surround the site. The majority of forest cover in the vicinity of the site is of well-drained immature to hardwood stands and are dominated by a mixture of red maple (*Acer rubrum*), paper birch (*Betula papyrifera*), and northern red oak (*Quercus rubra*) in the overstory, and an understory of sheep laurel (*Kalmia angustifolia*) and bracken fern (*Pteridium aquilinum*). A stand of red pine (*Pinus resinosa*) is present on the southern boundary of the existing footprint whereas eastern white pine (*Pinus strobus*) and red spruce (*Picea rubens*) are scattered throughout the surrounding forests. Black spruce (*Picea mariana*) is prevalent in relatively low-lying, imperfectly drained areas. The terrain within the surrounding forests is very rocky with boulders prevalent throughout and occasional bedrock outcropping. A variety of wildlife would use the area surrounding the Treated Soils Fill Area, including migratory birds characteristic of forested and shrubby habitats. Because of ongoing heavy equipment operations and other activities, species of migratory bird that are known to nest in open disturbed soils, such as common nighthawk are unlikely to nest at the Treated Soils Fill Area.

Additional information on the facility, environmental setting and surrounding area is provided in the 2003 EA (Envirosoil 2003).

### 1.5 PURPOSE AND NEED FOR THE PROJECT

The Envirosoil facility (Figure 2) has been in operation since 1992 under Industrial Approval No.2002-026440-R01. The facility has successfully treated almost one million tonnes of impacted materials to the Canadian Council of Ministers of the Environment (CCME) Residential/Parkland criteria. The majority of materials have been treated to non-detect for petroleum hydrocarbons (PHC) and polycyclic aromatic hydrocarbons (PAHs).

## **ENVIRONMENTAL ASSESSMENT REGISTRATION FOR THE ENVIROSOIL FACILITY: ADDITION OF STABILIZATION/SOLIDIFICATION TECHNOLOGY**

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Envirosoil is requesting that its Approval be updated to reflect the current regulatory regime and advances in treatment technology. The proposed amendments to add S/S treatment and treatment for salt impacted materials (the Project) will allow Envirosoil to enhance treatment capabilities and extend the current operations at their facility that has been operating under an Industrial Approval (No. 2002-026440-R01) originally issued by NSE in 2002 (and reissued in 2012).

Current options within Halifax Regional Municipality (HRM) for the treatment of inorganic metals impacted materials are limited. The establishment of additional treatment capacity and technology for inorganic metals impacted materials will present property developers with additional options for the disposal of impacted materials encountered during residential, commercial or industrial development projects.

Materials containing elevated levels of EC and SAR that are also impacted with hydrocarbons, PAHs, etc. can be generated in a variety of ways. They can be generated via the dredging of coastal harbors, the remediation of industrial sites such as salt storage depots, the drilling of wells through salt layers/domes, the drilling of hydrocarbon exploration wells in high saline environments, the use of saline based drilling muds, sludge generated from ship's bilge or the treatment of bilge waters, etc. Materials generated via these activities will typically contain EC and SAR values above the CCME Industrial criteria.

Under existing environmental regulations and facility approvals, there are currently no disposal facilities within Nova Scotia that can accept materials having EC and SAR above the CCME Industrial criteria. The majority of treatment facilities are limited to accepting material containing EC and SAR values that are below the CCME Residential/Parkland criteria. As a result, these materials are technically required to be disposed of out of province at an approved disposal facility or special permission obtained from NSE for alternate disposal options within the province. Under its existing Industrial Approval, Envirosoil cannot accept material having EC and SAR levels above the CCME Residential/Parkland criteria. Envirosoil is proposing that its Industrial Approval be amended to exempt the EC and SAR restrictions provided that all materials containing elevated EC and SAR are handled in accordance with the special procedures outlined in this EA Registration.

The amendment of Envirosoil's Industrial Approval to allow it to treat EC/SAR materials impacted with contaminants such as hydrocarbons, PAHs, etc. will provide Nova Scotia with a reliable local option for the disposal of these types of materials.



# ENVIRONMENTAL ASSESSMENT REGISTRATION FOR THE ENVIROSOIL FACILITY: ADDITION OF STABILIZATION/SOLIDIFICATION TECHNOLOGY

Project Description  
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## 2.0 Project Description

S/S is a well-established remediation technology for the treatment of soil, sediment and sludge contaminated with inorganic metals and various organic compounds. The United States Environmental Protection Agency (USEPA) has identified (S/S with cement as a Best Demonstrated Available Technology for more than 50 major industrial waste types and contaminants. The proposed amendments for this project focus on the following:

- Amendment to add S/S technology to allow treatment of materials with inorganic metals and organics; and
- Amendment to allow for the acceptance and treatment by S/S technology, materials containing elevated levels of EC and SAR (or, salt impacted materials).

Typically, S/S includes the mixing of inorganic cementitious/pozzolanic reagents into contaminated material to transform it into a durable, solid, low-hydraulic conductivity material that reduces the risk of contaminant leaching. This is achieved as the cement chemically reacts with water in the material being treated, creating changes in the physical and chemical properties of the treated materials, thereby preventing the escape of hazardous contaminants into the environment.

Although solidification and stabilization are defined separately, they are often implemented simultaneously through a single treatment process. The USEPA defines each as follows:

- Stabilization involves the process whereby chemical reactions occur between the reagents and contaminated material to reduce the leachability of contaminated material or convert them into a more stable, insoluble and/or less toxic form.
- Solidification involves the process whereby the contaminated material is encapsulated to form a solid material that effectively restricts contaminant migration by decreasing the surface area exposed to leaching. Solidification effectively entraps the contaminated material within a granular or monolithic matrix.

The popularity of S/S is due to the fact that it can be used to treat a wide variety of inorganic contaminants such as arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, antimony, uranium, and zinc as well as organic contaminants such as petroleum hydrocarbons and PAHs, etc. Soil, sediment and sludge impacted with an array of organic and inorganic contaminants have been treated successfully using this versatile technology.

### 2.1 UPDATED MATERIAL ACCEPTANCE CRITERIA

With the addition of the cement based S/S process, Envirosoil is requesting that the current material acceptance criteria be amended to reflect the additional treatment capability of the facility as it relates to inorganic metals, and EC/SAR materials.

## **ENVIRONMENTAL ASSESSMENT REGISTRATION FOR THE ENVIROSOIL FACILITY: ADDITION OF STABILIZATION/SOLIDIFICATION TECHNOLOGY**

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### **2.1.1 General Acceptance Criteria – Inorganic Metals, Excluding Arsenic and Lead**

Under the amendment, Envirosoil is proposing that the acceptance of inorganic metals impacted materials be based on the established Nova Scotia Contaminated Site Regulations (NSCSR, 2013) Tier 1 Environmental Quality Guidelines (EQS) for soil at a Non-Potable fine grained, industrial site. Acceptance of material containing metals concentrations in excess of the Tier I EQS guideline will be based on the leachate criteria outlined in the Nova Scotia Guidelines for Contaminated Solids in Landfills, Attachment C – Acceptance Parameters for Contaminated Soil (Leachate Results).

Please note that the Nova Scotia Guidelines for Contaminated Solids in Landfills, Attachment C – Acceptance Parameters for Contaminated Soil (Leachate Results) are based on disposal to an unlined, first generation landfill. As such, this guideline is considered conservative for this application since the material meeting this criteria will be treated through solidification/stabilization, which is not a requirements of these landfill disposal criteria.

### **2.1.2 General Acceptance Criteria - Arsenic**

Under the amendment, Envirosoil is proposing that the acceptance criteria for inorganic arsenic be modified from the values established in the proposed Industrial Tier I EQS to a value of 100 mg/kg. Acceptance of material containing arsenic concentrations exceeding 100 mg/kg will be based on the corresponding leachate guidelines outlined in the Nova Scotia Guidelines for Contaminated Solids in Landfills, Attachment C – Acceptance Parameters for Contaminated Soil (Leachate Results).

The rationale for the proposed modification is based on the most recent geological data regarding the distribution of arsenic within Nova Scotia soils, current NSE guidelines and the leachate extraction test (CGSB 164-GP-IMP) procedure.

As part of the North American Soil Geochemical Landscapes Project (NASGLP) conducted in 2009, the distribution of arsenic throughout Nova Scotia was examined. Results for the project found that arsenic concentrations within Nova Scotia ranged from 2.2. mg/kg to 347.7 mg/kg. The highest arsenic concentrations were found in the southern mainland of Nova Scotia, relatively close to HRM.

In a 2011 study funded by Environment Canada, the Nova Scotia Agricultural College (NSAC) and the HRM evaluated the distribution of various metals throughout the HRM landscape. The study was directed by the Ecology Action Centre (EAC). The study found that few locations had low levels of arsenic contamination. It also found that the concentration of arsenic was higher closer to the downtown core.

The disposal of impacted soil into landfills is governed by the Guidelines for Disposal of Contaminated Solids in Landfills. The guidelines stipulate landfill disposal criteria of 5 mg/L leachate for any materials containing concentrations of arsenic greater than 50 mg/kg.

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The requested criteria of 100 mg/kg for arsenic is derived from data contained within the Guidelines for Disposal of Contaminated Solids in Landfills and the analytical procedure associated with the leachate extraction test (CGSB 164-GP-IMP). The guideline stipulates disposal criteria of 5 mg/L leachate for arsenic. As per the leachate testing procedure, and assuming 100% leaching of the mass arsenic, the 5 mg/L corresponds to a mass concentration of 100 mg/kg (i.e., a CGSB 164-GP-IMP method dilution factor of 20). Since it is impossible for the leachate extraction procedure to be 100% efficient it would be extremely rare to have a material containing 100 mg/kg of arsenic generate a leachate of greater than 5 mg/L. The 100 mg/kg criteria therefore represent a conservative mass concentration that will ensure a leachate value of less than 5 mg/L. As a result, any material containing 100 mg/kg of arsenic would be acceptable for landfill disposal based on the 5 mg/L leachate criteria (subject to leachate testing confirmation). Materials containing arsenic that generate leachate concentrations less than 5 mg/L are not considered a waste dangerous good under the Dangerous Goods Management Regulations.

### **2.1.3 General Acceptance Criteria -Lead**

Under the amendment, Envirosoil proposes that the acceptance criteria for lead be modified from the values established in the NSCSR Tier I EQS for soil at a non-potable site (fine-industrial). Envirosoil is proposing that the acceptance criteria be established at 1000 mg/kg. Acceptance of material containing lead in concentrations greater than 1000 mg/kg will be based on the corresponding leachate criteria outlined in the Nova Scotia Guidelines for Contaminated Solids in Landfills, Attachment C – Acceptance Parameters for Contaminated Soil (Leachate Results). Under the landfill disposal guideline the lead leachate value must be less than 5 mg/L.

The presence of elevated levels of lead in Nova Scotia soils is well documented. There are a number of natural and anthropogenic sources that can contribute to high levels of metals in soils. Coal burning, leaded paint and gasoline, and bedrock can all have a potential effect on metals found in soils in Nova Scotia. The proposed criteria are more representative of the materials commonly encountered within HRM and are well within the treatment capability of the proposed S/S technology.

The rationale for the lead criteria of 1000 mg/kg or 5 mg/L leachate is based on the criteria contained within the Guidelines for Disposal of Contaminated Solids in Landfills. Landfill disposal guidelines have been the basis for acceptance for other soil treatment facilities in Nova Scotia. Reliance on the landfill leachate criteria will also ensure that materials containing leachate concentrations that would require them to be classified as a waste dangerous goods are not accepted at Envirosoil's facility.

### **2.1.4 General Acceptance Criteria - EC and SAR**

Under Envirosoil's existing approval, the facility is limited to accepting EC and SAR impacted materials not to exceed the Canadian Council of Ministers of the Environment (CCME)

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residential/parkland guidelines. Under this amendment, Envirosoil is proposing acceptance of soil with concentrations exceeding CCME Industrial guidelines.

Currently no disposal facilities in Nova Scotia can accept materials having EC and SAR above the CCME Industrial Guidelines. The majority of treatment facilities are limited to accepting material containing EC and SAR below CCME residential/parkland. As a result, these materials may be required to be disposed of out of province at a significant cost to developers, property owners and businesses.

### 2.1.5 Metals, EC and SAR Impacted Materials Requiring Treatment

For the purposes of the proposed amendment, Table 1 summarizes the criteria for S/S treatment.

**Table 1 Summary of Material Criteria for S/S Treatment**

Parameter	Minimum Concentration Requiring S/S Treatment	Maximum Concentration for S/S Treatment
<b>Metals (excl. Arsenic and Lead)</b>	Exceeding NSCSR Tier I EQS, coarse grained, residential land-use	NSCSR Tier I EQS, fine grained, industrial land-use or leachate criteria as specified in this document
<b>Arsenic</b>	Exceeding NSCSR Tier I EQS, coarse grained, residential land-use	100 mg/kg or leachate criteria as specified in this document
<b>Lead</b>	Exceeding NSCSR Tier I EQS, coarse grained, residential land-use	1000 mg/kg or leachate criteria as specified in this document
<b>EC</b>	Exceeding CCME residential/parkland	Greater than CCME Industrial
<b>SAR</b>	Exceeding CCME residential/parkland	Greater than CCME Industrial
<b>Petroleum Hydrocarbons</b>	Exceeding NSCSR Tier I EQS, coarse grained, residential land-use, non-potable guidelines	In accordance with existing approval
<b>Polycyclic Aromatic Hydrocarbons</b>	Exceeding NSCSR Tier I EQS, coarse grained, residential land-use, non-potable guidelines	In accordance with existing approval

## 2.2 SITE PREPARATION AND CONSTRUCTION

The proposed S/S treatment site is the existing Envirosoil facility (Figure 2). This facility is approximately 4 ha in size and is located within the quarry operation of the Municipal Group of Companies.

The topography of the treatment facility site is relatively flat and graded to drain overland surface water flow to an onsite storm water retention pond (see drawing in Appendix B). The pond has no discharge outlet and liquid levels in the pond are controlled seasonally by evaporation. The site area is underlain by 400 mm thick compacted, clay liner with a hydraulic conductivity of  $10^{-7}$  cm/sec limiting migration of potential impacts to offsite receptors. A groundwater monitoring network has been established. Groundwater is sampled and reporting



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is completed according to Envirosoil's existing Industrial approval (Appendix A). The site location and general features are shown on Figure 2.

The Treated Soils Fill Area is located approximately 2 km southeast of the Envirosoil treatment facility. The Treated Soils Fill Area is located in an area of quarry restoration where excess virgin fill from quarry operations has been imported and graded flat and gently sloping to the northeast. In general, fill material consists of coarse grained soils, gravel, cobbles and boulders. In some areas, fill thicknesses exceed 15 m. The proposed Treated Soils Fill Area is shown on Figure 3.

Access to both the Envirosoil processing facility and Treated Soils Fill Area is along existing roads.

Project activities have potential to cause erosion and deposition of sediment to down gradient surface water resources (including wetlands and watercourses), particularly during periods of heavy rainfall or snowmelt. Potential impacts to surface water resources will be reduced through site design and other mitigation techniques, including:

- Grading of the Treated Soils Fill Area surface so that surface water runoff is directed towards the south (*i.e.*, away from wetland and watercourse features located towards the north of the site; and
- Maintaining existing buffers of natural vegetation between disturbed areas and wetlands.

A 30 m setback will be established between site activities and wetlands.

Migratory birds are protected under the federal *Migratory Birds Convention Act* (MBCA) which prohibits killing migratory bird species, their eggs or young; except under authority of a permit thereof. Other bird species not protected under the federal Act, such as raptors, are protected under the provincial *Wildlife Act*. In order to avoid contravening these regulations, clearing, grubbing and stripping of vegetated areas, if required, will be preferentially conducted outside of the breeding season of most bird species (April 1 to August 15) so that the eggs and flightless young of birds are not inadvertently destroyed. Although none were observed during the field reconnaissance, the bank swallow fact sheet prepared by the Ontario Sand, Soil and Gravel Association (OSSGA) provides practical mitigation measures for bank swallows (OSSGA 2013).

### 2.3 PROCESS OVERVIEW

The treatment of impacted material will follow a procedure similar to that already established for treatment of materials designated for the LTLD plant (*i.e.*, PHC/PAH materials). The material will be treated via the following sequence of activities:

1. Material will be screened to remove oversize rocks and debris (oversize rock is not considered contaminated and will be segregated and disposed of separately);
2. Material will be homogenized to provide an optimum feed material;
3. Treatability testing will be completed to develop an optimum S/S reagent binder formulation;

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4. Analytical data will be collected to confirm compliance with the appropriate criteria; and
5. Treated material will be reused as noted in Section 2.4.6.

The proposed Project activities will be consistent with the current facility operations approved by NSE (Approval No. 2002-026440-R01; Appendix A) and any future amendments.

The existing infrastructure at the Envirosoil facility will be used to support the proposed S/S process. The only significant addition is an automatic pugmill system provided by Astec. The Astec system was chosen for its advanced pugmill design, its sophisticated level of automation, its automatic feeding and metering system and its proven reliability. The result is a final product that is extremely homogeneous in composition.

Figure 4 depicts the proposed equipment and Appendix C presents a specification and design data sheet for the proposed S/S plant.



**Figure 4** Pictures of Proposed S/S Equipment

## 2.4 S/S OPERATION

### 2.4.1 Binder/Reagent Selection and Mix Design

The S/S process involves the mixing of binders/reagents, additives, and water with impacted materials to produce a treated product having improved physical and chemical properties. A critical part of the S/S process is the development of an appropriate mix design of reagents and additives that will effectively achieve the treatment criteria.

The S/S process to be used by Envirosoil will involve the use of cementitious and/or pozzalanic reagents to solidify and stabilize the impacted materials. These reagents are the most commonly used S/S reagents to treat a wide variety of impacted materials. Cementitious and/or pozzalanic reagents include Portland cement, fly ash, ground granulated blast furnace

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slag, silica fume, cement kiln dust, various forms of lime and lime kiln dust. Although these reagents may be used singly or in various combinations, Portland cement is by far the most widely used. Fly ash is commonly used for the materials containing >50% peat.

Typical binder quantities vary from 75 kg/m<sup>3</sup> of contaminated soil up to 250 kg/m<sup>3</sup> of contaminated soil (*i.e.*, approximately 3% - 12% depending on soil density, contamination, binder type, *etc.*). Table 2 presents a general range of binder requirements for effective S/S of impacted materials. Although Table 2 presents quantities for individual binders, binder mixes consisting of two or more components are widely used and can be more versatile and effective in many cases. The quantities for multi-component binders are typically lower than for individual binders (*i.e.*, total binder quantities are not strictly additive).

**Table 2            Typical Binders and Quantities**

Binder Type	Required Quantity
Portland Cement	2% - 10%
Quicklime (calcium oxide)/Hydrated lime (calcium hydroxide)	1% - 10%
Cement kiln dust	0.5% - 5%
Blast furnace slag	0.5% - 10%
Fly Ash	2% - 15%
Water	12% - 40%

Prior to the treatment of impacted materials, a Treatability and Testing Program will be conducted. The Treatability and Testing Program will be developed with the assistance of Stantec and provided to NSE for review and comment. The program will be used to determine the optimal formulation of binders/reagents and design parameters to ensure that the treated material meets the appropriate criteria. During the program, various potential binders/reagents will be identified and tested. Final binder/reagent selection will be based on the type of contaminants to be treated, concentration of contaminants in the material and the material's geotechnical properties (*i.e.*, moisture, fines, particle size, *etc.*)

Stantec has many years of experience in the use of cement and cement products for S/S applications. The testing program will include:

- Description of program and number of samples for proposed tonnage to be treated;
- Selection of correct reagent(s);
- Optimization of the reagent(s) dosages and ratios;
- Identification of material handling issues;
- Assessment of the physical and chemical uniformity of the contaminated material;
- Confirm of the volume increase due to addition of reagent(s);
- Conformance to the treatability and performance criteria (*i.e.*, strength, leachability, *etc.*); and,
- Treated material physical parameters (*e.g.*, moisture content, slump, *etc.*).

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The above parameters will be confirmed by analytical work to evaluate the following:

- Initial contaminant concentrations – both mass and leachate;
- Treated material contaminate leachate analysis;
- Treated material compressive strength;
- Treated material hydraulic conductivity;
- Moisture cycling effects; and
- Temperature cycling effects.

Results of the Treatability and Testing program will be used to refine the final treatment mix designs to ensure the treatment criteria will be achieved.

### 2.4.2 Summary of Proposed Treatment Criteria

Table 3 includes proposed treatment criteria for stabilized and solidified material. Table 4 presents the variability criteria for each test parameter. These guidelines are conservative (*i.e.*, are protective) and are typically appropriate for most treatment and/or remedial activities. Following the proposed hydrogeological characterization of the subject Treated Soils Fill Area, the stated criteria maybe updated to reflect actual site conditions. If required, revisions will be completed in consultation with NSE.

Table 3 Summary of Proposed Treatment Criteria

Parameter	Test Description	Criteria
<b>Leachate</b>	SPLP	10 x EQS for Groundwater Value (metals, EC/SAR, hydrocarbons and PAHs based on source material chemistry)
<b>Mass Flux</b>	Tank Test	Leachability Index $\geq 8$ (if leachate tests fail)
<b>Strength</b>	UCS	344.7 kN/m <sup>2</sup> (50 psi) minimum
<b>Hydraulic Conductivity (HC)</b>	Falling Head Test	1 x 10 <sup>-6</sup> cm/sec
<b>Moisture Cycling</b>	Wet/Dry	Final placement minimum of 1 m above seasonal high groundwater table
<b>Temperature Cycling</b>	Freeze/Thaw	Final placement a minimum of 1.2 m (4 ft) below finished grade ( <i>i.e.</i> , below frost line) <u>or</u> to be completed where material is not covered Laboratory testing to ensure < 10% weight loss after 12 freeze/thaw cycles
<b>Free Liquids</b>	Free Liquids	US EPA Paint Filter Test. 5-min test period. If a portion of the material drops through the filter within the 5 min test the material is deemed to have free liquids.

The S/S performance objectives are to create a solidified mass that will no longer be prone to potential loss to the environment; this includes physically immobilizing the material and minimizing potential loss through leaching. The S/S treatment is also designed to provide a solidified mass that has the geotechnical strength properties to accommodate future land use. For this program, three types of performance criteria were chosen to demonstrate the potential of the solidified mass to meet these objectives: unconfined compressive strength; hydraulic

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conductivity and/or leachability. Leachability is commonly excluded as a specific performance objective if hydraulic conductivity criteria is established. A low hydraulic conductivity of the solidified mass inhibits groundwater penetration/migration through the waste, reducing the risk of leachate generation. Hydraulic conductivity is used as a performance criterion in lieu of leachability in other S/S processes.

For this project, Envirosoil proposes to utilize all three performance criteria in order to provide conservative treatment endpoints. Hydraulic conductivity testing will be completed during the mix design/treatability testing phase. Compressive strength and leachability testing will be conducted during both the design/treatability phase and field execution phase.

Table 4 Summary of Acceptable Performance Criteria Deviations

Parameter	Test Description	Criteria
<b>Leachate</b>	SPLP	Average of all samples $\leq 10 \times$ EQS Groundwater Value No individual sample $> 15 \times$ EQS Groundwater Value Not more than 20% of all values shall be $> 10 \times$ EQS Groundwater
<b>Mass Flux</b>	Tank Test	Performance Criteria (PC): Leachability Index $\geq 8$ Average of all samples $\geq$ PC No individual sample $< 6$ Not more than 20% of the samples values shall be $< PC$
<b>Strength</b>	UCS	Average of all samples $\geq 344.7 \text{ kN/m}^2$ No individual sample $< 275.8 \text{ kN/m}^2$ Not more than 20% of the samples $< 344.7 \text{ kN/m}^2$
<b>Hydraulic Conductivity (HC)</b>	Falling Head Test	Average of all samples $\leq 1 \times 10^{-6} \text{ cm/sec}$ No individual sample $> 1 \times 10^{-5} \text{ cm/s}$ Not more than 20% of the $> 1 \times 10^{-6} \text{ cm/s}$
<b>Moisture Cycling</b>	Wet/Dry If not buried $> 1 \text{ m}$ above seasonal groundwater	Performance Criteria (PC ): $< 10\%$ weight loss after 12 cycles Average of all samples $\leq PC$ No individual sample $> 20\%$ weight loss Not more than 20% of the samples values shall be $> PC$
<b>Temperature Cycling</b>	Freeze/Thaw If not buried $> 1.2 \text{ m}$ below finished grade	Performance Criteria (PC ) = $< 10\%$ weight loss after 12 cycles Average of all samples $\leq PC$ No individual sample $> 20\%$ weight loss Not more than 20% of the samples values shall be $> PC$

References for the above performance criteria are summarized as follows:

- USEPA. 2011. Development of Performance Specifications for Solidification/Stabilization. Prepared by The Interstate Technology & Regulatory Council Solidification/Stabilization Team. July 2011.
- EPA. 1999. Solidification/Stabilization Resource Guide. Office of Solid Waste and Emergency Response. EPA/542-B-99-002. April 1999.
- Environment Canada, US EPA and Alberta Environment. 1991. Investigation of Test Methods for Solidified Waste Evaluation – A Cooperative Program, Stegemann, J.A. and P.L. Cote.

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- Cote, P.L. Wastewater Technology Center, Environment Canada, USEPA and Ontario Ministry of Environment. 1991. Proposed Evaluation protocol for Stabilized/Solidified Waste.

### **2.4.3 Sample Collection Procedures**

In general, for ex-situ treatment methods, a bulk sample is typically collected from the discharge of the pugmill. The bulk sample is collected in a 20-L bucket and relocated to the sample preparation area for further processing, testing and sample specimen preparation.

Many tests on treated material require curing cylinder molds of a specific geometry and for a minimum period of time for hydration reaction to occur and the material to solidify. Preparation of sample specimens will follow standard procedures such as those outlined by American Society for Testing and Materials (ASTM) to promote consistent specimen preparation for the tests specified. Bulk material will be initially screened through a 1.3-cm mesh to remove oversize particles that would interfere with the specimen testing due to the relatively small size of test specimens (screen mesh size may vary depending on the size of the mold). Established standards and best management practices will be followed to get accurate results. A sufficient number of replicate samples will be prepared in the field.

### **2.4.4 Compliance Testing Sampling Plan**

The frequency of sampling freshly treated material depends on the overall size of the S/S project, the daily treatment rate, the observed consistency of mixing by the treatment facility, observed changes in the impacted material properties, and other factors. It is recommended that performance sampling of treated material be conducted considering the following (USEPA, 2011):

- Sample every 1000 tonnes of treated material (alternate frequencies may be appropriate based on overall volume to be treated for a site, anticipated contaminated material characteristics heterogeneity, and tests review as project progresses).
- Sample any time the impacted material or blended material physical characteristics appear to change significantly (e.g., greater contaminant level, significant variation in moisture content, significant variation in material gradation).

If failing tests occur, modifications to the mix design or blending method may be required and the sampling frequency will be increased until acceptable results are consistently achieved. All failed material will be reworked and re-solidified.

### **2.4.5 Equipment Layout and Material Handling**

#### **Equipment Layout**

The S/S equipment will be setup within the established boundaries of the current Envirosoil facility. All equipment will be located and operated within the confines of the existing clay liner

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system installed at the Envirosoil site. Figure 2 presents a site plan showing the proposed location(s) for the setup and operation of the S/S equipment.

### **Material Receipt, Storage and Handling Procedures**

Existing procedures established for waste acceptance under the existing Approval will apply to the receipt and acceptance of metals, EC and SAR materials. Existing procedures require that receiving soils be characterized prior to acceptance, including: analytical data confirming the contamination type and concentration levels; originating site location; and quantities. All materials received must be detailed on Envirosoil's Bill of Lading/Manifest including: date and time of arrival; originating site location and address; description of material; quantity; name of transport company; and Generator declaration of the accuracy of information provided.

It is anticipated that when fully operational the facility will receive 30,000 – 70,000 tonnes of impacted material per year that will be treated using the S/S technology. This additional quantity of materials does not require an increase in the current storage capacity of the Envirosoil facility. All of the requirements for analytical data, material receipt and tracking will be followed as required by the existing Industrial Approval.

All impacted materials will be stored within the confines of the Envirosoil facility and remain on the clay liner until treated. The metals impacted materials will be kept segregated from the materials that are designated for treatment in the LTLD unit.

### **2.4.6 Reuse of Treated Materials**

Once analytical data confirms that the inorganic metals, and/or the EC/SAR impacted materials have been successfully stabilized/solidified, Envirosoil proposes that the treated materials be placed at a site within the quarry property boundaries (Figure 3) within the quarry property boundaries.

Prior to reuse of the S/S material, the proposed receiving area will undergo a hydrogeological assessment as described in Section 5.2. Groundwater analysis will be expanded to include dissolved chlorides whenever there is high EC/SAR materials stored onsite (Section 5.2).

Prior to the placement of S/S materials, the receiving area will be suitably prepared (e.g., site grading, removing any large boulders, etc.). S/S material will be placed at the base so that materials are a minimum of 1 m above the water table to prevent moisture cycling in the unsaturated zone (hydrogeological characterization has yet to take place). Treated material will also be placed on a minimum base soil thickness of 1 m above bedrock. Solidified material will be placed in unlined cells in 2 to 3 m thick lifts. Once placed and covered, the S/S material will be compacted with a standard sized roller. The location of the placed material will be recorded yearly. Once placed and covered, ground surface will be graded to minimize ponding and promote drainage away from the covered material.



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At the end of each production season (*i.e.*, late fall) the deposited S/S material will be backfilled/covered with a minimum of 1.2 m (4 ft) of fill to ensure that the entire S/S monolith is below the local frost line to prevent temperature cycling. Interim covers may be placed to prevent material from being exposed for long periods of time. The fill cover will meet a hydraulic conductivity of  $10^{-5}$  cm/sec (consistent with NSE Industrial Approvals for select Construction and Demolition or C&D facilities in Nova Scotia). When used in conjunction with the requirement that the treated material be placed a minimum of 1 m above the seasonal high groundwater table, this will ensure that the material is protected from any potential degradation due to moisture or temperature cycling.

### **2.5 SCHEDULE**

Envirosoil operates on a year-round basis and maintains a full-time office with 24-hour accessibility. Pending approval, the new treatment options would commence in the summer of 2015. Treatment operations are normally confined to the months of May to October, unless dictated by project-specific requirements. During the operating season, the equipment will operate 5 days per week, 10 hours per day, unless project-specific requirements require longer operational times.

Envirosoil employs 12-15 staff and hourly employees at the facility site during the operational season. During the off-season, Envirosoil employs 4 to 5 full time employees. If volume increases, there will be a need to add further hourly workers and employees. This number can fluctuate depending on the activities taking place on-site. Employment levels are expected to remain the same following the addition of the new treatment options.

### **2.6 EFFLUENTS AND EMISSIONS**

Proposed Project activities (operation of the S/S equipment and the storage and treatment of EC/SAR impacted materials) will be consistent with the current facility operations approved by NSE (Approval No. 2002-026440-R01) and any subsequent amendments (Appendix A). The proposed Project amendments will not generate dust or noise at levels beyond those of the current Envirosoil operations.

Any monitoring of airborne particulate emissions (dust) is conducted at the request of NSE and in accordance with the Nova Scotia Air Quality Regulations and the facilities Approval permit (or future amendments) and shall not exceed the following limits at the property boundaries:

- Annual Geometric Mean  $70 \mu\text{g}/\text{m}^3$ ; and
- Daily Average (24 hrs)  $120 \mu\text{g}/\text{m}^3$ .

Cement dust will be controlled with appropriate filter mechanisms installed on the cement storage silos. These filters are industry standard equipment on all cement storage silos at cement plants and/or production facilities.

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The proposed Project amendments will not generate noise at levels beyond those of the current Envirosoil operations. As per the requirements of the current operating Approval and standard provincial guidelines, sound levels from the operation will be maintained at the following sound levels (Leq) at the property boundaries:

- Leq                      65 dBA                      0700-1900 hours (Days);  
                             60 dBA                      1900-2300 hours (Evenings); and  
                             55 dBA                      2300-0700 hours (Nights).

Envirosoil has handled PHC/PAH impacted materials for over 12 years without any issues related to odor.

All of the requirements for groundwater and surface monitoring, reporting and criteria will continue to be strictly followed. Details of the requirements are in the current operating Approvals (Appendix A). Groundwater analysis will be expanded to include dissolved chlorides whenever there is high EC/SAR materials stored onsite (Section 5.2).

The only solid materials generated by the S/S plant will consist of treated materials. The only solid materials generated by the impacted EC/SAR materials will consist of treated EC/SAR materials.

Combustion emissions will be generated from the operation of vehicles and equipment during Project activities. These emissions will be similar in quantities to the current operation. Emissions will be reduced through proper equipment maintenance and inspection practices for efficient operation. Consideration will be given to methods to reduce truck and equipment idling, as feasible.

Refuelling of equipment used to transport material to the Treated Soils Fill Area will continue to be conducted on-site on a regular basis. Refuelling activities will not be conducted within 100 m of any active stream or wetlands identified in the field surveys. Other control measures include implementing Envirosoil's existing best practices for handling of materials as well as established contingency plans. All spills will be reported to the 24-hour environmental emergencies reporting system (1-800-565-1633) in accordance with the Emergency Spill Regulations.

### 2.7 DECOMMISSIONING AND RECLAMATION

The Envirosoil facility is expected to be in operation for the foreseeable future with proper maintenance and according to market requirements. When permanent shut down of the facility is planned, Envirosoil will work with NSE to prepare a final decommissioning and reclamation plan according to regulations at the time. In general, it is expected that the equipment at the processing facility will be removed and any required site remediation will be conducted. The Treated Soils Fill Area will be closed, graded and re-vegetated. Sufficient financial bonding/security will be provided to NSE to cover these costs.

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Scope of the Environmental Assessment  
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## 3.0 Scope of the Environmental Assessment

The proposed Project must be registered for environmental assessment under the Environmental Assessment Regulations of the Nova Scotia *Environment Act* as a Class I Undertaking. This report substantially fulfils the requirements for Project registration under this legislation, as well as requirements outlined by NSE during the Project planning stages (NSE, pers comm, April 1, 2015).

There are no requirements under the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) as the proposed Project is not listed as a designated project as per Section 2 of the *Regulations Designating Physical Activities* and the Project does not take place on federal lands.

### 3.1 FIELD STUDIES

Field reconnaissance was conducted by Stantec on April 24, 28 and 29, 2015 to investigate and establish the existing conditions at the Envirosoil facility and the proposed Treated Soils Fill Area location, and to determine appropriate mitigation, if necessary, to manage environmental effects from the proposed Project. Information on the location and character of wetlands, watercourses, and general habitat conditions in and near the Envirosoil facility and proposed Treated Soils Fill Area was also gathered during the three site visits in April 2015.

The boundaries of the assessment at the existing Envirosoil facility were confined to the land parcel on which current activities are restricted. The existing processing facility site is located in a disturbed area, characterized by gravel pads, roads, and soil mounds. The proposed Treated Soils Fill Area is located in an area within the Municipal Quarry property boundaries. At the Treated Soils Fill Area, exposed soils characterize this area; this area is also elevated above the surrounding terrain. An approximate 50 m area surrounding the current disturbed footprint of the proposed Treated Soils Fill Area was searched for wetlands and watercourses but surveys extended to beyond 100 m from the edge of the current footprint when features of interest were encountered.

### 3.2 VALUED COMPONENT (VC) IDENTIFICATION

The scope of the EA for the proposed Project has been determined by the Proponent and Stantec, and is based upon the proposed Project elements and activities, the professional judgment of the study team, consultations with NSE, previous site information and reporting, and the results of three site visits conducted in April 2015 in support of this EA. Additional information on the facility, environmental setting and surrounding area is provided in the 2003 EA (Envirosoil 2003).

This EA focusses the evaluation of potential environmental effects of the proposed Project amendments on Valued Components (VCs). VCs are broad components of the biophysical and socio-economic environments that, if altered by the Project, may be of concern to regulatory agencies, the Mi'kmaq of Nova Scotia, scientists, and/or the general public.

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Table 5 indicates scoping considerations and selection of VCs used in this EA.

**Table 5 Scoping of VCs**

Component	Scoping Considerations	VC
<b>Biophysical Environment</b>		
Groundwater	The Project has the potential to interact with groundwater resources. The Project could potentially affect groundwater and surface water quality down-gradient. Effects on groundwater resources are discussed in the VC.	<ul style="list-style-type: none"> <li>Groundwater Resources</li> </ul>
Surface Water, Fish and Fish Habitat	The S/S process does not generate any wastewater that would require dedicated collection and/or treatment. All operational aspects of the S/S process will occur within the confines of the current Envirosoil facility and within the boundary of the existing clay liner system. The storage of impacted EC/SAR materials has the potential to generate runoff high in dissolved chlorides due to the percolation of rainwater over and through the stockpiled material during periods of heavy rainfall or snowmelt. No fish and fish habitat will be affected by the Project. The Project could affect groundwater at the Envirosoil facility and potentially affect groundwater and surface water quality down-gradient. Effects on surface water resources are discussed in the VC.	<ul style="list-style-type: none"> <li>Surface Water Resources</li> </ul>
Wetlands	Wetlands are valued resources, protected by the Nova Scotia <i>Environment Act</i> and Regulations. No wetlands (naturally occurring or anthropogenic) are present on the processing site, and because the settling pond lacks an outflow, it is isolated from down gradient water resources. Three wetland areas were identified in the surrounding area around proposed Treated Soils Fill Area. Surface runoff at the Treated Soils Fill Area will be directed away from wetlands and a 30 m setback will be maintained. Potential for groundwater flows to enter wetlands will be discussed in the context of interactions with surface water. No alterations to wetlands are anticipated.	<ul style="list-style-type: none"> <li>Surface Water Resources</li> </ul>
Flora and Fauna	There will be no new ground disturbance at "greenfield" areas. The existing processing site is confined to the land parcel on which current activities are restricted. The existing processing site is located in a disturbed area, characterized by gravel pads, roads, and soil mounds. The proposed Treated Soils Fill Area is also in a highly disturbed area. No direct habitat loss and disturbance to wildlife is expected. Migratory birds are protected by the <i>Migratory Birds Convention Act</i> (MBCA).	<ul style="list-style-type: none"> <li>N/A</li> </ul>
Atmospheric Conditions/Air Quality	Envirosoil is situated in an industrial area that is separated from residential areas and sensitive land uses. Envirosoil is an existing operation that has procedures for the handling of materials designated for LTTD treatment. These materials have been handled for over 12 years without any issues related to dust or other air emissions. Cement dust will be controlled with appropriate filter mechanisms installed on the cement storage silos. These filters are industry standard equipment on all cement storage silos at cement plants and/or production facilities. Emissions are further discussed in Section 2.6. Envirosoil will continue to comply with existing permit conditions.	<ul style="list-style-type: none"> <li>N/A</li> </ul>

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Scope of the Environmental Assessment  
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**Table 5          Scoping of VCs**

Component	Scoping Considerations	VC
Noise Levels	Envirosoil is situated in an industrial area that is separated from residential areas and sensitive land uses. S/S operations and the handling and treatment of impacted EC/SAR materials will not generate noise at levels beyond those of the current Envirosoil operations at the industrial site. Emissions are further discussed in Section 2.6. Envirosoil will continue to comply with existing permit conditions.	<ul style="list-style-type: none"> <li>N/A</li> </ul>
<b>Socio-economic Conditions</b>		
Land Use	The Project will not interact with surrounding land uses including residential and recreational land use. The Envirosoil facility and proposed Treated Soils Fill Area are located on private land with restricted access.	<ul style="list-style-type: none"> <li>N/A</li> </ul>
Transportation	The Project is not proposed to significantly increase traffic on public roads. Transportation of materials will be along existing private access roads in the quarry.	<ul style="list-style-type: none"> <li>N/A</li> </ul>
Cultural and Heritage Resources	There will be no new ground disturbance. The existing processing site is confined to the land parcel on which current activities are restricted. The existing processing site is located in a disturbed area, characterized by gravel pads, roads, and soil mounds. Existing permit conditions will continue to be followed should there be a chance find of an archeological or heritage resource.	<ul style="list-style-type: none"> <li>N/A</li> </ul>

# ENVIRONMENTAL ASSESSMENT REGISTRATION FOR THE ENVIROSOIL FACILITY: ADDITION OF STABILIZATION/SOLIDIFICATION TECHNOLOGY

Consultation and Engagement  
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## 4.0 Consultation and Engagement

NSE reviewed a preliminary project description and comments were received on the S/S technology following the technical review. These comments and questions were addressed in Section 2 of this EA.

A teleconference was held on April 16, 2015 with the NS EA Officer (NSE, pers comm, April 1, 2015). The purpose of the call was to: provide information about the Project; identify and discuss issues and concerns to inform the scope of the EA; and to discuss the proposed Project schedule and regulatory approvals process.

The existing Envirosoil facility has been in operation since 1992 and there have been no known issues or complaints to date. The facility operates under an existing Approval (Approval No.2002-026440-R01) and is on privately owned lands that are not open to the public for recreational use.

This EA Registration document will be subject to a public review process as required under provincial legislation. Copies of the EA Registration document will also be provided by NSE to Mi'kmaq organizations including the Kwilmu'kw Maw-klusuaqn (KMKNQ). The document will be posted on the NSE website <http://www.novascotia.ca/nse/ea/> with paper copies at several locations including near the Project area. Publication dates and Registration document locations will be advertised in one Province-wide newspaper and one local newspaper. Public and Mikmaq comments regarding the EA Registration will be collected and reviewed by NSE to inform the Minister's decision regarding the proposed Project.

## **5.0 Valued Component and Effects Management**

### **5.1 EFFECTS ANALYSIS METHODS**

A focused approach is used for the EA using the VCs identified in the scoping process described in Section 3.0. EA is used as a planning tool not only to identify predicted Project effects, but also to design mitigative strategies to reduce adverse effects and propose monitoring programs where substantial risk or uncertainty remains.

For the selected VCs, existing conditions in the facility area and proposed Treated Soils Fill Area are described. Potential Project-VC interactions are identified and effects, including proposed mitigation, are predicted. Effects are analyzed qualitatively, and, where possible, quantitatively, using existing knowledge, professional judgment and other analytical tools, where appropriate.

To assess the potential environmental effects of the Project and determine the significance of an effect, the study team has considered the magnitude, frequency, duration, geographical extent and reversibility of the potential effect, where applicable. In particular, regulatory standards were used, where appropriate, to determine thresholds of significance for predicted environmental effects after application of mitigation (*i.e.*, residual effects).

Requirements for follow-up and monitoring are linked to the potential sensitivity of the VC to predicted environmental effects as well as levels of uncertainty with respect to the prediction of effectiveness of mitigation.

### **5.2 GROUNDWATER RESOURCES**

Groundwater is an integral component of the hydrologic cycle that originates from the infiltration of precipitation or surface water into the ground. Within the subsurface, the upper surface of the saturated zone is called the water table. The water table intersects the surface at springs, lakes, streams where interaction between groundwater and surface water resources can occur. There is a dynamic interaction between groundwater resources and surface water resources in Nova Scotia. Groundwater generally sustains the base flow of springs, streams and wetlands during dry periods of the year. More rarely, surface water bodies can contribute to groundwater storage under certain hydrogeological conditions.

Aquifers are saturated geological formations or groups of formations that can store or yield useable bodies of permeable rock or unconsolidated material capable of storing or yielding useable volumes of groundwater to wells or springs. The yield of dug or drilled wells can vary greatly, depending on the hydraulic properties of overburden and bedrock aquifers into which wells are constructed. Natural groundwater quality is directly influenced by the geochemical composition of the aquifer materials through which it passes, and the length of time the water resides within those materials.



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Groundwater has been selected as a VC because of its importance to local ecosystems (e.g., wetlands and watercourses) and as a local private potable water supply. Groundwater Resources will be assessed in the context of potential Project-related effects on groundwater quality and quantity and will consider the Envirosoil facility and proposed Treated Soils Fill Area separately.

### **5.2.1 Existing Conditions for Groundwater Resources**

#### **Physiography and Drainage**

The Envirosoil facility is located within the footprint of the Municipal Quarry which is situated in the watershed of Rocky Lake (5.11 km<sup>2</sup>). The treated Soils Fill Area is located along the southwest border of the Lake William watershed (22 km<sup>2</sup>) and is within a sub-catchment of Marshall Brook. Lake William is one of the headwater lakes for the Shubenacadie Canal System and receives water from Rocky Lake and six other inlets along the south and west shores.

Surface topography is primarily bedrock controlled.

#### **Surficial Geology**

Surficial geology within the vicinity of the Site at higher elevations primarily consists of a thin veneer of glacial till and exposed bedrock outcrop. A quartzite till surrounds the till veneer and is approximately 1-10 m thick along Rocky Lake Road. The quartzite till consists of a light bluish-grey, loose matrix of angular clasts comprised of approximately 80% sand, 15% silt and 5% clay with large cobbles (Stea and Fowler 1981).

The proposed Treated Soils Fill Area is on an existing lobe of fill material that is upwards of 18 m thick. The source and composition of the fill material is not documented. A visual inspection during a site visit indicates the material is poorly sorted with grain sizes ranging from fines to boulders. Boulders have been placed preferentially around the perimeter of the filled area. The grain size distribution and heterogeneity of materials within the filled area has not been characterized; however, based on visual observation, it is expected that the bulk hydraulic conductivity of this materials is greater than the glacial till and bedrock.

#### **Bedrock Geology**

The bedrock in the vicinity of the Site consists of Cambrian-Ordovician aged fractured meta-sandstone (greywacke) and minor slate of the Goldenville Formation of the Meguma Group (Keppie 2000). The Goldenville Formation is not generally considered to be acid generating, although it is possible within mineralized zones. The occurrence of natural arsenic, in the form of arsenopyrite, in the Goldenville Formation is well known and documented (Grantham 1976; Grantham and Jones 1977).

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Tightly-folded bedrock forms northeast-trending ridges and swales in the landscape. The ridges are more competent meta-sandstones and control drainage and surface water features. The Treated Soils Fill Area is bordered to the north and south by such ridges (the swale is being filled). The southern ridge terminates a short distance to the east towards Lake William.

### **Groundwater Flow**

Approximate groundwater flow directions at the Envirosoil facility are interpreted based on topography. While local topography, stockpiles, active quarry operations and dewatering, and the clay liner underlying the facility site might act to induce southerly shallow local groundwater flow, the larger groundwater flow system is likely north-northwest towards Rocky Lake. The local groundwater flow direction is inferred from water levels measured in 10 shallow monitoring wells located around the outside perimeter of the existing facility. There are no monitoring wells internal of lined areas to establish if a hydraulic connection is present between the lined containment pond and the groundwater system.

Shallow groundwater flow within the Lake William watershed is expected to mimic topography, move northeasterly, and discharge to streams other surface water features and Lake William. The large lobe of fill underlying the Treated Soils Fill Area could induce groundwater mounding within its footprint and result in local radial outward groundwater flow.

The possible mechanisms for flow out of the Treated Soils Fill Area include: 1) seepage out of the toe of the fill at the fill-glacial till interface due to the contrast in permeability with direct discharge to surface water; 2) recharge into the till and upper weathered rock beneath the fill which is part of interflow with discharge to surface water features within close proximity; and 3) recharge into the deeper bedrock system beneath the pile due to a downward vertical gradient with more distal discharge to surface water features. There is no monitoring network currently in place in this area to assess groundwater flow.

### **Water Wells**

A survey of domestic water wells was previously conducted in 2005 as part of the Quarry Modification Project Environmental Assessment Registration (Jacques Whitford 2005). Domestic water supply in the vicinity of the Treated Soils Fill Area would be derived from dug or drilled wells. Water supply for the Lakeview Area, across Rocky Lake, is mainly provided by Halifax Water. The closest residential wells are located on Rocky Lake Road (unknown type) and Lakeview Drive (dug) approximately 1.7 km north of the Envirosoil facility. The closest commercial well is a drilled bedrock well reportedly in shale (Goldenville Formation) and is on Municipal Quarry property.

The Treated Soils Fill Area is bounded by forested area, which includes a rail line. No confirmed commercial or residential properties with dug or drilled wells are located within 1.5 km based on the data available in the Nova Scotia Interactive Groundwater Map (NSDNR 2014).

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### Water Quantity

Yields from dug wells are not reported but are expected to be relatively low. The glacial tills in the vicinity of the Treated Soils Fill Area have high silt and clay content and thus have a relatively low hydraulic conductivity on the order of  $10^{-7}$  to  $10^{-9}$  m/s (Freeze and Cherry 1979). Low hydraulic conductivity would result in low rates of groundwater infiltration and high potential for surface water retention (and wetland formation where drainage is poor).

Jacques Whitford (2005) compiled information from 38 available NSE well records for drilled bedrock wells that are reportedly located along Rocky Lake Drive or in Lakeview in the vicinity of the Treated Soils Fill Area. While the well locations have not been verified, the compilation of well construction details provides an indication of likely drilled well conditions. The average well depth is 64 m. Well yields range from nil to 36.4 L/min, with a median yield of 4.5 L/min which is relatively low but suitable for domestic use.

### Water Quality

The water quality from wells constructed in the Goldenville Formation is expected to be good, with most parameters meeting the Canadian Drinking Water Guidelines (Health Canada 2014). Arsenic in excess of drinking water guidelines is possible as a naturally-occurring water quality issue. Other potential aesthetic problems such as iron, manganese and moderate hardness have occasionally been reported (Jacques Whitford 2005).

The Envirosoil facility has an on-going groundwater quality monitoring program established under the current operating permit. The current groundwater quality monitoring for wells MW1-MW9 occurs bi-monthly for BTEX (benzene, toluene, ethylbenzene, and xylene)/TPH and quarterly for PAHs. Monitoring wells MW1, MW2, MW8R and MW9 are also sampled quarterly for metals, pH, phenols, conductivity, sulfate, and TSS. Water quality is not currently monitored at the proposed Treated Soils Fill Area.

## 5.2.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up

### 5.2.2.1 Potential Effects and Proposed Mitigation

#### *Envirosoil Facility*

The proposed changes at the existing Envirosoil facility relate to salt-impacted materials being stored and handled, and a new S/S operation and the associated equipment. Both of these activities are similar to current operations covered under existing approvals.

Potential groundwater quantity effects are expected to remain unchanged from existing conditions. The footprint of future operations remains within the confines of the lined Envirosoil facility.

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Project-related contamination could affect groundwater at the Envirosoil facility and potentially affect well water and surface water quality down-gradient. This could result from the release of fuel, lubricants and other industrial fluids associated with operations. It could also result from the infiltration of rain water or snow melt into stockpiles and the leaching and mobilization of salt, metals and organics. This water would have to breach the confines of the clay liner by leaking through or spilling over it, and migrate to the water table. The current Envirosoil facility is designed to prevent this from occurring.

Groundwater elevation contours and inferred flow lines developed by SLR (2015) show that the local groundwater flow spreads radially to the south of the lined area towards other parts of the quarry facility. Thus, contaminated groundwater could be captured by the quarry sump system. The regional flow direction is interpreted as being north towards Rocky Lake. In either case, the nearest water well is greater than 800 m away and is not likely in the flow path of groundwater moving from this location. This remains unchanged from existing and approved site conditions.

The proposed mitigation measures include following Best Management Practices (BMPs) for handling and storing all treated and untreated waste materials in addition the BMPs already established for operations under the existing approval. Proposed future S/S operations will remain with the confines of the lined Envirosoil facility. The Envirosoil facility will continue to be operated above the water table to retard the movement of contaminants into the groundwater system. Existing procedures established for waste acceptance under the existing Industrial Approval will apply to the receipt and acceptance of metals, EC and SAR materials.

### *Treated Soils Fill Area*

The Treated Soils Fill Area is proposed to receive S/S monoliths of organics and salt and metals-impacted soils. The Treated Soils Fill Area is constructed of poorly-sorted geologic materials on the order of 18 m thick.

Potential groundwater quantity effects are expected to remain unchanged from existing conditions; however these existing groundwater conditions remain to be characterized.

Project-related contamination could affect groundwater at the Treated Soils Fill Area and down-gradient groundwater and surface water receptors. This could result from the release of fuel, lubricants and other industrial fluids associated with operations. It could also result from the infiltration of rain water and snow melt into the Treated Soils Fill Area and the leaching and mobilization of salts, metals and organics from the S/S material before discharging from the pile via the potential mechanisms outlined in the Section 5.2.1. In theory, it could discharge directly into surface water at the toe of the fill. It could enter the shallow groundwater system under the pile as interflow and discharge to proximal surface water. It could migrate deeper into bedrock and discharge to surface water at more distal points such as Marshall Brook. The mechanism depends on the hydraulic characteristics of the fill, the glacial till and bedrock. This area has not been characterized to identify the mechanism or the likely receiving environment(s). There are no down-gradient groundwater wells.

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The proposed mitigation measures include following BMPs for handling and storing all treated and untreated waste materials outlined in this document in addition to the BMPs already established for operations under the existing approval. The Treated Soils Fill Area will be operated above the water table. The position of the water table in the fill has not yet been characterized. The magnitude of the potential effect would depend on mass loading at the source, the amount of dispersion and retardation in the environment, and the transit time. However, S/S is a proven technology that is widely used and is designed to reduce leaching of contaminants; S/S is inherently a mitigation measure. Downstream effects will be identified through further testing and monitoring and adaptive management will be applied as necessary so that all applicable criteria are maintained.

### 5.2.2.2 Monitoring and Follow-up

#### *Envirosoil Facility*

It is recommended that the 10 existing perimeter groundwater monitoring wells at the Envirosoil facility continue to be used for obtaining groundwater elevation and groundwater samples. The revised sampling frequency and analyte list proposed by SLR (2015) is appropriate for monitoring proposed operations (Appendix D). The monitoring program should be reviewed every two years.

#### *Treated Soils Fill Area*

Monitoring wells are needed to characterize the groundwater system around the Treated Soils Fill Area. Four to six shallow (5 m) monitoring wells should be installed around the perimeter of the Treated Soils Fill Area. Two additional multi-level well pairs are recommended. The first well pair should be located in the fill with the shallow interval completed at the fill-till-bedrock interface. The deeper interval should be completed 15 m into bedrock. The second well pair should be located down-gradient of the fill. The shallow and deep intervals should be completed in bedrock at depths of 5 m and 15 m, respectively.

In addition to monitoring wells, drive point wells should be installed in the toe of the fill at local lows where seepage might occur.

Manual groundwater level measurements should be conducted in all wells on a quarterly basis. Automated water level loggers should be deployed in the shallow and deep intervals of the multi-level well pairs.

Collectively, this monitoring network will help to define the groundwater flow regime and how it interacts with the fill. It will also help to identify which discharge mechanisms are at play and what the receiving water is likely to be.

Quarterly groundwater samples should be collected for a period of two years and analyzed for the same parameters as at the Envirosoil facility (RCap-MS, Volatile Organic Compounds or

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VOCs, BTEX/TPH, PAH, TSS and phenols) to establish baseline conditions. One down-gradient surface water sampling location will also be established (see Section 5.3, Surface Water Resources). If concentrations are observed to increase in relation to onsite activity, appropriate interception schemes or low-permeability capping alternative may be considered depending on the CCME guidelines for the receiving environment.

The water level measurement and chemical sampling programs should be reviewed after two years. The scope of the monitoring program should be evaluated in conjunction with the plan for onsite activity.

### **5.2.2.3 Summary**

S/S is a proven technology that is widely used and is designed to reduce leaching of inorganic and organic contaminants, and is designed specifically as an environmental protection measure.

The USEPA has identified S/S with cement as a Best Demonstrated Available Technology for more than 50 major industrial waste types and contaminants. There are no confirmed commercial or residential properties with dug or drilled wells located within 1.5 km of the Treated Soils Fill Area, based on the data available (NSDNR 2014). The closest residential wells are approximately 1.7 km north of the Envirosoil facility. The proposed monitoring will determine if there are any residual concerns and adaptive management will be applied as necessary so that all applicable criteria are maintained.

The Envirosoil facility is lined and S/S operations will continue to be operated above the water table. Existing procedures established for waste acceptance under the existing Industrial Approval will apply to the receipt and acceptance of metals, EC and SAR materials.

Assuming the application of proposed mitigation, monitoring and adaptive management measures are implemented and the integrity of the clay liner is maintained, significant Project-related effects on groundwater resources are not likely to occur or can be managed using the information provided by the monitoring program.

## **5.3 SURFACE WATER RESOURCES**

### **5.3.1 Description of Existing Conditions**

Surface water resources, including surface water quality and quantity, are included as a VC because of the potential interactions with the Project. Surface water resources are also affected by changes in associated wetlands and hydrology.

#### *Envirosoil Facility*

The S/S process at the Envirosoil facility does not generate any wastewater that would require dedicated collection and/or treatment. All operational aspects of the S/S process will occur

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within the confines of the current Envirosoil facility and within the boundary of the existing clay liner system.

### *Treated Soils Fill Area*

The mapped watercourse found to the north of the Treated Soils Fill Area (Figure 3) is a tributary to Lake William. As a result of the excessively rocky nature of the terrain, the majority of the mapped watercourse that is found in proximity to the site (*i.e.*, which runs through Wetland 1) runs below ground surface and would not be considered fish habitat. Channelized flow is occasionally visible amongst the large boulders but the watercourse is largely subterranean until it enters the boundary of the NSDNR-identified swamp and a forms a pronounced surface channel through organic substrate (reference to aerial imagery indicates that surface channeling is also prevalent up gradient). This surface channel is located approximately 200 m from the edge of the proposed infill area and would be considered potential fish habitat. Additional subterranean drainages are present throughout the forests at the northern end of the Treated Soils Fill Area and feed into the provincially mapped watercourse.

Several areas of wetland were identified in the vicinity of the Treated Soils Fill Area (Figure 3). The largest area of wetland habitat is located to the north of the site. In this area, a treed swamp (Wetland 1) is located in association with a provincially mapped watercourse. This wetland drains towards the north and feeds into a large swamp that has been identified through aerial imagery by the Nova Scotia Department of Natural Resources (NSDNR), the approximate location of its southern boundary being confirmed during the site visit. A small patch of remnant swamp (Wetland 2) is located on the eastern border of the proposed Treated Soils Fill Area. This wetland lacks a channelized outflow but drains towards the north via subterranean flow. A small basin swamp that lacks an inlet or outlet is also present on the eastern side of the site (*i.e.*, Wetland 3) and occurs within a linear depression caused by bedrock ridges. Field delineated wetlands were comprised of deciduous and mixedwood treed swamp. Red maple and black spruce formed the majority of the tree canopy within these wetlands, which typically had a well-developed tall shrub understory of mountain holly (*Nemopanthus mucronatus*), common winterberry (*Ilex verticillata*), speckled alder (*Alnus incana*) and regenerating tree species. Ground vegetation was limited at the time of visit but cinnamon fern (*Osmunda cinnamomea*), manna grass (*Glyceria sp.*), and peatmoss (*Sphagnum spp.*) provide important components to this layer.

### **5.3.2 Potential Effects, Proposed Mitigation, Monitoring and Follow-up**

#### **5.3.2.1 Potential Effects and Proposed Mitigation**

##### *Envirosoil Facility*

Potential effects on surface water resources will be reduced through site design and other mitigation techniques. The S/S process at the Envirosoil facility does not generate any wastewater that would require dedicated collection and/or treatment. All operational aspects



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of the S/S process will occur within the confines of the current Envirosoil facility and within the boundary of the existing clay liner system.

Treatment of impacted materials will not be performed during periods of inclement weather involving the potential for significant rainfall. Any water collected within the storage cells/lagoons will be handled as per the requirements of the existing Approval. All of the requirements for surface water monitoring, reporting and criteria, and any further amendments, will continue to be adhered to (Appendix A).

### *Treated Soils Fill Area*

Prior to the placement of S/S materials, the Treated Soils Fill Area, will be suitably prepared (e.g., site grading, removing any large boulders). S/S material will be placed at the base so that materials are a minimum of 1 m above the water table. Solidified material will be placed in unlined cells in 2 to 3 m thick lifts and covered.

Project activities have potential to cause erosion and deposition of sediment to down gradient surface water resources (including wetlands and watercourses), particularly during periods of heavy rainfall or snowmelt. Potential effects to surface water resources will be reduced through site design and other mitigation techniques, including:

- Grading of the Treated Soils Fill Area surface so that surface water runoff is directed towards the south (i.e., away from wetland and watercourse features located towards the north of the site); and
- Maintaining existing buffers of natural vegetation between disturbed areas and wetlands.

No wetland alterations are expected and surface water drainage will be directed away from wetlands. A 30 m setback will be established between site activities and wetlands.

### **5.3.2.2 Monitoring and Follow-up**

It is recommended that the existing groundwater and surface water monitoring locations at the Envirosoil facility continue to be used for obtaining samples. The revised sampling frequency and analyte list proposed by SLR (2015) is appropriate for monitoring proposed operations (Appendix D). The monitoring program should be reviewed every two years.

The proposed groundwater and surface water monitoring program for the Treated Soils Fill Area, described in Section 5.2 and Appendix D, will also detect changes in shallow groundwater potentially discharging to surface water flows. One down-gradient surface water sampling location will also be established. If concentrations are observed to increase in relation to onsite activity, appropriate interception schemes or low-permeability capping alternative may be considered depending on the CCME guidelines for the receiving environment. The water quality of the effluent exiting any the site will continue to meet parameters as stated in the facility's

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current Industrial Approval and future amendments. This includes any surface water quality and quantity monitoring required by NSE.

### **5.3.2.3 Summary**

S/S is a proven technology that is widely used for treating contaminated soil through a cement-based process, and is designed specifically as an environmental protection measure. Potential effects on surface water resources will be further reduced through site design and other mitigation techniques. The S/S process at the Envirosoil facility does not generate any wastewater that would require dedicated collection and/or treatment. All operational aspects of the S/S process will occur within the confines of the current Envirosoil facility and within the boundary of the existing clay liner system.

At the proposed Treated Soils Fill Area, the nearest fish habitat is located approximately 200 m from the edge of the proposed infill area. No wetland alterations are expected and surface water drainage will be directed away from wetlands. A 30 m setback will be established between site activities and wetlands. At the Treated Soils Fill Area, soils will be stripped systematically to a pre-determined depth below ground surface. S/S material will be placed at the base so that materials are a minimum of 1 m above the water table. Solidified material will be placed in unlined cells in 2 to 3 m thick lifts and covered and locations will be monitored.

Based on the results of the surface water assessment, existing mitigation, and the mitigation, monitoring and adaptive management measures proposed, significant Project-related effects on surface water resources are not likely to occur or can be managed using the information provided by the monitoring program.

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Other Approvals Required  
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### 6.0 Other Approvals Required

As stated in Section 2.0, the Proponent is required to register this Project as a Class I Undertaking pursuant to the Nova Scotia *Environment Act* and Environmental Assessment Regulations.

Other relevant provincial regulations include the Activities Designation Regulations, which requires an amendment to the existing Industrial Approval (No.2002-026440-R01) from NSE for construction and operation of the Project. Copies of approval permits are included in Appendix A.

Requirements under the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) are not anticipated as this type of soil treatment operation is not listed as a designated project as per Section 2 of the *Regulations Designating Physical Activities* and does not occur on federal lands.

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Funding  
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## 7.0 Funding

The proposed Project will be 100 percent privately funded.

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Additional Information  
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## **8.0 Additional Information**

No additional information is provided in support of this document.

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Summary  
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## 9.0 Summary

S/S is proven and widely used method for treatment of impacted soils and is designed specifically as an environmental protection measure. All operational aspects of the S/S process, as well as operational aspects of the receipt, handling, storage and treatment of impacted materials will occur within the confines of the current Envirosoil facility and within the boundary of the existing clay liner system. The proposed Treated Soils Fill Area or restoration area is located approximately 2 km southeast of the Envirosoil treatment facility, within the Municipal Quarry property boundaries. Access to the existing the Envirosoil processing facility and proposed Treated Soils Fill Area is along existing roads. Solidified material at the Treated Soils Fill Area will be placed in unlined cells in 2 to 3 m thick lifts and covered. No wetland alterations are expected and surface water drainage will be directed away from wetlands. A 30 m setback will be established between site activities and wetlands.

Activities associated with the proposed Project, including requirements for groundwater and surface monitoring, reporting and criteria, will be conducted in accordance with terms and conditions of the Industrial Approval (No. 2002-026440-R01) pursuant to Division V of the Activities Designation Regulations, as well as future amendments to the Industrial Approval.

Assuming the mitigative measures, monitoring and adaptive management (if required) specified in this EA are implemented, and the facility continues to be operated according to existing and any future provincial guidelines and approvals, significant Project-related effects are not likely to occur.

# ENVIRONMENTAL ASSESSMENT REGISTRATION FOR THE ENVIROSOIL FACILITY: ADDITION OF STABILIZATION/SOLIDIFICATION TECHNOLOGY

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## 10.0 References

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### **10.2 PERSONAL COMMUNICATIONS**

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NSE. 2015. Telephone communication with NSE (Helen Yeh) regarding Environmental Assessment Registration scoping and project information, April 16, 2015.



# ENVIRONMENTAL ASSESSMENT REGISTRATION FOR THE ENVIROSOIL FACILITY: ADDITION OF STABILIZATION/SOLIDIFICATION TECHNOLOGY

Appendices  
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## 11.0 Appendices

APPENDIX A	Existing Permits
APPENDIX B	Existing Envirosoil Facility Plan
APPENDIX C	S/S Equipment Design & Specifications
APPENDIX D	2015 Revised Site Monitoring Program (SLR 2015)

**ENVIRONMENTAL ASSESSMENT REGISTRATION FOR THE ENVIROSOIL FACILITY: ADDITION OF  
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**Appendix A  
Existing Permits**

## APPROVAL

Province of Nova Scotia  
*Environment Act*, S.N.S. 1994-95, c.1

APPROVAL HOLDER: Envirosoil Limited

SITE PID: 40237182

APPROVAL NO: 2002-006440-R01

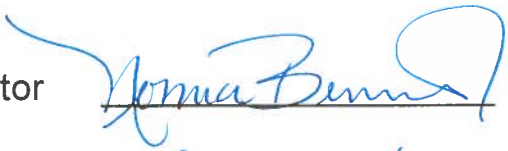
EXPIRY DATE: January 9, 2022

Pursuant to Part V of the *Environment Act*, S.N.S. 1994-95, c.1 as amended from time to time, approval is granted to the Approval Holder subject to the Terms and Conditions attached to and forming part of this Approval, for the following activity:

Operation of a Contaminated Soil Treatment Facility, and associated works, at or near 48 Quarrystone Drive, Bedford, Halifax Regional Municipality, in the Province of Nova Scotia.

Administrator

Effective Date

  
August 9/2012

# **TERMS AND CONDITIONS OF APPROVAL**

## **Nova Scotia Environment**

**Approval Holder:** Envirosoil Limited  
**Project:** Contaminated Soil Treatment Facility  
**Site:** 48 Quarrystone Drive  
Bedford, Halifax Regional Municipality

**Approval No:** 2002-026440-R01

**File No:** 30100-31-BED-026440

### **Reference Documents:**

- Application dated December 20, 2011 and attachments
- All previous documentation on this process contained in file 30100-31-BED-026440.
- Drawing # 8370-7-1R1, Site Plan and Monitor Well Locations, Envirosoil Limited., Soil Recycling Facility, Rocky Lake Quarry, Jacques Whitford, January 28, 2003.

### **1. Definitions**

- a) "Act" means the Environment Act S.N.S. 1994-1995. c. 1 and includes all regulations made pursuant to the Act.
- b) "Administrator" means a person appointed pursuant to Section 21 of the Act.
- c) "Approval" means an Approval issued pursuant to Section 50 (1) & (2) of the Act.
- d) "Associated works" means any building, structure, processing facility, pollution abatement system or stockpiles associated with the Facility.
- e) "Department" means the Central Region, Bedford Office, of Nova Scotia Environment located at the following address:

Nova Scotia Environment  
Environmental Monitoring and Compliance Division  
Central Region, Bedford Office,  
Suite 115, 30 Damascus Road,  
Bedford, Nova Scotia, B4A 0C1.

Phone: (902) 424-7773

Fax: (902) 424-0597

- f) "District Manager" means district manager of the Department.
- g) "Facility" means the contaminated soil treatment facility, including associated works.
- h) "Minister" means the Minister of Nova Scotia Environment.
- i) "PAH's", polycyclic aromatic hydrocarbons, refers to the list of PAH's identified in the *Canadian Council of Ministers of the Environment (CCME) Canadian Environmental Quality Guidelines* and *Nova Scotia Environment Guidelines For Disposal of Contaminated Solids in Landfills*, both, as amended from time to time.
- j) "Regional Director" means regional director of the Department.
- k) "Site" means the lands encompassing PID# 40237182, situated at civic 48 Quarrystone Drive, Bedford, Halifax Regional Municipality (HRM) associated with the Facility.

## **2. Scope of Approval**

- a) Reference Drawing # 8370-7-1R1, Site Plan and Monitor Well Locations, Envirosoil Ltd., Soil Recycling Facility, Rocky Lake Quarry, Jacques Whitford, January 28, 2003. This approval (the "Approval") relates to Envirosoil Limited (the "Approval Holder") and their Contaminated Soil Treatment Facility (the "Facility") to store, treat and dispose of barium based drill mud waste, petroleum hydrocarbon, creosote, coal and polycyclic aromatic hydrocarbon contaminated soils at 48 Quarrystone Drive within the property of the quarry operated by Municipal Enterprises Limited (the "Site").
- b) This Approval relates to the application of low temperature thermal desorption technology (the "LTDD unit") for barium based drill mud waste and petroleum and PAH impacted soils only.
- c) For the purpose of this Approval, PAH impacted soils which are acceptable for treatment are as defined in the *Policy For Facilities For The Thermal Treatment Of Soils.*, April 6, 2002 and subsequent revisions.

- d) Soils containing contaminants which would cause them to be classified as waste dangerous goods as defined in the *Dangerous Goods Management Regulation* are not to be treated at this Facility, with the exception of those soils specifically exempted by the *Policy For Facilities For The Thermal Treatment Of Soils*.
- e) Approval # 2002-026440-R01 replaces Approval # 2002-026440-A01, which is now null and void.

### **3. General Terms and Conditions**

- a) The Approval Holder shall operate it's Facility in accordance with provisions of the:
  - i) *Environment Act*, S.N.S. 1994-95, C.1, as amended from time to time;
  - ii) Regulations, as amended from time to time, pursuant to the above *Act*.
- b) The Approval Holder is responsible for ensuring that they operate the Facility on lands which they own or have a lease or written agreement with the landowner or occupier. The Approval Holder shall be responsible for ensuring that the Department has, at all times, a copy of the most recent lease or written agreement with the landowner or occupier. Breach of this condition may result in cancellation or suspension of the Approval.
- c) If there is a discrepancy between the reference documents and the terms and conditions of this Approval, the terms and conditions of this Approval shall apply.
- d) Any request for renewal or extension of this Approval is to be made in writing, to the Department, at least ninety (90) days prior to the Approval expiry.
- e) The Minister or Administrator may modify, amend or add conditions to this Approval at anytime pursuant to Section 58 of the Act.
- f) This Approval is not transferable without the consent of the Minister or Administrator.
- g)
  - i) If the Minister or Administrator determines that there has been non-compliance with any or all of the terms and conditions contained in this Approval, the Minister or Administrator may cancel or suspend the Approval pursuant to subsections 58(2)(b) and 58(4) of the Act, until such time as the Minister or Administrator is satisfied that all terms and conditions have been met.
  - ii) Despite a cancellation or suspension of this Approval, the Approval

Holder remains subject to the penalty provisions of the Act and regulations.

- h) The Approval Holder shall notify the Department prior to any proposed extensions or modifications of the Facility, including process changes or waste disposal practices which are not granted under this Approval. Extensions or modifications to the Facility may be subject to the *Environmental Assessment Regulations*. An amendment to this Approval will be required before implementing any change.
- i) Pursuant to Section 60 of the Act, the Approval Holder shall submit to the Administrator any new and relevant information respecting any adverse effect that actually results, or that may potentially result, from any activity to which the Approval relates and that comes to the attention of the Approval Holder after the issuance of the Approval.
- j) The Approval Holder shall immediately notify the Department of any incidents of non-compliance with this Approval.
- k) The Approval Holder shall bear all expenses incurred in carrying out the environmental monitoring required under the terms and conditions of this Approval.
- l) Unless specified otherwise in this Approval, all samples required to be collected by this Approval shall be collected, preserved and analysed, by qualified personnel, in accordance with recognized industry standards and procedures.
- m) Unless written approval is received otherwise from the Administrator, all sample required by this Approval shall be analysed by a laboratory that meets the requirements of the Department's *Policy on Acceptable Certification of Laboratories*, as amended from time to time.
- n) The Approval Holder shall submit any monitoring results or reports required by this Approval to the Department. Unless specified otherwise in this Approval, all monitoring results shall be submitted within 30 days following the month of monitoring.
- o) The Approval Holder shall ensure that this Approval, or a copy, is kept on Site at all times and that personnel directly involved in the Facility operation are made fully aware of the terms and conditions which pertain to this Approval.

#### 4. Liability Insurance

- a) The Approval Holder shall maintain Third Party Environmental Liability Insurance of at least \$1,000,000 to cover clean up costs in the event of contamination caused by the operation of this Facility. The coverage shall name the Department as an insured and the issuing agency must provide notice to the Department 30 days prior to cancellation of the policy.

#### 5. Acceptance Criteria

- a)
  - i) Soils shall only be accepted at the Site with appropriate documentation and analytical characterization. Minimum analysis shall include total benzene, toluene, ethylbenzene and xylene (BTEX), total petroleum hydrocarbons (TPH) and benzene. Analysis for PAH parameters listed in Table 1 shall be conducted on all soils which indicate that a specific PAH is detectable through the required BTEX\TPH analysis.
  - ii) Analysis previously carried out at the source as a result of environmental investigations shall constitute compliance with Condition 5. a) i). This condition is exempted for situations involving contamination from domestic petroleum hydrocarbon fuel oil spillage.
- b)
  - i) The Approval Holder shall not accept drill mud waste or soils contaminated with petroleum hydrocarbon or PAH which also contain inorganic metal contaminants exceeding the most recent *Canadian Council of Ministers of the Environment (CCME), Canadian Environmental Quality Guidelines*, Industrial Criteria for soil.
  - ii) With the exception of condition 5. b) i), the Approval Holder shall not accept drill mud waste or soils contaminated with petroleum hydrocarbon or PAH which also contain other contaminants exceeding the most recent *Canadian Council of Ministers of the Environment (CCME), Canadian Environmental Quality Guidelines* Residential/Parkland Criteria for soil.
  - iii) All drill mud waste and soils with contaminants exceeding those identified in Conditions 5. b) i) and ii) shall be reported to the Department for review prior to acceptance at the Site. The Regional Director or District Manager may approve the treatment of soils and subsequent disposal on a case by case basis. Leachate testing of soils for specific parameters may be required to determine acceptance and disposal/reuse requirements.
  - iv) Exemption to condition 5. b) i) is extended to the parameter of barium when it is associated with barium sulphate in the drill mud waste.



- v) Soils which can be reasonably suspected of containing contaminants such as inorganic, halogenated or chlorinated compounds shall be analysed for specific contaminants consistent with condition 5. b) i) and ii) prior to acceptance for treatment at the Facility.
- c) Only soils which are generated in Nova Scotia or within the immediate offshore area of the Province of Nova Scotia shall be treated at the Facility under the conditions of this Approval, unless otherwise approved by the Regional Director or District Manager.

## **6. Soil Delivery**

- a) Soil shall be accepted during normal working hours and every load shall be fully documented with the following information:
  - i) Date and time of arrival
  - ii) Name and address of source
  - iii) Quantity (weight and volume)
  - iv) Name of transport company
  - v) Truck registration number
  - vi) Name and license of truck owner
  - vii) Proof of analysis
  - viii) Name of contact approving shipment at source
- b) The above condition may be exempted for emergency situations. The Facility may accept contaminated soil from emergency response incidents with prior authorization from the Department without the need for prior sampling or testing. This material shall be stored in a separate stockpile at the Site until analysis of soil can be completed.

## **7. Contaminated Soil/Drill Mud Storage and Handling**

- a) The Approval Holder shall not process contaminated soil or drill mud containing free liquid, excluding water.
- b) Contaminated soil/drill mud shall be stored in a segregated area.
- c) The Approval Holder shall not mix or dilute contaminated soil/drill mud with uncontaminated material(s).

## 8. Air Emissions

### Sound Levels

- a) Sound levels measured at the Site property boundaries shall not exceed the following equivalent sound levels (Leq):

65dBA (0700-1900 hours) Day  
60dBA (1900-2300 hours) Evening  
55dBA (2300-0700 hours) Night

- b) Monitoring of sound levels shall be conducted at the request of the Regional Office.

### Fugitive Dust Emissions

- c) Fugitive dust emissions shall not exceed the following limits at the Site property boundaries:

Annual Geometric Mean	70 $\mu\text{g}/\text{m}^3$
Daily Average (24 hr.)	120 $\mu\text{g}/\text{m}^3$

- d) The generation of fugitive dust emissions from the Site will be suppressed by the application of water sprays, or the application of other suitable dust suppressants approved by the Department. The use of waste or used oil is not permitted.
- e) Monitoring of fugitive dust emissions shall be conducted at the request of the Department.

### Ambient Air

- f) The Approval Holder shall ensure that air emissions from the Facility do not contribute to an exceedance of the maximum permissible ground level concentrations specified in Schedule "A" of the *Air Quality Regulations*.
- g) Where the Approval Holder is contributing to exceedances of the Schedule "A" concentrations, the Approval Holder shall be required to implement a corrective action plan which may include ambient air monitoring or air modelling.

- h) The Approval Holder shall be required to monitor ambient air ground level concentrations or complete air modelling for selected contaminants at the request of the Department. Monitoring and air modelling procedures shall meet the approval of the Department. Ambient air ground level monitoring or air modelling may be requested if results of stack testing or continuous emissions monitoring indicate a potential non-compliance with the terms and conditions of this Approval.

#### Stack Emissions

- i) The LTTD unit shall be stack tested for compliance with the emission criteria established in Table 1 and Condition 8. o) (ie. all PAH contaminants listed in CCME, *Canadian Environmental Quality Guidelines*) every two years.
- j) The test shall be conducted while processing PAH and petroleum hydrocarbon contaminated soils which are acceptable to the Department.
- k) The following parameters shall be continuously monitored and recorded whenever the LTTD unit is in operation:
- carbon monoxide concentrations in the stack gas,
  - gas temperature at the exit from the secondary treatment unit (STU),
  - the baghouse pressure drop.
  - gas temperature at the inlet to the baghouse
  - oxygen concentration at the outlet to the STU

**Note: Continuous monitoring for opacity may be required by the Department if particulate emissions become a concern.**

- l) The baghouse shall be fully functional and in operation whenever the LTTD unit is operating. A preventive maintenance program shall be implemented to ensure the baghouse is operating to expected efficiency.
- m) Corrective actions, additional air emission controls and/or additional monitoring may be required if off-site impacts, such as odour or particulate become a problem.
- n) The Approval Holder may be required to make modifications to the Facility or the LTTD unit if there is sustained non-compliance with the air emission limits established in this Approval or if Destruction and Removal Efficiency (DRE) for PAH's or particulate removal efficiency drops below the results of the test burn evaluation.
- o) The DRE for PAH destruction and removal from the LTTD unit shall be at a minimum 99.99%. DRE shall be calculated based on the total mass of all PAH inputs to the airstream and PAH outputs to the stack.



**Department of  
Environment & Labour**

PO Box 697  
Halifax, Nova Scotia  
B3J 2T8

*Our File Number:*  
10700-40  
40100-34-93

Office of the Minister

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Original Dated June 6, 2003

Dick Tiller  
Envirosoil Limited  
P.O. Box 48100  
Bedford, NS  
B4A 3Z2

Dear Mr. Tiller:

**Re: Environmental Assessment - Envirosoil Limited - Proposed Remediation of  
Soils Containing Perchloroethylene and its Daughter Products**

The environmental assessment of the proposed remediation of soils containing perchloroethylene and its daughter products by Envirosoil Limited, 315 Rocky Lake Drive, Waverley, Halifax County, Nova Scotia, has been completed.

This is to advise that I have approved the above project in accordance with Section 13(1)(b) of the *Environmental Assessment Regulations*, pursuant to Part IV of the *Environment Act*. I am satisfied following a review of the information provided by Envirosoil Limited, and through the government and public consultation as part of the environmental assessment, that any adverse effects or significant environmental effects of the undertaking can be adequately mitigated through compliance with the attached terms and conditions.

This letter in conjunction with the attached terms and conditions constitutes my approval. This approval is subject to any other approvals required by statute or regulation, including but not limited to, approval under Part V of the Nova Scotia *Environment Act* (Approvals and Certificates section).

If you have any questions regarding the approval of this project, please contact the Manager, Environmental Assessment Branch, Mr. Chris Daly at (902) 424-4936.

With personal regards,  
Original Signed

Ronald S. Russell, CD  
Minister  
MLA - Hants West

Encl.

# **Environmental Assessment Approval**

**Approval Date: Original Dated June 6, 2003**

## **Remediation of Soils Containing Perchloroethylene and its Daughter Products**

**Envirosoil Limited**

**Waverley,  
Halifax County, Nova Scotia**

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Remediation of Soils Containing Perchloroethylene and its Daughter Products (the "Undertaking"), proposed by Envirosoil Limited (the "Proponent"), 315 Rocky Lake Drive, Waverley, Halifax County, is approved pursuant to Section 13(1)(b). This Approval is subject to the following conditions and obtaining all other necessary approvals, permits or authorizations required by municipal, provincial and federal acts, regulations, by-laws, guidelines, policies or standards before commencing work on the Undertaking. It is the responsibility of the Proponent to ensure that all such approvals, permits or authorizations are obtained before commencing work on the Undertaking.

This Environmental Assessment Approval is based upon the review of the conceptual design, environmental baseline information, impact predictions, and mitigation presented in the Registration Information.

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## **Terms and Conditions for Environmental Assessment Approval**

### **1.0 General Approval**

- 1.1 The Environmental Assessment Approval for the project is limited to the project as described in the registration document. Plans for any proposed extension, expansion, modification or relocation of any aspect of the Undertaking from that proposed in the registration document shall be submitted to the Environmental Assessment Branch for review and may require an environmental assessment.
- 1.2 Unless granted a written extension by the Minister, the Environmental Assessment Approval shall expire within two years of the date of its issuance unless the Proponent commences work on the Undertaking by the end of the two year period.

- 1.3 The Proponent shall implement all mitigation and commitments in the Registration Document, unless approved otherwise by the NSDEL or as indicated in the attached terms and conditions.
- 1.4 a) The Proponent shall not transfer, sell, lease, assign or otherwise dispose of this approval without the written consent of the Minister.
- b) The sale of a controlling interest of a business or a transfer of an approval from a parent company to a subsidiary or an affiliate is deemed to be a transfer requiring consent under 1.4(a) of these Terms and Conditions.

## **2.0 Groundwater Resources**

- 2.1 The Proponent, as part of the application for amendments to the Part V Approval under the *Environment Act* shall provide for review and approval:
- a) details of a groundwater monitoring program. This program shall be designed to confirm impacts to groundwater resources and provide an early warning of any unexpected groundwater impacts migrating from the facility. Based on the results of monitoring programs, the Proponent shall make necessary modifications to monitoring programs, equipment, facility operation and/or mitigation measures to prevent continued unacceptable environmental effects to the satisfaction of NSDEL.

## **3.0 Surface Water**

- 3.1 All discharges from the site must meet the NSDEL requirements.
- 3.2 The Proponent, as part of the application for amendments to the Part V Approval under the *Environment Act*, shall provide for review and approval:
- a) details regarding erosion and sediment control protection
- b) details regarding the monitoring, maintenance and upgrading of the collection pond
- c) details regarding the program to monitor surface water, including sampling locations and parameters. Sampling shall include event sampling as well as routine sampling. Stations shall include the collection pond and Lily Lake outfall. Based on the results of monitoring programs, the Proponent shall make necessary modifications to monitoring programs, equipment, mitigation plans and/or facility operations to prevent continued unacceptable environmental effects to the satisfaction of NSDEL.

## **4.0 Public Consultation**

- 4.1 The Proponent shall form a Community Liaison Committee (CLC) in consultation with the NSDEL and with municipal and community representatives. The NSDEL *Guidelines for the Formation of a Community Liaison Committee* (attached) shall be used for the guidance of the Proponent and community.

## **5.0 Archaeological Resources**

- 5.1 The Proponent shall cease work and contact the Director, Heritage Division, Nova Scotia Department of Tourism and Culture, immediately upon discovery of an archaeological site or artifact unearthed during any phase of the proposed project.

## **6.0 Noise**

- 6.1 All equipment is to be operated with standard noise suppression exhaust systems and kept in good repair.
- 6.2 The Proponent shall monitor for noise at the request of the NSDEL.

## **7.0 Facility Operation and Maintenance**

- 7.1 The Proponent, as part of the application for amendments to the Part V Approval under the *Environment Act*, shall:
- a) provide for review and approval details of a plan to perform a test burn(s) of soils contaminated with perchloroethylene and its daughter products, the results of which must meet the requirements established by the NSDEL
  - b) undertake a test burn(s) as per an approved NSDEL plan
  - c) provide for review the results of the test burn(s). Based on the results of the test burn and the ability of the facility to meet the required emission limits and soil remediation criteria, the Proponent may be required to submit for review and approval plans for further test burns, undertake these, and provide results to the NSDEL.
- 7.2 The Proponent can only begin full-scale treatment of soils contaminated with perchloroethylene and its daughter products once and if the NSDEL is satisfied with the results of the test burn(s).

- 7.3 In the event the Proponent is able to meet the parameters required by the NSDEL, the Proponent shall submit for review and approval prior to beginning full-scale treatment of soils contaminated with perchloroethylene and its daughter products:
- a) details of an air monitoring program, which shall include but not be limited to, stack emission and ambient air parameters and monitoring protocols. The monitoring program shall also include vapours from stockpiled material. If monitoring program results do not meet NSDEL requirements, the Proponent shall make necessary modifications to monitoring programs, equipment, facility operation and/or mitigation measures to the satisfaction of the NSDEL
  - b) detailed plans for facility operation including but not limited to plans for any modifications necessary to meet NSDEL requirements, operation and shutdown schedules
  - c) details of a handling and monitoring program for accepting untreated materials which ensures the only halogenated organic solvent in soil accepted by the facility is perchloroethylene and/or its daughter products
  - d) details of a handling and monitoring program for screened and treated materials ensuring NSDEL treatment criteria are met
  - e) details of stockpiling, including, as a minimum, locations, volumes, characteristics, duration, and erosion protection measures
  - f) details of the facility liner system capable of handling perchloroethylene and its daughter products to meet the NSDEL requirements.
- 7.4 The Proponent shall participate in future airshed management program(s) as required by the NSDEL.
- 7.5 Petroleum products shall not be used as a dust suppressant.
- 7.6 The facility can only handle materials as approved by the NSDEL.

## **8.0 Decommissioning and Reclamation**

- 8.1 The Proponent shall provide NSDEL's Regional or District Manager, Central Region, with a finalized abandonment plan three months prior to the permanent shut down of the undertaking for approval.



## 9.0 Contingency Plan

- 9.1 As part of the application for amendments to the Part V Approval under the *Environment Act*, the Proponent shall provide an acceptable contingency plan that addresses:
- a) accidental occurrences, including but not limited to contingencies for fires
  - b) procedures for responding to fire incidents and incidents occurring during times when the facility is not staffed (e.g. evenings, weekends, holidays).

Original Signed By

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Ronald S. Russell, CD  
Minister of Environment and Labour

# **GUIDELINES FOR THE FORMATION OF A COMMUNITY LIAISON COMMITTEE**

## **PREAMBLE**

The following guidelines are presented to assist Proponents and community representatives in establishing a Community Liaison Committee. Conditions of Release under the *Environment Act* may necessitate further guidance by the Department.

The earlier the formation of the Committee, the more likely it will be that the Committee will be able to address in a timely and sensitive fashion the issues which may be raised by a particular project. Proponents are encouraged to establish, where warranted, a Community Liaison Committee as early as possible in the planning stages of the proposed undertaking.

## **PURPOSE AND STRUCTURE**

A Community Liaison Committee is an advisory body to the project Proponent and provides input on matters regarding operations or approvals/permits that have or are perceived to have environmental impacts. Community representatives provide an avenue for the exchange of information on the project to interested individuals.

The Community Liaison Committee is intended to be an ongoing mechanism established with the following terms of reference:

- a) for consultation between the Proponent and the residents of the area on the final design and operational stages of an approved undertaking as stipulated in the Conditions of Release, which impact or are perceived to impact on the environment and the quality of life of the residents in the area;
- b) the establishment of a forum for ongoing dialogue between the facility operators and area representatives for consideration of any issues of public concern;
- c) a means for the facility operator to provide information to, consult with, and obtain advice from a body representative of the community; and
- d) a provision whereby the residents can bring any issues which occasion public concern to the attention of the facility operators.

A Committee may choose to establish additional terms of reference that address specific issues of interest to the community.

It is the Proponent's responsibility to hold an organizational meeting with any interested parties to determine the make-up and mandate of the Committee. Interested parties or representatives could be ascertained during the public consultation review process. The Committee should be kept to a manageable size, in most cases no greater than ten members.

Members of the Committee may be chosen from individuals or groups representing the geographic area which will be impacted by the project. However, if there are specific groups impacted by the project who do not reside within the immediate area, the Proponent, in consultation with the Community Liaison Committee, may decide to select additional members.

The Proponent is to be represented at all Committee meetings.

The Committee shall ensure that the views of the Committee are made available to the public in an appropriate manner. This could include the posting of minutes in a public place in the affected area or the provision of minutes to interested parties.

Where the Committee is established by Conditions of Release under the *Environment Act* notice of the formation of said Committee shall be made known to the residents of the affected area and include a list of Committee members.

The selection of a Chairperson shall be the responsibility of the Proponent. This may be achieved through an election by CLC members, the appointment of Co-chairs, the selection of an impartial third party, or through another process chosen by the Proponent.

The mandate and membership of the Committee is to be reviewed on an annual basis.

The Committee shall establish a schedule of meetings.

## **PROCEDURES**



The Proponent shall be responsible for the provision of meeting space, copying of minutes (copies to be sent to regulatory agencies) and, where applicable, an annual meeting and annual reporting.

**ENVIRONMENTAL ASSESSMENT REGISTRATION FOR THE ENVIROSOIL FACILITY: ADDITION OF  
STABILIZATION/SOLIDIFICATION TECHNOLOGY**

Appendices  
May 2015

**Appendix B**  
**Existing Envirosoil Facility Plan**



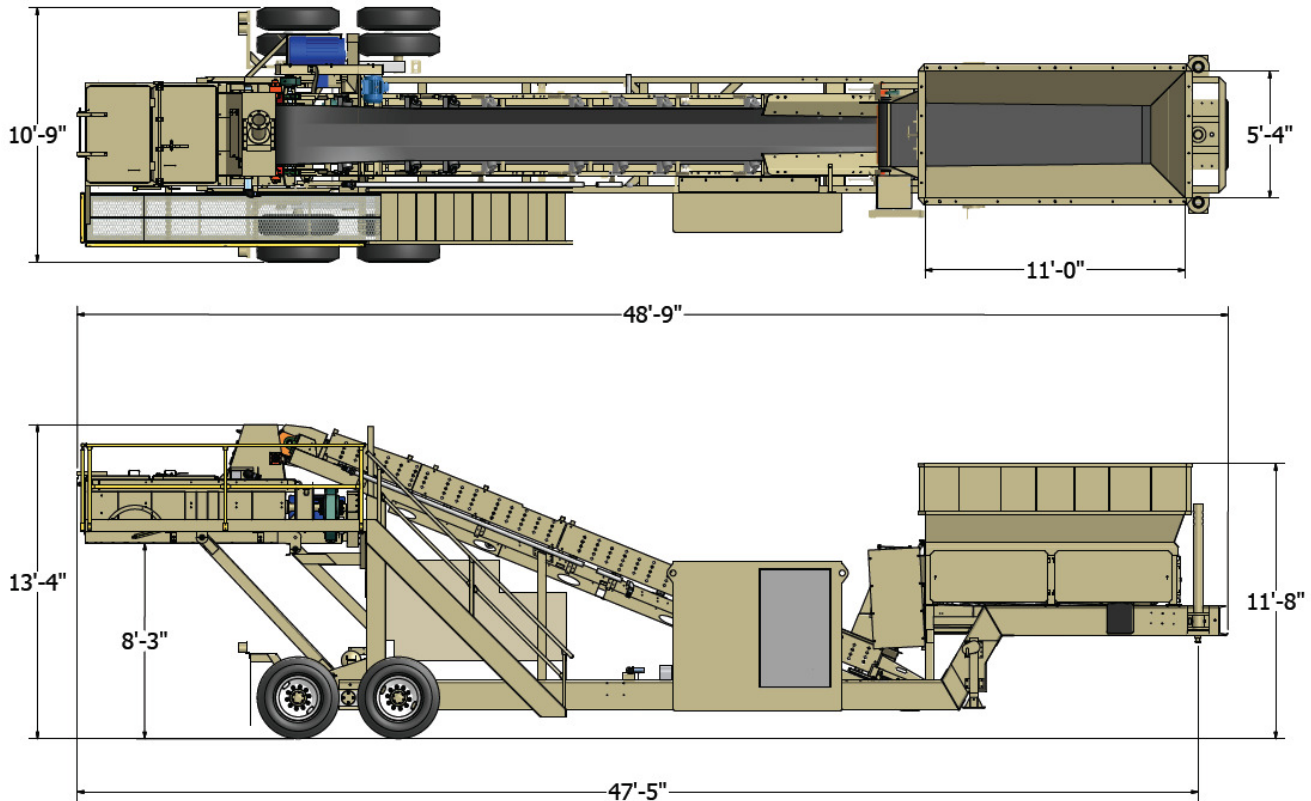
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**ENVIRONMENTAL ASSESSMENT REGISTRATION FOR THE ENVIROSOIL FACILITY: ADDITION OF  
STABILIZATION/SOLIDIFICATION TECHNOLOGY**

Appendices  
May 2015

**Appendix C**  
**S/S Equipment Design & Specifications**





#### **Primary Hopper Belt Feeder:**

The primary hopper has a nine cubic yard capacity with an 11' x 5'-4" top opening. The sides of the hopper have a 70 degree slope and are constructed of 3/16" thick A-36 steel.

The primary belt feeder is positioned underneath the primary feed hopper. The belt feeder is powered with a 5 hp variable speed electric drive. The feeder has a belt-width of 36" and is 11'-6" long.

#### **Feed Conveyor:**

The feed conveyor transfers material from the feed hoppers to the pugmill mixing box. It has a heavy duty channel-type frame, and is powered with a 7.5 hp electric head end drive. The conveyor is 27'-6" long and has a belt width of 30".

#### **Pugmill:**

The twin shaft pugmill consists of an enclosed 4' x 6' mixing box with AR steel liners. Enclosed in the mixing box are two heavy-duty 6" XH counter rotating shafts. These shafts push 40 double tip paddles in an overlapping spiral arrangement. The paddles are 4 3/4" x 5 1/4" x 1" Ni-hard tips set at a 45 degree pitch. Paddle tips have an adjustable wall clearance range of 3/4" to 2".

Power is transferred to the rotating shafts from a 60 hp electric motor through a v-belt/gear reducer drive. The reducer drives a single shaft which in turn powers the other shaft. The shafts are coupled with 3" timing gears that rotate in an oil bath.

The mixing box has an adjustable dam gate, a receiving hood, a spray bar, inspection doors, and a drop out bottom for easy clean out.

### Chassis:

The pugmill plant's portable chassis consists of a heavy duty channel-style frame with a gooseneck and kingpin located at the feed end of the plant. The chassis utilizes a walking beam-type tandem axle with dual 11.0 x 22.5 tires (8 total) located at the discharge end. The kingpin area of the chassis is supported with hand crank landing gear during storage and two pin lock tube style support legs during operation.

### Secondary Hopper:

The optional secondary hopper has a six cubic yard capacity with an 10' x 5' top opening. The sides of the hopper have a 60 degree slope and are constructed of 3/16" thick A-36 steel.

The secondary belt feeder is positioned underneath the secondary feed hopper. The belt feeder is powered with a 5 hp variable speed electric drive. The feeder has a belt-width of 30" and is 8' long.

### Water System:

The pugmill plant's optional water system includes a 150 gpm pump (powered by a 3 HP motor), a flowmeter, and a valve. The system can be configured per customer request to be adjusted manually or to be automatically proportioned.

### Asphalt System:

The optional asphalt system includes a 100 gpm pump (powered by a 10 hp motor), a flowmeter, and a valve. The system can be configured per customer request to be adjusted manually or to be automatically proportioned.

### Walkway:

The 24" wide walkway gives the operator access to the pugmill mixing chamber. It consists of an operator's platform and a stairway (with handrail) to provide access to the platform from the ground.

### Automatic Proportioning:

Automatic Proportioning is an optional feature that utilizes feedback from a belt scale to automatically adjust the amount of additives (e.g. water, asphalt, fly ash) that will be combined with varying amounts of material being fed to the pugmill mixing box.

### Controls:

Controls for the pugmill plant are located on a ground accessible panel mounted to the side of the plant. Operators have start/stop capability for the plant as well as the ability to vary both the speed of the belt feeder and the rate at which any additives will be blended into the feed material.

### Physical / Operating Characteristics:

Overall Length .....	48'-9"
Travel Length; kingpin to tail: .....	47'-5"
Travel Height .....	13'-4"
Travel Width .....	10'-9"
Feed Height.....	11'-8"
Discharge Height.....	8'-3"
Travel Weight (kingpin) .....	10,400 lbs
Travel Weight (axle) .....	26,400 lbs

### Mixing Capacities (100 pcf material):

Dry Material Throughput .....	300 TPH
Water System (Optional) .....	150 GPM
Asphalt System (Optional) .....	100 GPM

### Options:

Secondary Feed Hopper (6 yd<sup>3</sup>)  
Belt Scale  
Dry Solids Flowmeter  
Diesel Genset (95 KW)  
Hydraulic Dribble Gate with Power Pack  
Manual Water System  
Automatic Water System  
Manual Asphalt System  
Automatic Asphalt System  
Discharge Hood



700 W. 21<sup>st</sup> Street – P.O. Box 20  
Yankton, South Dakota 57078  
Phone: (605) 665-8771  
FAX: (605) 665-8858  
[mail@kpijci.com](mailto:mail@kpijci.com)  
[www.kpijci.com](http://www.kpijci.com)

**NOTE: Specifications are subject to change without notice.**

Because KPI-JCI may use in its catalog & literature, field photographs of its products which may have been modified by the owners, products furnished by KPI-JCI may not necessarily be as illustrated therein. Also continuous design progress makes it necessary that specifications be subject to change without notice. All sales of the products of KPI-JCI are subject to the provisions of its standard warranty. KPI-JCI does not warrant or represent that its product meet and federal, state, or local statutes, codes, ordinances, rules, standards or other regulations, including OSHA and MSHA, covering safety, pollution, electrical wiring, etc. Compliance with these statutes and regulations is the responsibility of the user and will be dependent upon the areas and the use to which the product is put by the user. In some photographs, guards may have been removed for illustrative purposes only. This equipment should not be operated without all guards attached in their normal position. Placement of guards and other safety equipment is often dependent upon the area and the use to which the product is put. A safety study should be made by the user of the application, and, if required additional guards, warning signs and other safety devices should be installed by the user, wherever appropriate before operating the products.



**ENVIRONMENTAL ASSESSMENT REGISTRATION FOR THE ENVIROSOIL FACILITY: ADDITION OF  
STABILIZATION/SOLIDIFICATION TECHNOLOGY**

Appendices  
May 2015

**Appendix D**  
**2015 Revised Site Monitoring Program (SLR 2015)**



March 27<sup>th</sup>, 2015

Jerry Scott  
Envirosoil Limited  
P.O. Box 48100  
927 Rocky Lake Drive  
Bedford, NS  
B4A 3Z2

**CONFIDENTIAL**

**SLR Project No.: 210.05726.00015**

**RE: 2015 REVISED SITE MONITORING PROGRAM, ENVIROSOIL RECYCLING FACILITY, 48 QUARRYSTONE DRIVE, BEDFORD, NS**

Dear Mr. Scott,

SLR Consulting (Canada) Ltd. (SLR) is providing the following letter in accordance with Nova Scotia Environment's (NSE) requirement for a revised site monitoring program to address Envirosoil Limited's (Envirosoil) Request for Amendments Related to Approval No. 2002-026440-R01, dated December 5, 2014. Features of the site, including monitor wells, surface water sampling locations, groundwater elevations and flow plan, are shown in **Drawing 1**.

### **Current Monitoring Program**

SLR collects groundwater and surface water samples at a monthly frequency for various parameters in accordance with NSE approval 2002-026440-R01 for the Construction, Operation and Reclamation of a Soil Recycling Facility including preparation of quarterly monitoring reports and one annual report. The current monitoring program schedule is outlined in **Table 1**, attached, including specified parameters at each sample location.

### **Proposed Site Monitoring Program**

NSE is requesting a revised monitoring program encompassing aspects associated with the proposed stages of a soil Solidification/Stabilization (S/S) process and the handling of salt impacted soils, including disposal on site.

Pending approval, the proposed changes would take effect for the next regularly scheduled monitoring event. Quarter 1 (January, February and March 2015) monitoring events have been completed in accordance with the current Approval (No. 2002-026440-R01). The current and proposed monitoring plans are outlined in **Table 1 & 2**. The proposed changes are highlighted and the rationale for each change is provided in reference to the proposed amendments. Detailed information for each proposed amendment at the Envirosoil facility is found in **Appendix A**.

### Amendment #1 – Solidification/Stabilization (S/S)

Envirosoil is requesting that the current approval be expanded to allow for the installation and operation of a cement-based Stabilization/Solidification process to treat soils impacted with low level organics and inorganic metals. The proposed monitoring program includes additional PAH, phenols and metals sampling based on Amendment #1 (**Appendix A**):

#### 1.) ES1 (Holding Pond, Surface Water) and ES2 (Lily Lake, Surface Water)

Each surface water sampling location will continue to be monitored monthly; however, more parameters will be added for each sample. A full suite of general chemistry and total metals parameters will be collected from each location including electrical conductivity, chloride, a metals scan among other parameters. Additional analysis of phenols and PAH's have been added to ES1 due to its proximity to the proposed S/S equipment location at the Envirosoil site.

Note that phenols and PAH are currently collected from ES2 (Lily Lake) at a monthly frequency as outlined with the current approval and will remain the same in the proposed site monitoring program.

#### 2.) Groundwater (Monitor Wells: MW1, MW2, MW3, MW4A, MW5, MW5A, MW6R, MW7R, MW8R, MW9)

Currently, all wells are monitored bi-monthly for benzene, toluene, ethylbenzene, xylenes and Total Petroleum Hydrocarbons (BTEX/TPH) and quarterly for polycyclic aromatic hydrocarbons (PAH). Under the proposed changes, all wells will be monitored quarterly for BTEX/TPH and polycyclic aromatic hydrocarbons PAH aligning sampling event frequency with those for other approvals (see Item 3, below) and monitoring potential groundwater impacts from materials with low level organics.

#### 3.) Additional Groundwater Analysis (Monitor Wells: MW1, MW2, MW8R, MW9)

In addition to the above mentioned analysis for all monitor wells, quarterly monitoring also occurs at wells MW1, MW2 and MW9 for select dissolved metals, pH, phenols, conductivity, sulfate and total suspended solids (TSS). This program was part of the compliance monitoring required by the expired approval for sulphite-bearing materials. Due to their proximity to the proposed S/S and PERC storage areas, it is proposed that monitor wells MW1, MW2, MW9 and an additional well, MW8R, will be monitored for Volatile Organic Compounds (VOCs) to assess water quality from the acceptance of materials containing low level organics for the proposed S/S process.

### Amendment #5 – Treatment of Salt Impacted Materials

Under the current approval, Envirosoil cannot accept salt-impacted materials. Envirosoil is proposing to treat EC/SAR materials in accordance with the established procedure, mix-bury-cover (MBC) method (**Appendix A**). Changes to water quality monitoring based on proposed site activities include the following:

#### 1.) Additional Groundwater Analysis (Monitor Wells: MW1, MW2, MW8R, MW9)

In addition to BTEX/TPH and PAH analysis, monitor wells MW1, MW2 and MW9 are currently monitored quarterly for select dissolved metals, pH, phenols, conductivity, sulfate and total suspended solids (TSS).

Due to the proximity to the proposed EC/SAR storage cell and site features, select monitor wells (MW1, MW2, MW9 and an additional well, MW8R) will be sampled for additional parameters, collected at a quarterly frequency to align with the program described in Items 2 and 3, above. A full suite of general chemistry and dissolved metals parameters will be collected from each location, including electrical conductivity and chlorides among other parameters, to assess potential impacts from salt impacted materials.

### Closing

Site monitoring in accordance to NSE approval 2002-026440-R01 for the Construction, Operation and Reclamation of a Soil Recycling Facility is ongoing at the Envirosoil facility until further notice from NSE. Modifications to the site monitoring plan discussed in this letter report reflect Envirosoils proposed impacted material disposal methodologies.

Please contact the undersigned should you have any questions or comments.

Yours sincerely,  
**SLR Consulting (Canada) Limited**



**Ashley Gould, B.Sc., CET, EP**  
Project Scientist



**Craig Chandler, MSc, PEng, LEED AP**  
Senior Project Manager

Enc.

Drawing 1 – Site Plan and Groundwater Flow Plan

Table 1 – 2015 Current Site Monitoring and Sampling Program

Table 2 – Proposed 2015 Monitoring Program

Appendix A – Request for Amendments Related to Approval No. 2002-02640-R01

cc: Robert Cuthburt, NSE

**DRAWING**

2015 Revised Monitoring Program  
48 Quarrystone Drive, Bedford, NS  
SLR Project No.: 210.05726.00015

NOTES

DRAWING COMPILED FROM ENVIROSOIL LIMITED.

ALL GROUNDWATER ELEVATIONS RELATIVE TO AN ARBITRARY DATUM OF 100.00m

INFERRED GROUNDWATER CONTOURS AND FLOW DIRECTIONS SHOWN AS BASED ON THE ASSUMPTION OF SIMILAR STRATIGRAPHY AND WELL COMPLETION DETAILS ACROSS THE AREA OF INVESTIGATION. NO BOREHOLE LOGS AVAILABLE AT THE TIME OF THIS REPORT PREPARATION

LINED CONTAINMENT POND ASSUMED TO NOT BE HYDRAULICALLY CONNECTED TO GROUNDWATER

### LEGEND

 SLOPE

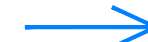
BOREHOLE LOCATION COMPLETED AS A  
MONITORING WELL (OTHERS)



SURFACE WATER SAMPLE LOCATION (OTHERS)

65.08 GROUNDWATER ELEVATION (m)

64.50m ■■■■■ INFERRED GROUNDWATER ELEVATION CONTOUR  
(INTERVAL 0.25m)



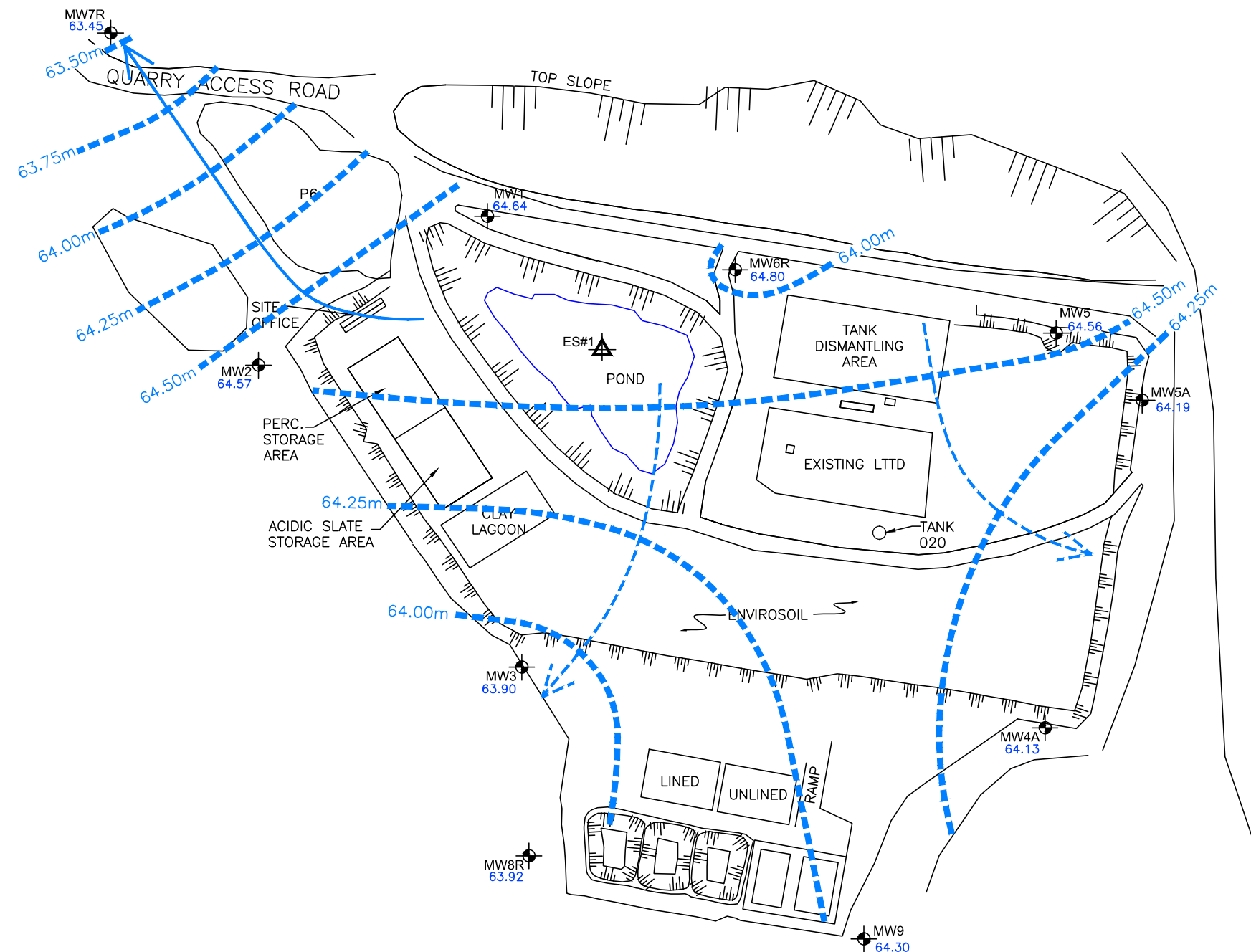
REGIONAL GROUNDWATER FLOW DIRECTION



POTENTIAL SITE GROUNDWATER FLOW DIRECTION  
(INFLUENCED BY WEIGHT LOAD OF ADJACENT  
GRAVEL PILES)



NOT MONITORED OR DATA NOT INCLUDED IN  
CONTOUR DUE TO REASONS PROVIDED BELOW



MUNICIPAL CONTRACTING LTD.  
ENVIROSOIL  
48 QUARRYSTONE DRIVE  
BEDFORD, NS

Report

2014 ANNUAL MONITORING REPORT

Drawing

INFERRED GROUNDWATER CONTOUR PLAN  
- OCTOBER 9, 2014

Date December 17, 2014

Scale AS SHOWN

Drawing No.

File Name S\_210-05726-00013-E1

Project No.	210.05726.00013
-------------	-----------------

1

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

SCALE 1:2000  
WHEN PLOTTED AT 11 x 17 PAGE SIZE



## **TABLES**

2015 Revised Monitoring Program  
48 Quarrystone Drive, Bedford, NS  
SLR Project No.: 210.05726.00015

Month	Sample Location			
	ES1	ES2	MW1-MW9	MW1, MW2, MW9 <sup>1</sup>
<b>January</b>	Metals, pH, TSS, Sulfate, conductivity, BTEX/TPH	Metals, pH, TSS, sulfate, conductivity, BTEX/TPH, PAH, phenols	N/A	N/A
<b>February</b>	Metals, pH, TSS, Sulfate, conductivity, BTEX/TPH	Metals, pH, TSS, sulfate, conductivity, BTEX/TPH, PAH, phenols	BTEX/TPH <sup>2</sup> , PAH	Metals, pH, phenols cond, sulfate,TSS
<b>March</b>	Metals, pH, TSS, Sulfate, conductivity, BTEX/TPH	Metals, pH, TSS, sulfate, conductivity, BTEX/TPH, PAH, phenols	N/A	N/A
<b>April</b>	Metals, pH, TSS, Sulfate, conductivity, BTEX/TPH	Metals, pH, TSS, sulfate, conductivity, BTEX/TPH, PAH, phenols	BTEX/TPH	N/A
<b>May</b>	Metals, pH, TSS, Sulfate, conductivity, BTEX/TPH	Metals, pH, TSS, sulfate, conductivity, BTEX/TPH, PAH, phenols	PAH	Metals, pH, phenols cond, sulfate,TSS
<b>June</b>	Metals, pH, TSS, Sulfate, conductivity, BTEX/TPH	Metals, pH, TSS, sulfate, conductivity, BTEX/TPH, PAH, phenols	BTEX/TPH	N/A
<b>July</b>	Metals, pH, TSS, Sulfate, conductivity, BTEX/TPH	Metals, pH, TSS, sulfate, conductivity, BTEX/TPH, PAH, phenols	N/A	N/A
<b>August</b>	Metals, pH, TSS, Sulfate, conductivity, BTEX/TPH	Metals, pH, TSS, sulfate, conductivity, BTEX/TPH, PAH, phenols	BTEX/TPH, PAH	Metals, pH, phenols cond, sulfate,TSS
<b>September</b>	Metals, pH, TSS, Sulfate, conductivity, BTEX/TPH	Metals, pH, TSS, sulfate, conductivity, BTEX/TPH, PAH, phenols	N/A	N/A
<b>October</b>	Metals, pH, TSS, Sulfate, conductivity, BTEX/TPH	Metals, pH, TSS, sulfate, conductivity, BTEX/TPH, PAH, phenols	BTEX/TPH	N/A
<b>November</b>	Metals, pH, TSS, Sulfate, conductivity, BTEX/TPH	Metals, pH, TSS, sulfate, conductivity, BTEX/TPH, PAH, phenols	PAH	Metals, pH, phenols cond, sulfate,TSS
<b>December</b>	Metals, pH, TSS, Sulfate, conductivity, BTEX/TPH	Metals, pH, TSS, sulfate, conductivity, BTEX/TPH, PAH, phenols	BTEX/TPH	N/A

Notes:

N/A - Not Applicable, laboratory analysis for applicable not required as outlined in  
NSE approval

Month	Sample Location				Proposed Changes & Rationale		
	ES1 <sup>2</sup>	ES2 <sup>2</sup>	MW1-MW9	MW1, MW2, MW8R, MW9 <sup>1</sup>			
<b>January</b>	RcapMS (general chem + metals), BTEX/TPH, TSS, Phenols <sup>3</sup> , PAH <sup>4</sup>	RcapMS (general chem + metals), TSS, BTEX/TPH, PAH, Phenols	N/A	N/A	Amendment #1, 2, & 5 (S/S, Metals & Salt Impacted Materials) RcapMS (metals, conductivity, chloride + other parameters) and Phenols (ES1)	Amendment #1 (S/S) - PAH (ES1)	
<b>February</b>	RcapMS (general chem + metals), BTEX/TPH, TSS, Phenols <sup>3</sup> , PAH <sup>4</sup>	RcapMS (general chem + metals), TSS, BTEX/TPH, PAH, Phenols	BTEX/TPH <sup>3</sup> & PAH <sup>4</sup>	RcapMS (gen chem + metals, VOCs <sup>6</sup> , Phenols, TSS	Amendment #1, 2, & 5 (S/S, Metals & Salt Impacted Materials) RcapMS (metals, conductivity, chloride + other parameters) and Phenols (ES1)	Amendment #1,4 & 6 (S/S,SBM & PERC) Impacted Materials. Additional analysis at MW1, MW2, MW8R, MW9 for RCapMS, VOC's	Amendment #1 (S/S) PAH & BTEX/TPH (all sample locations, quarterly frequency)
<b>March</b>	RcapMS (general chem + metals), BTEX/TPH, TSS, Phenols <sup>3</sup> , PAH <sup>4</sup>	RcapMS (general chem + metals), TSS, BTEX/TPH, PAH, Phenols	N/A	N/A	Amendment #1, 2, & 5 (S/S, Metals & Salt Impacted Materials) RcapMS (metals, conductivity, chloride + other parameters) and Phenols (ES1)	Amendment #1 (S/S) - PAH (ES1)	
<b>April</b>	RcapMS (general chem + metals), BTEX/TPH, TSS, Phenols <sup>3</sup> , PAH <sup>4</sup>	RcapMS (general chem + metals), TSS, BTEX/TPH, PAH, Phenols	N/A	N/A	Amendment #1, 2, & 5 (S/S, Metals & Salt Impacted Materials) RcapMS (metals, conductivity, chloride + other parameters) and Phenols (ES1)	Amendment #1 (S/S) - PAH (ES1)	
<b>May</b>	RcapMS (general chem + metals), BTEX/TPH, TSS, Phenols <sup>3</sup> , PAH <sup>4</sup>	RcapMS (general chem + metals), TSS, BTEX/TPH, PAH, Phenols	BTEX/TPH <sup>3</sup> & PAH <sup>4</sup>	RcapMS (gen chem + metals, VOCs <sup>6</sup> , Phenols, TSS	Amendment #1, 2, & 5 (S/S, Metals & Salt Impacted Materials) RcapMS (metals, conductivity, chloride + other parameters) and Phenols (ES1)	Amendment #1,4 & 6 (S/S,SBM & PERC) Impacted Materials. Additional analysis at MW1, MW2, MW8R, MW9 for RCapMS, VOC's	Amendment #1 (S/S) PAH & BTEX/TPH (all sample locations, quarterly frequency)
<b>June</b>	RcapMS (general chem + metals), BTEX/TPH, TSS, Phenols <sup>3</sup> , PAH <sup>4</sup>	RcapMS (general chem + metals), TSS, BTEX/TPH, PAH, Phenols	N/A	N/A	Amendment #1, 2, & 5 (S/S, Metals & Salt Impacted Materials) RcapMS (metals, conductivity, chloride + other parameters) and Phenols (ES1)	Amendment #1 (S/S) - PAH (ES1)	
<b>July</b>	RcapMS (general chem + metals), BTEX/TPH, TSS, Phenols <sup>3</sup> , PAH <sup>4</sup>	RcapMS (general chem + metals), TSS, BTEX/TPH, PAH, Phenols	N/A	N/A	Amendment #1, 2, & 5 (S/S, Metals & Salt Impacted Materials) RcapMS (metals, conductivity, chloride + other parameters) and Phenols (ES1)	Amendment #1 (S/S) - PAH (ES1)	
<b>August</b>	RcapMS (general chem + metals), BTEX/TPH, TSS, Phenols <sup>3</sup> , PAH <sup>4</sup>	RcapMS (general chem + metals), TSS, BTEX/TPH, PAH, Phenols	BTEX/TPH <sup>3</sup> & PAH <sup>4</sup>	RcapMS (gen chem + metals, VOCs <sup>6</sup> , Phenols, TSS	Amendment #1, 2, & 5 (S/S, Metals & Salt Impacted Materials) RcapMS (metals, conductivity, chloride + other parameters) and Phenols (ES1)	Amendment #1,4 & 6 (S/S,SBM & PERC) Impacted Materials. Additional analysis at MW1, MW2, MW8R, MW9 for RCapMS, VOC's	Amendment #1 (S/S) PAH & BTEX/TPH (all sample locations, quarterly frequency)
<b>September</b>	RcapMS (general chem + metals), BTEX/TPH, TSS, Phenols <sup>3</sup> , PAH <sup>4</sup>	RcapMS (general chem + metals), TSS, BTEX/TPH, PAH, Phenols	N/A	N/A	Amendment #1, 2, & 5 (S/S, Metals & Salt Impacted Materials) RcapMS (metals, conductivity, chloride + other parameters) and Phenols (ES1)	Amendment #1 (S/S) - PAH (ES1)	
<b>October</b>	RcapMS (general chem + metals), BTEX/TPH, TSS, Phenols <sup>3</sup> , PAH <sup>4</sup>	RcapMS (general chem + metals), TSS, BTEX/TPH, PAH, Phenols	N/A	N/A	Amendment #1, 2, & 5 (S/S, Metals & Salt Impacted Materials) RcapMS (metals, conductivity, chloride + other parameters) and Phenols (ES1)	Amendment #1 (S/S) - PAH (ES1)	
<b>November</b>	RcapMS (general chem + metals), BTEX/TPH, TSS, Phenols <sup>3</sup> , PAH <sup>4</sup>	RcapMS (general chem + metals), TSS, BTEX/TPH, PAH, Phenols	BTEX/TPH <sup>3</sup> & PAH <sup>4</sup>	RcapMS (gen chem + metals, VOCs <sup>6</sup> , Phenols, TSS	Amendment #1, 2, & 5 (S/S, Metals & Salt Impacted Materials) RcapMS (metals, conductivity, chloride + other parameters) and Phenols (ES1)	Amendment #1,4 & 6 (S/S,SBM & PERC) Impacted Materials. Additional analysis at MW1, MW2, MW8R, MW9 for RCapMS, VOC's	Amendment #1 (S/S) PAH & BTEX/TPH (all sample locations, quarterly frequency)
<b>December</b>	RcapMS (general chem + metals), BTEX/TPH, TSS, Phenols <sup>3</sup> , PAH <sup>4</sup>	RcapMS (general chem + metals), TSS, BTEX/TPH, PAH, Phenols	N/A	N/A	Amendment #1, 2, & 5 (S/S, Metals & Salt Impacted Materials) RcapMS (metals, conductivity, chloride + other parameters) and Phenols (ES1)	Amendment #1 (S/S) - PAH (ES1)	

Notes:

<sup>1</sup> - Additional analysis for monitor wells MW1, MW2, MW8R, MW9<sup>2</sup> - Surface water sampling locations ES1 and ES2 proposed sampling for RcapMS as it includes parameters previously monitored plus chloride.<sup>3</sup> - BTEX/TPH monitoring frequency changed from bi-monthly to quarterly to coincide with PAH sampling.<sup>4</sup> - PAH currently monitored quarterly from all wells, unchanged from current monitoring plan.<sup>5</sup> - PAH sample collection proposed from ES1 (holding pond) at a monthly frequency<sup>6</sup> - VOC's and Rcap (general chemistry and dissolved metals) proposed for a quarterly sampling frequency from the following: MW1, MW2, MW8R, MW9<sup>7</sup> - Phenols samples proposed at ES1, monthly

Quarter 1 2015 (January, February &amp; March) completed as shown in Table 1, former monitoring schedule.

S/S - Solidification/Stabilization

SBM - Sulfide Bearing Materials

PERC - Perchloroethylene