NOVA SCOTIA
Transportation and Public Works

Generic Environmental Protection Plan (EPP) for the Construction of 100 Series Highways

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RECORD OF REVISIONS

This Generic EPP is considered to be a 'living document' and updates will be prepared as new or revised information becomes available. Updates will be posted on the Department's website:

www.gov.ns.ca/tran/enviroservices/govEPP100.asp

It is the responsibility of all users of this Generic EPP to ensure they are using the most recent version. The following table has been included for your convenience.

Section	Revision Date	Inserted By	Date Inserted
2.1-2.3, 3.2-3.4, 4.2.3, and 6.0	July 2007	Dr. Bob Pett	

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DEFINITIONS

Apron

A lining that protects a surface from erosion by dissipating the energy of a direct flow of water; it is placed on the downstream side of a velocity check or at the outlet of a culvert.

Berm

A constructed ridge that breaks the continuity of a slope.

Brush Mat

Matting composed of slash and non-merchantable wood placed on the ground to minimize soil disturbance by heavy equipment.

Buffer Zone

A strip of permanent vegetation that is not grubbed until the culvert for the drainage or watercourse has been installed. Typically the boundaries of the buffer zone are delineated with silt fence.

Erosion

Process by which the land's surface is worn away by erosive agents, principally water, wind, ice and gravity.

Erosion Control Blanket

A temporary ground cover, designed to keep seed bed in place until vegetation is established, by retaining soil moisture and protecting against the impact of raindrops. Can be made of jute, excelsior, wood or polypropylene.

Filter Bag

A geosynthetic bag which is used to filter sediment out of water. Water is pumped into the bag and allowed to flow out though the membrane, trapping the sediment in the bag.

Filter Fabric

A synthetic material of woven or non-woven (plastic) description. Its purpose is to allow water to filter through while retaining fine soil particles and prevent them from washing away.

Flow Check

A device installed across a drainage ditch to slow the velocity of concentrated flows, reducing erosion of the ditch and promote the deposition of suspended sediment. Can be made of sand bags or Clear Stone. Use only in small open channels.

Hydroseeding

Mechanical application, by spraying onto the surface of the soil, a specially mixed slurry of turf-establishing materials, consisting of water, seed, fertilizer, and short-fibre wood or paper mulch.

Mulch

A temporary natural or artificial layer covering the surface of soil to protect and enhance certain characteristics, such as retention of soil moisture and protection against the impact of raindrops.

Runoff

The portion of precipitation in a drainage area that is not absorbed into the ground but is discharged into streams (includes overland and open-channel flow).

Scouring

Erosion of the bed and banks of a channel, usually localized around an obstruction or structure in a channel or at the outlet of a pipe, due to an increase in water velocity around the obstruction or discharging from the conduit.

Sediment

Particles of soil that have become detached though erosion.

Sediment Barrier

A temporary perimeter control placed across or at the toe of a slope to intercept and detain sediment laden runoff, and to decrease sheet flow velocities as it leaves the construction site.

Settlement Ponds

A pond designed to intercept and detain sediment laden runoff from a drainage area for a long enough time that suspended solids may settle out.

Stabilization

The process of establishing an enduring soil cover of vegetation and/or mulch or other ground cover in combination with installing temporary or permanent structures for the purpose of minimizing soil erosion.

Swamp Mat

Mats constructed of 10x10 lumber used to place under tracks of heavy equipment to minimize ground disturbance and support equipment in wet areas. In some circumstances mats can be used as temporary bridges with DFO and NSEL approval.

Turbidity Curtain

A floating geotextile material which minimizes sediment transport from a disturbed area adjacent to or within a body of water. Provides sedimentation protection for a watercourse from up-slope land disturbance or from dredging or filling within the watercourse.

Turbidity (Turbid Water)

Condition of water when it becomes cloudy due to sediment moving in suspension in the water.

LIST OF ACRONYMS

CEAA	Canadian Environmental Assessment Act
CLC	Community Liaison Committee
CMP	Culvert Mitigation Plan *(prepared for various water crossings)*
DFO	Department of Fisheries and Oceans *(Federal)*
EC	Environment Canada
ECM	Environmental Compliance Monitoring
ECP	Environmental Control Plan (prepared for various segments of the project)
EEM	Environmental Effects Monitoring
EPP	Environmental Protection Plan
ESC	Erosion and Sediment Control
NSEL	Nova Scotia Department of the Environment and Labour
NSNR	Nova Scotia Department of Natural Resources
ROW	Right-of-Way
TC	Transport Canada
TPW	Nova Scotia Department of Transportation and Public Works

FEDERAL/PROVINCIAL LEGISLATION AND GUIDELINES	RESPONSIBLE AGENCY
1.0 Federal Legislation	
• Canadian Environmental Assessment Act	• Environment Canada
• Canadian Environmental Protection Act	• Environment Canada
• Clean Air Act	• Environment Canada
• Species at Risk Act	• Environment Canada/Fisheries and Oceans Canada
• Fisheries Act - No Net Loss of Fish Habitat; Fish Passage; Disposal/Release of Deleterious Substances; Use of Explosives in Canada's Fisheries Waters	• Fisheries and Oceans Canada
• Migratory Birds Convention Act	• Environment Canada
• Navigable Waters Protection Act	• Canadian Coast Guard
• Transportation of Dangerous Goods Act	• Transport Canada
• Water Act	• Environment Canada
• Wildlife Act	• Environment Canada
1.1 Federal Guidelines	
• Environmental Guidelines and Design Criteria for Resource Road Construction	• Environment Canada
• Environmental Code of Good Practice for Highways and Railways	• Environment Canada
• Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities	• Environment Canada
2.0 Provincial Legislation	
• Environment Act	• NSEL
• Dangerous Goods Transportation Act	• TPW
• Special Places Protection Act	• Dept. of Education - Museum
• Occupational Health and Safety Act - Construction Safety Regulation General Blasting Regulations	• NSEL
• Sulphide Bearing Material Disposal Regulations	• NSEL
• Forest Act	• NSNR
• Public Highways Act	• TPW
• Crown Lands Act	• NSNR
• Ditches and Watercourses Act	• Municipal responsibility
• Endangered Species Act	• NSNR
• Weed control Act	• Dept. of Agriculture and Fisheries
• Wildlife Act	• NSNR
2.1 Provincial Guidelines	
• Standard Specifications	• TPW
• Approval Process for Pits Containing Slates	• TPW
• Erosion and Sediment Control Course Materials (available on-line at: http://www.gov.ns.ca/tran/enviroservices/enviroErosion.asp)	• TPW
• Asphalt Paving Plant Guidelines	• NSEL
• Guidelines for Environmental Noise Measurement and Assessment	• NSEL
• Guidelines for Sampling of Domestic Water Supplies in Conjunction with Construction of Highways	• NSEL
• Pits and Quarry Guidelines	• NSEL
• Policy Guidelines on Watercourse Alterations	• NSEL
• Procedure for Conducting a Pre-Blast Survey	• NSEL
• Watercourse and Wetland Alteration Specifications	• NSEL
• Wetland Designation Policy	• NSEL

3.0 Joint Federal/Provincial Guidelines	
• Environmental Construction Practice Specifications	• Fisheries and Oceans Canada / NSEL
4.0 Other Guidelines	
• National Guide to Erosion and Sediment Control on Roadway Projects	• Transportation Association of Canada (TAC)
• Environmental Stewardship Practices, Procedures, and Policies for Highway Maintenance and Construction. NCHRP Project 25-25(04). http://environment.transportation.org/environmental_issues/construct_maint_prac/compendium/manual/	• American Association of State Highway and Transportation Officials (AASHTO) Centre for Environmental Excellence

1.0 ENVIRONMENTAL PROTECTION PLAN

The Nova Scotia Department of Transportation and Public Works (TPW) is committed to the construction and maintenance of highways in a manner which is protective of the environment including maintaining water quality through erosion and sediment control, and minimizing disturbance to land use, wildlife and habitat. TPW has prepared this environmental protection plan (EPP) to communicate this commitment to TPW staff, Contractors, regulatory agencies and the public. This generic plan is intended for use on the construction of all 100 Series Highways and complements EPPs developed for individual projects and Environmental Control Plans (ECPs) for specific segments of a highway project.

1.1 TPW Environmental Policy

TPW implemented the following environmental policy in December 2000, which was endorsed by the Deputy Minister of the Department.

Rationale

The intent of this policy is to identify and resolve environmental issues when planning and implementing projects and programs undertaken by this department. Federal and Provincial environmental legislation provide the basis for environmental decisions; this department not only abides by the legislation, but strives to incorporate this environmental policy into all its decision-making processes.

Policy Statement

Using federal and provincial legislation as the basis for environmental decisions, the Department shall incorporate the environmental policy into all relevant processes and activities. In so doing, TPW protects the province's environment and enhances the quality of life of Nova Scotians. On an ongoing basis, the Department shall evaluate the environmental benefits and consequences of its activities and implement practices that eliminate or minimize negative environmental impacts.

Policy Objectives

- *Ensure environmental legislation is identified and incorporated, in a timely manner, into relevant departmental decision-making processes and activities.*
- *Ensure the department meets and, if possible, exceeds environmental standards defined in legislation.*
- *Encourage participation by all departmental employees in using best management practices and protecting and promoting environmental responsibility.*
- *Ensure timely coordination and review of programs and projects.*
- *Resolve environmental issues by cooperating/forming partnerships with federal and provincial agencies, other public agencies, public interest groups and the private sector.*
- *Demonstrate commitment to continual improvement and pollution prevention.*

Application

This policy applies to all staff of TPW.

Accountabilities

The Deputy Minister is responsible to:

- *ensure the department adheres to this Policy;*
- *allocate resources for environmental initiatives;*
- *delegate responsibility/authority to trained and competent personnel and hold them accountable by including environmental responsibilities in performance criteria, as is appropriate;*
- *ensure audit results of environmental program initiatives are reviewed and appropriate action taken;*
- *ensure that the department complies with the Environment Act and Regulations;*

Management/Supervisors are responsible to:

- *adhere to this Policy and ensure compliance with the Environment Act and Regulations within workplaces under their supervision;*
- *Integrate best management practices into departmental activities and hold employees accountable for following best practices in performance appraisals;*
- *provide information and training to employees to ensure appropriate environmental practices are performed by employees;*
- *take action immediately upon any report or suspicion of environmentally hazardous situations;*
- *supervise employees and audit work processes to ensure that employees work in an environmentally appropriate manner;*
- *evaluate environmental performance and provide feedback to the Deputy Minister;*

Employees are responsible to:

- *work in accordance with the Environment Act and Regulations;*
- *adhere to this Policy and all other management policies and directives on environmental performance to ensure compliance with the Environment Act and Regulations;*
- *report any and all environmental hazards to the immediate manager/supervisor or a representative of the Environmental Services Section.*

Monitoring

The Department will develop and implement an auditing program to monitor, evaluate and report on environmental performance and compliance with this policy. Monitoring of the policy's implementation, performance and effectiveness will be the responsibility of the Manager of the Environmental Section.

Directives

TPW staff shall comply with applicable environmental legislation.

References

Acts which should be consulted in conjunction with this policy:

- *Nova Scotia Environment Act*
- *Nova Scotia Endangered Species Act*
- *Canadian Environmental Protection Act*
- *Fisheries Act*

- *Species at Risk Act (SARA)*
- *Navigable Waters Protection Act (NWPA)*
- *Canada Wildlife Act*
- *Migratory Birds Convention Act*

This generic EPP is a compilation of environmental procedures and controls to be used by TPW and its Contractors to ensure highway construction minimizes its potential adverse effects on the environment. This EPP has been developed to:

☼ Provide regulatory agencies with a generic description of the procedures and controls that TPW will follow during highway construction to ensure environmental protection;

☼ Provide TPW and its Contractors with a comprehensive review of environmental concerns and clear, concise guidance on the methods to be used to address these concerns in the construction of a highway; and

☼ Facilitate acquisition of approvals and permits required by federal and provincial legislation.

1.2 On-Site Meetings

An on-site meeting with the Project Engineer and such other representative of TPW as may be required, the Contractor, and representatives of DFO, NSEL and other agencies as required, will be held prior to the commencement of any work. Additional meetings may be held as required during the project.

1.3 Responsibilities

The primary responsibility for implementing environmental protection rests with the Contractor's Construction Supervisor. TPW's Project Engineer has the responsibility to: (1) ensure that the Contractor and its staff are fully aware of their obligations; (2) approve and monitor the Contractor's *Work Progression Schedule* (see Section 3.1); (3) advise the Contractor on site-specific environmental and erosion and sediment control (ESC) issues noted in the project EPP and ECPs for various segments of the project; and (4) ensure compliance with all provisions of the Project EPP, ECPs and government approvals/authorizations.

The Contractor is required to designate a person responsible for environmental protection. This person, the Environmental Monitor, will have taken an Erosion and Sediment Control Course approved by TPW, and will be responsible for routine environmental inspection and monitoring, completion of appropriate notes, and the provision of verbal and written feedback to the Contractor's Construction Supervisor and the Project Engineer (or designated inspector).

TPW's Environmental Services Section (ESS) has the responsibility to provide the Project Engineer, and where appropriate the Contractor's Construction Supervisor, with timely advice on the implementation of the Project EPP and ECPs for various segments of the project. ESS staff will also conduct periodic inspections of construction sites and environmental control measures.

1.4 Organization and Use of the EPP

This Generic EPP shall be used by the Contractor as a guide to preventing impacts on the environment as a result of highway construction activities. The reader should note that the Generic EPP is a dynamic document that will be updated as regulations change and as improved protection measures arise. TPW performs an annual review of this Generic EPP and the document will be revised as required. This EPP and all revisions to this EPP will be available through TPW's website:

www.gov.ns.ca/tran/enviroservices/govEPP100.asp

It is the responsibility of all users of this Generic EPP to ensure they have up-to-date protection measures. Regulators will be notified prior to any revisions in the EPP. Proposed revisions must be approved by TPW and the regulators.

This EPP is to be used in conjunction with the following documents, and as such it forms part of contracts:

- The most recent version of TPW's *Standard Specification - Highway Construction and Maintenance* (in particular, Divisions 1.5 and 7);
- Selected Special Provisions to the *Standard Specification* (see **Appendix A**);
- Project EPP and ECPs prepared for various segments of the Project; and
- Culvert Mitigation Plans (CMPs) prepared for works at various water crossings.

This EPP is organized as follows:

- **Section 1** provides TPW's Environmental Policy and details the responsibilities for implementing environmental protection measures;

- **Section 2** provides an overview of items of special consideration in highway construction;

- **Section 3** provides detailed environmental protection measures for highway construction activities in general;

- **Section 4** provides detailed monitoring plans for highway construction activities;

- **Section 5** provides contingency plans for issues that may be encountered during construction;

- **Section 6** provides a list of references used in this document; and

- **Appendices** attached to this EPP provide:
  - Selected Special Provisions
  - Work Progression Schedule
  - Erosion and Sediment Controls - Typical Details
  - EPP for Winter Clearing
  - Construction Specifications for Access Roads
  - Spill Contingency Plan
  - Environmental Inspection Forms

2.0 AREAS OF SPECIAL ENVIRONMENTAL CONSIDERATION

2.1 Wetlands and Watercourses

2.1.1 Wetlands

Wetlands are defined as land that has the water table at, near, or above the land surface, or which is saturated for long enough periods to promote wetland or aquatic processes (National Wetlands Working Group, 1988; NSEL *Wetlands Designation Policy*, 2007a). Wetlands include bogs, fens, swamps, and marshes. In addition to their key roles in local hydrological and hydrogeological cycles, wetlands are valuable natural resources providing habitat for a variety of wildlife and plant species, both aquatic and terrestrial. For these reasons, the preservation of wetlands through highway design and construction practices is critical and is primarily accomplished through avoidance and secondarily by impact minimization/mitigation.

All work in a wetland requires an NSEL Wetland Alteration Approval prior to starting construction. Alteration is defined as filling, draining, flooding or excavation of all sizes and types of wetlands (including the six main types found in NS: bogs, fens, marshes, swamps, floodplain/lakeshore wetlands, and salt marshes). The approval process requires a comprehensive environmental screening and review by NSEL, NSNR and DFO. Details concerning the screening and approval processes are outlined in NSEL's (2007b) *Operational Bulletin Respecting Alteration of Wetlands*.

For the construction of 100 Series Highways, the following practices will be used at wetlands to protect wildlife and habitat, and to minimize affects on drainage and water quality:

(a) All work will follow the Terms and Conditions of NSEL *Wetland Alteration Approvals*;
(b) Activities will be timed to coincide with low water or frozen conditions, where possible;
(c) When permitted, crossings will be restricted to a single location and will occur perpendicular to and at a narrow point on the wetland. Brush matting, swamp matting, ice bridges and floatation tires on vehicles shall be used when crossing as dictated by site conditions, the NSEL Inspector and the Project Engineer;
(d) Equipment shall be in good working order and free of leaks. No equipment maintenance including fuelling shall be carried out within 30 m of a wetland;
(e) To avoid spreading of invasive plant species, such as purple loosestrife, any equipment working in an area involving topsoil and vegetation (such as grubbing) shall be cleaned of mud and vegetation prior to leaving the site. Equipment that has been working with topsoil and vegetation prior to arriving on site, shall also be cleaned of mud and vegetation;
(f) Excavation in wetlands shall be carried out by an excavator operating from a dry stable surface to minimize sediment generation;
(g) Excavate only what is absolutely necessary to meet engineering requirements. Excavated material shall not be sidecast in the wetland;
(h) In wetlands associated with sensitive watercrossings, grubbing shall be minimized by the placement of geogrid and geotextile prior to the placement of fill;
(i) Vegetation will be retained where possible to provide wildlife habitat. Where applicable, no work near wetlands will be scheduled during wildlife breeding seasons;
(j) Excavated wetland material shall be retained for placement in the median or along the ROW to improve seeding success. Material may be stored at locations specified by the Project Engineer or applied directly to designated areas to a minimum thickness of 100 mm (± 25

mm). Note that wetland material typically has a very high organic matter content that may require further mixing with inorganic soils prior to spreading;

(k) Surplus excavated materials from wetlands and other TPW excavation sites may be disposed in other locations including nearby private properties. The Contractor and recipients of the fill are responsible for ensuring that surplus fill is not placed in a wetland. Release forms have been prepared to protect all parties from future legal action by NSEL or DFO;

(l) As permitted, excavated wetlands will be infilled with approved fill material as soon as possible to minimize sloughing, over excavation and generation of sediment;

(m) Water control shall be maintained at all times. Water removed from the excavation shall be pumped to an approved sediment control measure (*e.g.*, settlement pond, adjacent vegetated area or filter bag). The Contractor shall ensure that no discharge to adjacent watercourses will occur when total suspended sediment (TSS) concentrations exceed 25 mg/L, or other level noted by NSEL and DFO permits and letters of advice; and

(n) Ditches shall not drain directly to wetlands. Flows must be directed away from wetlands by take-off ditches for dissipation through settling ponds and/or adjacent vegetated areas.

2.1.2 Watercourses

Watercourses are defined as the bed and shore of every river, stream, lake, creek, pond, spring, lagoon or other natural body of water, and the water therein, within the jurisdiction of the Province, whether it contains water or not. In-stream work will only occur between June 1 and September 30 unless authorized by DFO and NSEL.

TPW is committed to the protection of fish and fish habitat. General protection measures for watercourses are described in Section 3 of this document, TPW's *Standard Specification - Highway Construction and Maintenance*, and the DFO (1998) draft document *"Guidelines for the Protection of Fish and Fish Habitat: The Placement and Design of Large Culverts."* More specific measures are attached to government approvals, authorizations, and letters of advice, and will be summarized in the Project EPP. TPW will work with DFO and local watershed groups to design and construct appropriate fish passage at existing and future watercourse crossings.

2.2 Wildlife

2.2.1 General Protection Measures

In the planning of the highway, all sensitive wildlife habitat has been avoided where possible. General protection measures that apply during construction include:

(a) TPW employees and Contractor employees and agents shall not interfere with wildlife and shall not carry firearms within the ROW;

(b) Where important wildlife species are encountered impacts shall be minimized by avoiding noisy, disruptive activities during sensitive wildlife periods (e.g., March to June for nesting bald eagles; see below);

(c) No one shall disturb, move or destroy migratory bird nests. If a nest or young birds are encountered, the Contractor shall cease work in the immediate area of the nest and contact NSNR, Environment Canada-Canadian Wildlife Service, and the Project Engineer;

(d) Should a bald eagle nest be identified, the following approach shall be followed:

- Within 200 m of a nest, avoid activities that result in significant landscape changes; road and trail use shall be closed from February to mid-June.

- Within 400 m of a nest, activity is permitted except during the most critical period between March and mid-May;

(e) The Contractor shall consult with the local office of NSNR and DFO regarding removal of beaver dams and/or nuisance beavers (See Section 2.2.2);

(f) All refuse shall be disposed of at an approved landfill facility. Refuse stored on site prior to removal shall be stored in closed containers; and

(g) Report any nuisance wildlife to the Project Engineer or directly to the local NSNR office.

2.2.2 Beaver Dams and Ponds

Removal of beaverdams in problem situations requires an approved "Nuisance Wildlife Permit" and compliance with the "Beaverdam Removal Code of Practice" (NSEL/NSNR 2005). This procedure was jointly developed by NSNR, NSEL and DFO to ensure that Contractors (or TPW field staff) safely remove beaver dams and minimize the impact of beaver dam removal on fish and wildlife resources. Improper removal of dams can result in the discharge of excessive amounts of sediment and water and significant impacts on downstream fish and wildlife habitat.

2.3 Habitat for Species at Risk and Rare Species

The environmental impact assessment process routinely identifies species at-risk and rare species, as well as their habitats in the project study area, and TPW mitigates impacts through avoidance. However, in the event that designated at-risk species are encountered during construction, the Project Engineer and TPW's Environmental Services Section will be notified, and NSNR and/or Environment Canada contacted for advice. Designated species are listed on both provincial and federal government websites:

http://www.gov.ns.ca/natr/wildlife/endngrd/endg.htm
http://www.sararegistry.gc.ca/species/default_e.cfm

2.3.1 Management Plan for Construction Work in Wood Turtle Areas

Based on recommendations from one of TPW's environmental consultants (Jacques Whitford Limited, 2005), and guidance provided in Nova Scotia's *Stewardship Plan for Wood Turtles* (NS Natural Resources, 2003; http://www.gov.ns.ca/natr/wildlife/biodiv/species_recovery/recoveryplans/finalwoodturtleplan.pdf), Contractors will adopt the following generic practices to ensure the protection of wood turtles:

> *"Immediately prior to grubbing within 100 m of riparian areas, a herpetologist and/or other qualified searchers will attempt to locate any foraging wood turtles, or any turtle species at-risk from construction activities. These turtles will be located outside of the ROW, preferably upstream within the riparian habitat corridor in which they were found. In addition, construction crews shall be provided with environmental awareness training including wood turtle management procedures.*
>
> *If wood turtles are found during construction, they will be picked up and moved just off site, along the same habitat corridor in the direction of travel the turtle was originally oriented. A New York State study (Carroll and Ehrenfeld, 1978) showed that 84% of wood turtles displaced less than 2 km overland were able to return to their home range. Moving wood turtles 100 m to 400 m or so from the original site where they were found should not unduly disrupt the turtle (Jacques Whitford Limited, 2005)"*

These pre-emptive measures are **only** to be used in areas that do not offer either good nesting sites or hibernaculae (over-wintering habitat). A more detailed protection plan with timing constraints will be developed for work in or near these specific habitats.

2.4 Heritage Resources

Heritage resources include sites and artifacts of value for their archaeological or historic importance or interest. As noted above for species-at-risk, TPW routinely mitigates impacts through avoidance.

Should any resources or human remains be encountered during construction, the Contractor shall follow the contingency procedures described in Section 5.2.

2.5 Land Use and Access

Highway ROWs traverse both Crown lands and privately held lands, and may affect a variety of land uses. TPW will minimize impairment of access to private lands through awareness and maintenance of access where possible adhering to the following principles:

- being cognizant of access roads and driveways from the corridor to these lands and maintaining them as passable, when and wherever possible;
- replacement of roadside culvert structures where effected by the work;
- replacement of access driveways to private lands where impacted by the work;
- communication with emergency response organizations to allow for alternative evacuation protocols in the event of a fire or spill incident; and
- through general cooperation with land owners affected by the work.

In order to minimize inconvenience to surrounding landowners and users, the Contractor shall:

(a) Control litter and construction waste on site including off-site office sites and camps. All waste shall be removed from the job site and disposed of in accordance with NSEL and municipal requirements;
(b) Not burn construction waste or refuse;
(c) Obtain from the Project Engineer information on any stipulations in landowner agreements which may impact on the Contractor's work, e.g. stipulations regarding use of access roads;
(d) Schedule work in residential areas or near sensitive receptors such as hospitals to minimize noise disturbance, where practical; and
(e) Make every effort to carry out the work in a manner which causes minimum inconvenience to the landowner.

2.6 Areas with Potential Acid Generating Bedrock

Disturbance of sulfide-bearing bedrock may result in acid drainage. The Meguma Group, particularly the Halifax Formation (slates) and its transition zone with the Goldenville Formation (quartzite and greywacke), is often rich in sulfides (iron pyrite and arsenopyrite). Coal bearing units may also have acid generating potential. Whenever possible, TPW avoids these areas. However, if coal or slates are encountered, the Contractor will immediately notify the Project Engineer for advice on how to proceed. Samples will be required for subsequent testing of acid-generating potential. High levels will mandate NSEL, DFO and Environment Canada notification, and the

preparation of an ECP to treat/handle the materials in accordance with the Nova Scotia "*Sulphide Bearing Material Disposal Regulations*." Some of the concerns and protection measures are outlined in Section 5.4 of this document.

2.7 Areas with High Soil Erodibility

If soils have been identified as having a moderate to high potential for erosion (*i.e.*, through the environmental impact assessment process), the Contractor will be directed to take additional precautions with regards to erosion and sediment control. Details will be provided in the Project EPP and the ECPs for appropriate segments of the highway project.

3.0 ENVIRONMENTAL PROTECTION MEASURES

3.1 Work Progression Schedule

The purpose of the work progression schedule is to ensure that construction in any work area is carried out continuously from initiation to completion; to ensure orderly progression of the work; and to offer effective protection of the environment by minimizing both the time and amount of exposed soil on construction sites.

3.1.1 Work Areas

A "work area" is an area, defined by station chainages, the limits of which shall be established by the Contractor with the approval of the Project Engineer prior to commencement of work. The size of the work area shall be determined with due consideration to the Contractor's ability to complete all grading work, to the lines and grades shown on the plans, seeding and final slope protection within 30 calendar days. Work will commence with the start of grubbing in that work area, and will be considered complete when the specified cover material is applied (*e.g.*, straw/hay/compost/bark mulch, erosion control blanket, Clear Stone, sod, hydroseeding).

The Work Progression Schedule (Appendix B) and a Contingency Plan for failure of ESC measures (see Section 5.5) shall be completed by the Contractor and approved by the Project Engineer prior to commencement of any grubbing. Further information about environmental timing constraints applicable to a project will be detailed in the Project EPP.

3.1.2 Unforseen Circumstances

If conditions are encountered in an active work area which requires extra care or work which the Contractor is unable to continue at that time, the Contractor will be allowed to open up additional work area(s) with the approval of the Project Engineer only after the original work area is temporarily protected, *i.e.*, straw/hay/compost/bark mulch.

If unforseen circumstances occur, the 30 calendar day period may be extended with the approval of the Project Engineer. This extension must be accompanied by a written report outlining the need for the extension and the measures to be taken to control erosion and sedimentation.

Inconvenience to the Contractor, poor planning or not having adequate or appropriate equipment will not be considered unforeseen circumstances.

3.1.3 Non-Compliance

Once the grubbing operation within a specific work area has begun, work shall be continuous from grubbing through to the placement of seed (including fertilizer, lime) and final slope protection, where required. If after 30 calendar days the above described work is not completed, then:

(a) No additional work area(s) will be allowed to commence until these work areas are completed; and
(b) All work areas will be immediately protected with straw/hay or compost/bark mulch.

If, in the Project Engineer's judgement, there is non-compliance with ESC provisions, or if the Contractor receives a warning or citation from NSEL or DFO, then corrective action may require

a shutdown of construction activities, until such time as the non-compliance is satisfactorily corrected.

3.2 Erosion and Sediment Control

Erosion and sedimentation can occur at any time during the construction of the highway. The highest potential for erosion occurs during the grubbing, grading, and culvert/structure installation. The emphasis in all of TPW's construction projects is to **prevent erosion rather than treat sediment**.

TPW defines seven principles of erosion and sediment control (further information is available in the annual ESC Course jointly prepared by TPW, NSEL, DFO, and Dalhousie University - Centre for Water Resource Studies (see http://www.gov.ns.ca/tran/enviroservices/enviroErosion.asp)):

1. Go gently into this good site.
2. Keep clean water clean.
3. Minimize amount of exposed soil.
4. Minimize time of exposure (of soil).
5. Keep sediment on site.
6. Avoid steep slopes.
7. Have a contingency plan and the resources for emergencies.

In order to meet these principles and minimize the impacts related to erosion and sedimentation, TPW has adopted the erosion and sediment control (ESC) practices and techniques as outlined in the following sections.

TPW's "*Standard Specification - Highway Construction and Maintenance*" and the Transporation Association of Canada (TAC) *"National Guide to Erosion and Sediment Control on Roadway Projects"* are the principal reference documents for all ESC measures. The key elements are summarized in this EPP along with five "Selected Special Provisions" (see Appendix A: Supplying and Placing Compost, Supplying and Placing Bark/Compost Berms for Sediment Control, Supplying and Placing Bark for Erosion Control, Wire Backed Silt Fence Barrier, Erosion and Sediment Control Plans for Borrow Pits).

The following sections provide an overview of erosion types, factors effecting rates of erosion, effects of sedimentation, and recommended ESC measures.

3.2.1 Erosion

Erosion is defined as the gradual wearing away of the land surface by the action of water, wind and ice. Water is the leading cause of erosion in highway construction projects in Nova Scotia. There are several types of erosion that can affect exposed soils and frequently these types of erosion will work in combination. Erosion types include:

Splash Raindrops impact the ground at 2-9 m/s and dislodge and scatter soil particles.

Sheet Refers to the removal of a fairly uniform layer of soil by shallow sheets of water, without the development of channels. While sheet erosion will rarely detach soil particles, it is primarily responsible for the transportation of soil particles detached by splash erosion. Shallow surface or sheet flow only moves a few metres across land before concentrating in surface irregularities causing rills.

Rill Rills will begin to develop as sheet flow concentrates in low spots on the surface. Rills are small channels on the order of 1-10 cm in depth. This concentration of flow is able to detach and transport soil particles.

Gully Gully erosion occurs as flow in rills combines into larger channels. Runoff in gullies has more erosive powers than that in rills, and is capable of transporting large amounts of soil. Continued growth of gullies can lead to slumps, landslides and major damage to roads, adjacent lands (up and down-gradient), and fish habitat.

3.2.2 Factors Influencing Erosion

Soil Type

Runoff occurs when the rate of rainfall or snowmelt exceeds the infiltration capacity of the soil, and the surface water retention. Soils containing high percentages of silt and fine sands are the most erodible (*i.e.*, muddy soils typical of alluvial, colluvial and marine deposits). Clay has low erodibility because it acts as a binder, however, once detached the fine particles are easily transported by water and tend to remain in suspension for a long time. Removal of these particles from construction runoff will require the use of settlement (settling) ponds and probably a flocculant to clarify the water prior to discharge from the construction site.

In contrast, coarse sands are easily detached, but have low erodibility because they are difficult to transport. Clear, well-drained and well-graded gravel and gravel-sand mixtures are the least erodible. Soils which are high in organic matter tend to increase infiltration and soil permeability, decreasing their erodibility, provided they are not subject to deep rutting.

Average loss rates of soil from bare ground are on the order of 63 m^3/ha (33 yd^3/acre) or 67 tonnes/ha (30 tons/acre). Because the best soils are usually lost first, excess loading of topsoil nutrients into lakes and streams can also lead to a variety of eutrophication-related problems.

Vegetation

Maintaining or establishing vegetation is important to preventing erosion as vegetation will:

- Intercept and reduce the energy of falling raindrops;
- Reduce runoff velocity;
- Filter out sediment;
- Increase infiltration of water to the soil;
- Hold soil in place with roots; and
- Remove subsurface water between rainfalls through evapo-transpiration.

Table 2 provides a comparison of soil loss under various types of vegetation against unprotected ground. Table 3 compares the effectiveness of selected ground covers in reducing erosion.

Table 2
Runoff and Soil Loss by Land Use

Land Use	Runoff as Percent of Rainfall (silt loam, 7% slope)	Annual Soil Loss by Land Use (tonnes/km^2)
Woods	0.009	0.8
Grass	0.29	4
Crop rotation	8.6	4400
Bare ground	29.1	26640

Source Unknown

Table 3
Effectiveness of Selected Ground Covers

Cover Type	% Reduction in Soil Loss
Grass - 0 to 60 days	0 - 16
Grass - 2 to 12 months	60 - 95
Grass - >12 months	90 - 99
Woodchips (15 to 25 tonnes/ha)	80 - 95
Straw (2 to 10 tonnes/ha)	80 - 97
Chemical Mulches	90

J. Li (1997) Erosion and Sediment Control Training Manual. Report Prepared for the Ontario Ministry of Environment and Energy. Toronto, Ontario.

Further information on vegetative covers for Nova Scotian Highways, together with advice on best practices for establishment and long-term maintenance, are presented in TPW's (2003) "*Integrated Roadside Vegetation Manual*" and its companion "*Roadside Vegetation Field Manual*."

Topography

The size, shape and slope characteristics all influence the amount and rate of runoff. As the length and the gradient of the slope increases, so does the velocity and rate of runoff and thus the erosion potential. Slope orientation can also be a factor. For example, south/north facing slopes may have different abilities to reestablish vegetation due to duration of snow cover and amount of sunlight received.

Weather, Climate/Microclimate and Hydrogeology Interactions

Rainfall is the dominant climatic factor which contributes to erosion. Seasonal changes also play a role. For example, when precipitation falls as snow, no erosion will take place. When melting snow adds to runoff, especially when combined with a rain event, erosion potential is increased.

Similarly, frozen ground is generally erosion resistant, however soils with high moisture content are subject to heaving by freezing action and are very easily eroded upon thawing. High moisture content may arise because of climatic factors, microclimate (orientation to the sun and wind), soil organic matter content, groundwater seepage to the surface (springs), and seasonal/storm-related variations in the water table.

The highest potential for erosion occurs when intensive rainfall (measured as both intensity and duration) combines with open or unstable ground conditions (caused by snow melt, or melting of frost). This will generally coincide with grubbing (typically in the Spring) and maximum earthworks exposure in the Summer and Fall. Contractors shall be prepared for the worst and ready to implement their contingency plans (see Section 5.5).

3.2.3 Sedimentation

Sedimentation is the deposition and accumulation of detached soil particles. Sedimentation can have the following impacts on watercourses, waterbodies and wetlands:

- Alters oxygen balance in water;
- Clogs small pebbles fish use for spawning.;
- Suffocation of eggs and fry of salmon and trout;
- Suffocation of aquatic insects (an integral part of the food supply of trout and salmon);
- At high concentrations, sediment can suffocate fish;
- Clouds the water and prevents salmonoids (trout, salmon) from seeing their prey;
- Transport toxic materials;
- Increase water temperature to uninhabitable levels;
- Fills in and may alter hydrology of wetlands; and
- Diminishes drinking water quality.

3.2.4 Erosion and Sediment Control - General Requirements

Erosion control techniques to be implemented on highway construction shall be implemented in any area where there is exposed soil and a potential for erosion. The following sections provide techniques available for use by the Contractor to ensure runoff leaving the site meets NSEL and DFO criteria for total suspended solids (TSS).

While the Project Engineer is available to advise the Contractor on protection measures, **the Contractor has the ultimate responsibility to install, maintain, and monitor ESC measures until the completion of the contract. The Project Engineer and TPW inspectors will conduct daily inspections.**

The following general requirements shall be adhered to by the Contractor:

(a) Adhere to NSEL (2006) *Watercourse Alteration Specifications*, including the on-site availability of all Approvals and Terms and Conditions;
(b) Educate all construction personnel about Project Approvals, Terms and Conditions, and the importance of ESC measures and plans;
(c) Notify Project Engineer and NSEL of changes and modifications to ESC measures and plans prior to implementation;
(d) Travel shall be restricted as much as possible to areas between slopes stakes in cuts and fills;
(e) No fording of watercourses or wetlands and no equipment to work within watercourses or wetlands unless specifically approved by NSEL and DFO;
(f) Access ways on the ROW and approaches to water crossings shall be stabilized to support the anticipated traffic. Maintain access roads to prevent erosion and sedimentation;
(g) Adhere to construction monitoring/inspection programs noted in this EPP (Section 4). Maintain daily records, discuss proposed changes and alterations with the Project Engineer prior to implementation, and immediately report potential problems to the Project Engineer or TPW inspectors (and NSEL/DFO depending upon statements in the Project Approvals and Terms and Conditions).
(h) Runoff shall be controlled and sediment will be prevented from leaving the site at all times. In addition, to ensure ESC measures are maintained during construction, the Contractor shall periodically inspect all installed ESC measures (especially before and after storm events) and protect exposed soil with either temporary or permanent covers as soon as areas are brought to grade;
(i) Install drainage and siltation control devices prior to grubbing. Install Type 2 Silt Fence, also known as 'Wire Backed Silt Fence Barrier' (see *Selected Special Provisions* in Appendix A), near watercourses and monitor condition daily. Any deterioration/damage is to be repaired immediately or operations ceased until repairs are completed;
(j) Divert clean water from undisturbed areas around the site using berms or lined channels or carry the water across the site in lined channels or pipes;
(k) Maintain on site sufficient quantities of silt fence barrier, straw/hay mulch, compost, bark, Clear Stone, erosion control blanket and geotextile fabric to address ESC issues as the work progresses, and fulfill the requirements of the Contingency Plan for failure of ESC measures (see Section 5.5);
(l) Maintain sufficient personnel and equipment to manage erosion and sediment control during storm events and other emergency situations (*e.g.*, failure of ESC measures; Section 5.5);

(m) Should a storm event be predicted, the Contractor shall inspect all installed ESC measures and implement additional controls as necessary to ensure runoff leaving the site meets TSS criteria. The Contractor shall also be prepared to implement a Contingency Plan to deal with emergencies (see Section 5.5 for further guidance);
(n) Steep slopes, erodible soils, wet areas, and watercourses are areas of high erosion potential and the Contractor shall exercise extra caution in these areas. Point source discharges will be minimized and sheet flow maximized where appropriate;
(o) All in-stream work to be carried out "in isolation from flowing waters" and strictly following NSEL and DFO Approvals, Terms and Conditions, and Letters of Advice;
(p) Dewatering flows to be pumped to appropriate settlement ponds or adjacent vegetated areas, and no discharge to the watercourse when TSS levels exceed 25 mg/L;
(q) The length of time that soil is exposed shall be minimized. This will be achieved by minimizing grubbing to the extent necessary to meet engineering requirements, avoiding working during wet periods, and staging construction schedules using the Work Progression Schedule to minimize the length of time soils are exposed;
(r) Stabilization prior to area being brought to final grade may be required if the area has a high potential for erosion that could adversely impact a watercourse;
(s) Erodible soils shall be stabilized using slope roughening, rip-rap and filter fabric, or by rehabilitating by seeding, mulching, erosion control blankets, or sod immediately after grading is completed;
(t) Surface runoff will be directed to vegetated areas where possible, or via stabilized ditch systems which follow similar routing to natural existing drainage patterns;
(u) Existing drainage provisions for the existing highway will be used where possible; and
(v) ESC measures for borrow pits shall be prepared by the Contractor and submitted to the Project Engineer for review prior to construction commencing.

The following subsections provide a summary of the installation and maintenance of ESC measures commonly used in highway work. These measures are to be installed in accordance with Division 7 of TPW's *Standard Specifications*, Selected Special Provisions (see Appendix A), and, as a minimum, at locations designated in ECPs prepared for various segments of the project. This does not alleviate the responsibility of the Contractor to implement ESC measures on its own accord to prevent erosion and to ensure transport of sediment from the site is minimized. Typical details for ESC measures are provided in Appendix C. Additional guidance is available in the AASHTO (2005) document entitled "*Environmental Stewardship Practices, Procedures, and Policies for Highway Maintenance and Construction*", the course binder for the annual ESC Course jointly prepared by Dalhousie University - Centre for Water Resource Studies, TPW, NSEL and DFO, and the various course presentations (digital versions are available at the following weblinks: http://environment.transportation.org/environmental issues/construct maint prac/compendium/manual/, and http://www.gov.ns.ca/tran/enviroservices/enviroErosion.asp).

3.3 Clearing

Clearing work involves travel along the ROW, clearing of trees, piling of merchantable timber and the chipping of all non-salvageable material such as brush, slashings, limbs, fallen branches, and other surface litter. The primary concern during clearing is to prevent ground disturbance that may result in the sedimentation of watercourses and wetlands.

3.3.1 General Protection Measures

(a) Where possible, all clearing shall take place during the winter months on frozen ground (see Appendix D for further information about winter clearing). All vehicles shall use flotation tires, properly sized for the vehicle. When the Project Engineer deems that ground conditions are not suitable for machinery use, hand clearing will be done;
(b) Under no circumstance is the soil to be disturbed within the designated buffer zone of any watercourse. The buffer zones for clearing are provided in the environmental control plans and may be increased by the Project Engineer if site conditions warrant during construction;
(c) Trees within this buffer zone shall be hand cleared or cleared by equipment that can reach into the buffer zone without disturbing the soil;
(d) Any merchantable timber or non-salvageable material removed from the buffer zone shall be done in such a manner that does not result in disturbance of the surface or exposure of the underlying soil. Brush mats or swamp mats shall be used to protect the surface. Brush mats should be between 300 and 500 mm in height. When ground conditions are not suitable for machinery use, even with matting, clearing shall be done by hand;
(e) The chipped material shall be left in place to cover the ground and minimize ground disturbance everywhere except within buffer zones; and
(f) Only when avoidance is impossible, will a water crossing be implemented. Equipment will not be permitted to enter a watercourse. To facilitate water crossings, temporary bridges or ice bridges (crossings less than 5 m in width) will be used. The Contractor must adhere to all Terms and Conditions regarding the use of temporary bridges in NSEL and DFO approvals. The temporary crossing must be removed as soon as possible when it is no longer required. If any disturbance to the creek banks has occurred due to bridge removal, the Contractor shall immediately stabilize the banks with Clear Stone or rock.

3.3.2 Disposal of Clearing Waste

Burning is not permitted on 100 Series highways. TPW will accept the following methods for the disposal of surplus brush, slash, or non-merchantable timber.

Chipping

(a) Wherever possible, chips shall be spread on side slopes and back slopes as part of final slope dressing;
(b) Large stockpiles of chips shall be avoided;
(c) Chips shall be disposed of where they will not run into a watercourse or block ditches, culverts, or drains. Chips shall not be disposed of within buffer zones; and
(d) If feasible, stumps shall be ground using a stump grinder.

Burying

Material that cannot not be disposed of by the above methods shall be buried. The material is permitted to be buried in the following locations:

(a) In a grubbings disposal area obtained by the Contractor;
(b) Buried in pits, or in the toe of slopes or outside the theoretical slope with the approval of the Project Engineer; and
(c) In a suitable location in the ROW outside the roadway and with the approval of the Project Engineer.

3.4 Culvert Installation

For the purposes of this document, a watercourse is defined as the bed and shore of every natural, river, stream, lake, creek or pond, whether or not it contains water.

This section is intended to cover the protection measures associated with culvert installation including ESC measures, water (flow) control, and temporary diversions of watercourses. Temporary crossings that may be associated with culvert installation shall be carried out using the general protection measures described in Section 3.2.

Culvert design will address potential climate change impacts through use of 1:100 year design storm based on a range of runoff coefficients developed from actual streamflow response to a 1:100 year event (hourly flows). Where applicable, culverts and culvert extensions shall also be designed based on DFO specifications for fish passage (see DFO's (1998) *Guidelines for the Protection of Fish and Fish Habitat: The Placement and Design of Large Culverts*). Further details about culverts requiring fish passage will be provided on culvert mitigation plans (CMPs) prepared for the project.

Note: Blasting in or near watercourses must receive DFO approval (see "*Guidelines for Use of Explosives in or Near Canadian Fisheries Waters*"; Wright and Hopky, 1998).

Protection Measures

(a) Prior to the commencement of any work associated with culvert construction, an on-site meeting shall be arranged between the Project Engineer, DFO, NSEL, and the Contractor to discuss the construction procedures;

(b) The Contractor shall adhere to any further stipulations discussed and agreed to by the approved parties as a result of the above on-site meeting. These stipulations shall form part of the Contract;

(c) All work shall conform to the "*NS Watercourse Alteration Specifications* (2006)", the TPW *Standard Specification*; and the Terms and Conditions of NSEL and DFO Approvals;

(d) An Environmental Monitor will be on-site at all times during culvert construction to assist construction personnel as required, collect water samples, and ensure compliance to DFO and NSEL Authorizations, Approvals and Letters of Advice;

(e) All in-stream work shall be completed between June 1 and September 30, and "in isolation from flowing water";

(f) Machinery shall avoid work near watercourses unless specifically permitted;

(g) Prior to work on culverts, a Type 2 Silt Fence shall be installed on both sides of the watercourse at a location delineating the edge of a buffer zone. This buffer zone shall be 75 m on either side of the watercourse unless otherwise specified. The Contractor will monitor the silt fence daily and any damage/deterioration will be repaired immediately or operations ceased until repairs are complete;

(h) Install erosion and sediment control measures as detailed in Appendix C and on the CMPs;

(i) A buffer zone shall be maintained on both sides of each watercourse within which no grubbing or filling is to take place until the drainage structure and the erosion control devices are installed, with the exception of the footprint under the proposed culvert and stream diversion or the access road and working platform necessary to construct the culvert. Buffer zones will be shown on CMPs and ECPs for various segments of the project;

(j) During construction, temporary access roads and working areas within the buffer zone shall be adequately surfaced with Clear Stone and properly maintained to prevent siltation of the watercourse;

(k) Excavation shall be carried out in the dry, either by (1) building the new structure in the dry and diverting the stream into it upon completion, (2) constructing a temporary plastic-lined diversion channel (see Appendix C), (3) installing sheet pile barriers [cofferdam] for culvert footings of span structures, or (4) damming the stream and pumping the water around the site. If the dam and pump option is used for water control, the Contractor shall ensure the pumping operation is monitored 24 hours per day to ensure that adequate flow is provided at all times to downstream areas. Backup pumps and hoses shall also be available on-site.

(l) Temporary diversions channels shall be constructed to resemble the existing channel in cross section or as directed by the Project Engineer, and must be designed to pass the maximum discharge anticipated during the period of construction. The entire walls and floor of the diversion channel shall be lined with polyethylene or a geotextile;

(m) Cofferdams shall be made of sheetpile barriers or sandbags covered with plastic;

(n) All fish stranded when the stream is temporarily diverted or re-directed into the completed culvert shall be rescued by electrofishing or netting and placed in the new watercourse. DFO shall be notified prior to the transfer of fish;

(o) Dewatering flow from sheetpile barriers, and other intercepted water from the construction site shall be pumped, or directed to, appropriate settlement ponds or adjacent vegetated areas. The Contractor will ensure that no discharge to adjacent watercourses will occur when TSS concentrations exceed the 25 mg/L criterion; and

(p) Excavated material and construction debris shall be disposed of away from the watercourse so that rain or high flow conditions will not return the sediment and debris to the watercourse (unless the material is being temporarily stored for future restoration purposes; wetland and aquatic vegetation and associated root mat may be stored with the knowledge and approval of the Project Engineer and government regulators; enhanced ESC measures will be required, *e.g.*, turbidity curtains and containment berms).

3.5 Structures

Construction of structures, in particular, excavation of foundations in or adjacent to watercourses and wetlands present environmental issues related to water control and erosion and sediment control.

General measures for structure construction are provided below:

(a) Excavation for foundations in or near a watercourse or wetland shall be done to prevent siltation. Excavations shall be isolated from the watercourse or wetland using methods such as cofferdams and turbidity curtains as directed by the site-specific plans and the Project Engineer. All work in watercourses or waterbodies must have prior approval of NSEL, DFO, and if required, the Coast Guard (*Navigable Waters Protection Act* [NWPA] approval);

(b) Water pumped from an excavation shall not be discharged directly to the watercourse or wetland and must be filtered through vegetation or by the use of a filter bag on the end of the discharge hose (or temporarily stored in appropriate-sized settlement ponds). Water reentering the watercourse shall not have a TSS concentration exceeding 25 mg/L;

(c) Rock protection shall not consist of net acid-generating rock or rock that has the potential to leach heavy metals or arsenic. The Contractor shall provide test results from the source of the material to the Project Engineer for approval prior to placing the rock; and
(d) Storage and handling of chemicals used in structure construction shall follow the procedures detailed in section 3.15.

3.6 Grubbing

Grubbing is the removal of all organic material and unsuitable soil above the underlying subsoil. It also consists of the removal and disposal of all stumps, roots, downed timber, embedded logs, humus, root mat and topsoil from areas of excavations and embankments or other areas as directed by the Project Engineer.

Protection Measures

(a) The area to be grubbed shall not extend into the buffer zones shown on the ECPs for various segments of the Project until completion of culvert/structure installation and all ESC measures are in place;
(b) The areas where debris from the grubbing operation will be stored shall be selected to minimize any potential impact on watercourses (minimum distance of 100 m from any watercourse), unless the material is being temporarily stored for future restoration of the stream banks or lakeshore (*i.e.*, the riparian zone). As noted earlier, wetland and aquatic vegetation and associated root mat may be stored with the knowledge and approval of the Project Engineer and government regulators (enhanced ESC measures such as turbidity curtains and containment barriers will be required);
(c) Grubbing debris shall have appropriate ESC measures applied;
(d) Areas used for the disposal of material removed in the grubbing operation shall not obstruct drainage patterns nor shall runoff from the disposal areas contaminate or cause siltation of any streams or wetlands;
(e) If approved by the Project Engineer, grubbing and excess materials can be used to flatten slopes, construct berms, or be deposited as directed by the Project Engineer, provided it presents a neat appearance and does not adversely affect abutting property; and
(f) The grubbing debris areas shall be seeded and dressed to establish vegetation as soon as possible.

3.6.1 Topsoil

Topsoil is defined as the surface layer of soil that has been processed (using a root rake or other means) to be free from woody vegetation, stumps, roots, or other debris that would prevent proper placement of the topsoil when finishing slopes and other areas. The material shall also be free from any material toxic to plant growth. Specialty topsoil for application in the riparian zone of streams and lakes may also be specified to ensure maximum germination and growth of vegetation. Further details are provided in a new Special Provision (see Appendix A).

The pH of topsoil shall be between 5.5 and 7.6. If topsoil has a pH less than 5.5, the pH shall be increased by applying pulverized limestone at a rate necessary to attain a 6.5 pH value. Topsoil shall have an organic content (% of dry weight) of 2.0%. If the organic content is less than 2.0%, it shall be increased by adding peat or composted material at a rate necessary to attain the minimum organic content.

Other guidance is summarized below:

(a) Topsoil shall be retained from grubbing operations wherever possible, and placed on sideslopes, backslopes and the medians to improve the establishment of vegetation;
(b) Topsoil shall be removed from construction surfaces and stockpiled in consultation with the Project Engineer. If space within the right of way is not available for stockpiling of topsoil, the Contractor shall secure suitable areas elsewhere for the duration of the contract;
(c) The Contractor shall employ ESC measures to reduce runoff and minimize loss of topsoil due to erosion;
(d) Processed topsoil shall be free from stones, clay lumps or similar objects larger than 50 mm in greatest dimension;
(e) Sod and herbaceous growth such as grass, weeds and shrubs need not be removed but shall be thoroughly broken up and mixed with the topsoil during handling operations;
(f) Areas where topsoil is to be placed shall be fine graded to a uniform surface. It shall be free of all vegetation and other debris, and free from stones which would not be covered by the specified depth of topsoil; and
(g) Topsoil shall be spread to a uniform depth of approximately 100 mm on designated areas.

3.6.2 Settlement Ponds

Settlement or settling/sedimentation ponds are designed to intercept and retain sediment-laden runoff so that sediment may settle out, reducing the amount of sediment leaving the disturbed area, and protecting areas and watercourses downstream of the pond from excessive sedimentation. **Settlement ponds do not solve erosion problems** - they are used as a 'last resort' to treat runoff which has already become silt laden.

Location

Settlement ponds may be required where larger flows of water or larger drainage areas are encountered. Ponds shall not be constructed in a location that cannot be accessed later in the construction process for maintenance purposes or removal (*e.g.,* near the base of fills).

Construction

Unless otherwise directed by the Project Engineer, ponds shall be constructed in accordance with the *Standard Specification* (Division 7, Section 3), Drawing HS708 (see Appendix C), and the following guidance:

(a) Ponds shown on ECPs for various segments of the Project shall be constructed prior to grubbing upstream of the pond;
(b) Ponds shall be constructed in the locations shown on the ECPs or as directed by the Project Engineer, and shall be of sufficient size to filter all runoff from the highway ROW to be drained;
(c) As per the *NS Watercourse Alteration Specifications*, the minimum size requirement is 190 m^3 of storage for each hectare of exposed construction area (or 0.0625 acre-feet per acre);
(d) Size and number of ponds can be minimized by reducing the area exposed soil; and
(e) Flocculating agents may be required for adequate settling of fine colloidal soils and clays. The Contractor may be required to use flocculating agents if pond discharge results in a TSS concentration in excess of 25 mg/L at the ROW boundary or entering a watercourse.

Maintenance

(a) Ponds shall be cleaned out when the storage is 50% full. Filters must be kept free of silt build-up;
(b) The water level shall be such that the pond can hold water in the next rain event; and
(c) The ponds shall only be removed on the direction of the Project Engineer.

3.6.3 Sediment Barriers

Sediment barriers are used as a temporary perimeter control to intercept sediment-laden runoff as it leaves the construction area. The barrier will slow flow and allow sediment to settle out before it enters a ditch or watercourse. Fine-grained sediment is trapped, while storm runoff may pass through at a slower rate. Sediment barriers are to be used to intercept sheet runoff only. They are not effective in ditches and are not permitted in watercourses, or when continuous flow and/or moderate to high velocities are expected.

Sediment Barriers can come in several forms:

- Straw/hay bale barriers;
- Silt fence barrier and 'Wire backed silt fence barrier' (Type 2 Silt Fence; see Appendix A);
- Berm barriers; and
- Sandbag barriers.

Other sediment barriers that are available for use (with approval of the Project Engineer), but not listed in the *Standard Specification* include coir logs, triangular Silt Dyke™, and Enviro Berm®.

The most commonly used barrier in highway construction is the silt fence barrier, however, berm and sandbag barriers can be used in situations where longer term protection is required. While berms may be more costly to construct, they offer the benefit of lower maintenance costs. In some situations, a berm barrier can be left following construction as a permanent ESC measure with the approval of the Project Engineer.

Locations

Sediment barriers are to be located in a continuous fashion, perpendicular to the flow. They shall be installed in the following areas:

- to delineate the construction site;
- to delineate buffer zones;
- toe of fill slopes;
- the downhill side of large cut areas; and
- along watercourses and drainage swales.

During the course of construction, it may be necessary to install sediment barriers at other locations to contain sediment from excavations, embankments or temporary stockpiles of grubbings, topsoil, root mat and vegetation plugs.

Construction

- Barriers shall be constructed in accordance with the *Standard Specification* (Division 7, Section 1) and/or any Special Provisions (e.g., Bark/Compost Berm and Wire Backed Silt Fence Barrier; see Appendix A);

- ☼ Sediment barriers are to be installed prior to any grubbing work commencing on the construction site;
- ☼ Barriers are not to be used in a ditch as flow checks as they are not designed to withstand concentrated flow;
- ☼ As construction proceeds, the site contours may change, and the barrier location and extent shall be re-evaluated by the Contractor to ensure its effectiveness; and
- ☼ Various styles of sediment barriers, and the correct installation techniques, are shown in Appendix C and the *Standard Specifications*.

Maintenance

(a) The barrier shall be inspected after each rainfall and at least daily during prolonged rainfall. Silt fences installed near watercourses must be inspected daily. Any deterioration or damage is to be repaired immediately, or operations ceased until repairs are complete;

(b) All barriers or parts of barriers that have been damaged shall be repaired immediately;

(c) If barriers are removed or opened to allow equipment to pass, the barrier must be replaced immediately;

(d) If significant volumes of silt (one half the height of the barrier or a depth of 300 mm immediately upstream of the control device) have accumulated against the barrier fence at any location, the silt shall be removed from the barrier or a second line of barrier installed;

(e) Fine colloidal clays may pass through sediment barriers. If this condition is encountered, special ESC techniques may be necessary, *e.g.* settlement ponds treated with flocculants to promote settling; and

(f) The barriers shall be removed to the satisfaction of the Project Engineer when areas upstream of the measure have been stabilized or, in the Project Engineer's opinion, they are no longer required. The area of the removed fence and any exposed sediment removed from the fence shall be dressed, seeded and mulched in accordance with this EPP, the *Standard Specification*, and any Special Provisions to the tender documents.

3.6.4 Diversion Ditches

Diversion ditches are used to intercept surface runoff and direct it to a collection or discharge point.

Location

- ☼ Diversion ditches shall be constructed along the top of cut areas, where the direction of the slope is toward the cut section. Typically, the top of slope ditches would transfer water to riprap down drains and then to the road ditch, or toe of slope ditch;
- ☼ Ditches shall also be placed at the base of grubbings disposal areas where the direction of slope is toward the highway; and
- ☼ Ditches can also be used to divert concentrated flow to sheet flow over vegetated areas.

Construction

(a) Diversion ditches shall be installed prior to grubbing to intercept surface runoff and divert water away from the slopes being constructed;

(b) Ditch dimensions shall be based on anticipated flows. As a minimum, diversion ditches shall be 300 mm deep with 3:1 side slopes;

(c) The ditch shall be lined with erosion control blanket for grades from 0% - 5% and with Clear Stone for grades over 5%. In ditches where velocities in excess of 3 m/s are anticipated, stone riprap size shall follow item C16 of the *NS Watercourse Alteration Specifications*; and

(d) Where ditches have been installed on long slopes to redirect surface runoff, the ditches shall be constructed as permanent features.

3.7 Grading

Grading for the purposes of the EPP includes the excavating, transporting, disposing or placement of materials within the limits of the work. Grading includes rock and overburden cut and fills, ditch excavation, and sloping and shaping of embankments. It is during these operations, that result in the exposure of large areas of soils, that highway construction has the highest potential for erosion.

The most effective and widely used erosion control practices used to minimize erosion include: strict adherence to the Work Progression Schedule (Section 3.1), sediment barriers, flow checks, straw/hay/compost/bark mulch, or erosion control blankets.

3.7.1 Straw/Hay Bales

Location

Straw/hay bales are temporary measures used to filter sheet flow and low-flow rill runoff. They may be used on an as-required basis along the toe of fill slopes and as surface protection (*i.e.*, when dispersed on the ground surface). Bales are **not** to be used adjacent to watercourses (install Type 2 silt fence) **nor** across ditches as flow checks.

Construction

(a) Bales for sediment barriers shall be installed in accordance with the *Standard Specification* (Division 7, Section 1);
(b) Straw bales shall be installed perpendicular to the flow and keyed in (*i.e.*, placed in a trench measuring 750 mm wide by 150 mm deep);
(c) Bales shall be securely bound and anchored with steel pins or wooden stakes; and
(d) The remaining trench space shall then be backfilled and compacted to existing grade.

Maintenance

(a) Sediment behind the bales shall be removed when sediment has accumulated up to one half of the height of the bale;
(b) Bales shall be removed and replaced if they have deteriorated to the point where they are no longer effectively filtering runoff; and
(c) Bales shall be maintained until the area upstream of the bales has been vegetated. On removal, bale strings shall be cut and disposed of, and the straw distributed on the ground.

3.7.2 Flow Checks

Flow checks are designed to slow the velocity of water in ditches, thereby reducing its erosive power. Although, not the primary purpose, flow checks also provide limited sediment control by trapping sediment on the upstream side of the flow check.

Location

Flow checks shall be constructed with clear stone or sandbags across roadside drainage ditches throughout cut sections and adjacent to inlets and outlets of culverts, or as otherwise directed by the Project Engineer (see Table 4).

Table 4
Recommended Flow Check Construction

Ditch Grade	Flow	Flow Check Type
0-2%	Low	Clear Stone
2-5%	Medium	Sand bags, Clear Stone
5-8%	High	Clear Stone. Materials to be graded to ensure trapping of sediment

Note: Flow checks are not recommended from grades >8%. For grades >8%, the Contractor shall line the ditch with permanent turf reinforcing mats or Clear Stone.

Construction

(a) Flow checks shall be constructed in accordance with the *Standard Specification* (Division 7, Section 2);
(b) The ends of the flow check must be higher than the middle to allow water to flow over the centre and to prevent scouring of the foreslope and backslope;
(c) The low point of the flow check must be lower than the top of the sub-grade;
(d) In general, flow checks are to be installed along any new ditching of the highway including the median and at spacings to be determined by dividing 200 m by the ditch grade in percent (Table 5). In coarser soils, this spacing can be increased with the approval of the Project Engineer. Spacing can also be increased if the ditch is lined with erosion control blanket;
(e) Flow checks shall be installed during construction and again after ditches are brought to final grade;
(f) Flow checks shall be installed around each catch basin located in the highway median; and
(g) Typical construction techniques for flow checks are shown in Appendix C.

Table 5
Recommended Flow Check Spacing

Slope (%)	Distance between flow checks	
	m	ft
2	100	300
3	65	200
4	50	150
5	40	120
8	25	75

Maintenance

(a) Flow checks shall be monitored by the Contractor throughout the construction period and cleaned out after each storm or when they become half full of sediment. Flow checks shall be maintained until vegetative cover is established; and

(b) All flow checks must be removed when vegetation is established. When the flow checks are removed, they should not be excavated to bare ground, instead a 5-10 mm layer of gravel from the flow check shall be left to prevent erosion, or the flow check location can be seeded and covered with erosion control blanket.

3.8 Site Access

The following protection measures apply to all existing and new right-of-way site access roads. Specifications and protection measures for landowner access roads are detailed in Appendix E.

(a) The number and size of access roads to the right-of-way will be minimized. Where possible, existing roads will be used (logging and farm roads). Existing roads shall be upgraded to meet the demands of heavy equipment. Upgrading can include: frequent grading to promote drainage off the rock, the addition of rock to stabilize soft areas, or gravelling;

(b) Where new access roads are constructed, the roads shall be built 200 m at a time to minimize amount of exposed soil;

(c) Access road ditches are important to keep the roadbed dry and stable. Ditches are not to run directly into the watercourse. Where ROW permits, take-off ditches are to be constructed to direct the runoff to drain through natural vegetation before it reaches any watercourses;

(d) Natural land drainage must not be blocked by the construction or use of access roads. Culverts or temporary bridges will be required at low points where drainage crosses the road. Culvert installations will be in accordance with the *NS Watercourse Alteration Specifications* (2006); and

(e) The Contractor shall maintain access roads to promote drainage off the road and to prevent deterioration of the road.

3.9 Winter Construction

Apart from clearing, winter construction is not normal practice for TPW. However, in certain circumstances such as wetland excavation, structure construction, or to avoid interactions with rare species during sensitive life stages, winter construction will reduce environmental impacts. Note however that winter construction is plagued by saturated soils, frozen ground, and variable success with soil stabilization measures and other ESC methods.

Protection Measures

(a) Prior to initiating winter works, all ESC measures that can be installed, shall be installed;

(b) If a delay is anticipated in finishing slopes, all exposed areas shall be covered with mulch in accordance with the *Standard Specification* (and/or Special Provisions). If the slopes are finished, they shall be covered with an erosion control blanket that can be seeded through in the spring. Alternatively, slopes can be sprayed with a bonded-fibre matrix product such as Soil Guard®. Slopes adjacent to watercourses, wetlands or other sensitive areas shall be covered with Clear Stone. Slopes shall be protected within one day of finishing;

(c) Straw/hay bales and sediment ponds will not be appropriate in frozen conditions, therefore the contractor shall use sediment fences, sediment control berms, and diversion ditches to intercept and direct water to adjacent vegetated areas;
(d) Buffer zones adjacent to watercourses, wetlands, and sensitive areas shall not be disturbed except to access temporary crossings (see section 3.2.4) unless otherwise approved by DFO and NSEL;
(e) Exposed subgrade shall be gravelled or roller compacted. Traffic on the subgrade shall be avoided if practical. If travel is required, it shall be limited to a single travelway; and
(f) Prior to winter shutdown, the Contractor shall have stockpiles of ESC materials on-hand, ready to mobilize to the Project site in the case of failure of ESC measures (*e.g.*, straw/hay bales, compost/bark mulch, Clear Stone, geotextile, stakes, plastic sheeting and tarps, and sediment control fence [Types I and II]).

3.10 Stabilization

Stabilization includes those measures applied to finished slopes and ditches as part of permanent erosion protection. These measures include: surface roughening; straw/hay, compost, bark mulch, erosion control blanket, Clear Stone, hydroseeding, and sod. Stabilization will be undertaken in a timely manner, as per the Work Progression Schedule.

3.10.1 Surface Preparation

Surface preparation shall include (a) removal of all deleterious materials such as sticks, roots or large rocks, (b) loosening of the top 50 mm of soil, and (c) scarification to minimize runoff velocities and to hold seed. Scarification shall be parallel to the contours of the slope with a minimum indentation (high to low) of 25 mm and a maximum spacing of 150 mm. Surface preparation can be used as a short term measure in conjunction with mulch and it shall be carried out to prepare slopes prior to placement of erosion control blanket or hydroseeding.

3.10.2 Straw/Hay, Compost and Bark Mulch

Mulch shall be applied as surface protection on slopes and other exposed ground to prevent erosion. It shall be used as a temporary protection measure for any area with erodible soil, or to protect areas that are built to final grade and a delay in hydroseeding is anticipated.

Locations

- Areas of exposed soil that do not require erosion control blanket; and
- Used as temporary slope protection until slopes can be finished and hydroseeded.

Construction

- Mulch shall be applied in accordance with the *Standard Specification* (Division 7, Section 6) and Special Provisions to the tender;
- Mulch shall be compost, bark, hay or straw, free of noxious weeds and other undesirable material, and not so wet, decayed or compacted so as to inhibit even and uniform spreading. The Contractor shall be responsible for confirming that the straw is free of noxious or invasive weeds;
- Mulch applied between May 1st and September 1st may or may not require binder. All mulching after September 1st and before May 1st shall require binder. Binder (tackifier) shall be applied at the manufacturer's recommended application rate;

- ☼ All slopes to be stabilized after September 1st shall utilize mulch and binder within 48 hours following the application of the hydroseed mix; and
- ☼ Rough ground and steep slopes require more mulch and binder per hectare than finished and/or flatter ground. Therefore, the Contractor shall adjust application rates within the allowable tolerance to ensure that the ground is covered with mulch as required.

Maintenance
Mulched areas shall be monitored frequently and additional mulch shall be applied to any bare areas observed.

3.10.3 Clear Stone
Clear Stone (Type C1) is used to ensure rapid and permanent stabilization of slopes, ditches and drains. Clear Stone is also required in the construction of culvert inlets, outlets, and energy dissipation (plunge) pools (see typical details in Appendix C).

Locations
- ☼ On the immediate embankment slopes at all culvert extensions to the lines and grades shown on the CMPs;
- ☼ Liner for ditches in erodible soils, or with slopes >5%;
- ☼ Permanent slope drains as indicated in the ECPs for various segments of the Project, or as required to prevent erosion from spring drainage;
- ☼ The outlet of culverts and ditches and in plunge pools and reconstructed stream channels in fish-bearing watercourses;
- ☼ Energy dissipation aprons at the outlet of diversion ditches;
- ☼ Fill slopes as shown in ECPs or as directed by the Project Engineer to prevent erosion;
- ☼ Placing of Clear Stone on embankment slopes shall be done concurrently with the placement of fill. Under no circumstances shall the height of the exposed surface exceed 2 m or a delay in the placement of Clear Stone exceed three days; and
- ☼ In other environmentally sensitive areas as directed by the Project Engineer.

3.10.4 Hydroseeding
Hydroseeding consists of applying a mixture of seed, fertilizer, mulch, binder, and water on foreslopes, median, backslopes, ditches and other prepared areas, to produce a uniform cover of grasses.

Locations
All exposed slopes, ditches, medians and disposal areas.

Construction
(a) The seed mix (percentage by mass) shall consist of:
40% Creeping Red Fescue
15% Timothy
15% Tall Fescue
10% Kentucky Blue Grass
10% Alsike Clover
5% Red Top
5% Perennial Rye

(b) Hydroseeding shall not be permitted on hardened or crusted soil. Hydroseeding shall be carried out as soon as possible after the completion of the surface preparation;
(c) If seeding is to take place after October 1, 10% oats shall be added to the mix to provide a quick growing, stable root mass;
(d) Each species shall meet or exceed the Canadian Grade Standards for Common No. 1 Seed. The Contractor shall provide the Project Engineer with seed certificates to confirm this requirement has been met;
(e) Fertilizer shall be 15-25-15 for seeding done May 1st to Sept. 1st, and 10-20-20 thereafter;
(f) Mulch shall be shredded newsprint (cellulose) coloured green with environmentally acceptable dye. Mulch shall contain no growth-inhibiting chemicals or compounds;
(g) Binder (tackifier) may be supplied in liquid or powder form and shall be applied at the Manufacturer's recommended application rate;
(h) Water shall be free of any impurities which would inhibit germination of grasses;
(i) Hydroseeding shall be carried out as soon as possible after completion of the surface preparation. Final dressing of slopes and other exposed soil shall be done as areas are completed, to enable hydroseeding to be done in stages as work progresses;
(j) Prior to hydroseeding, the surface of slopes shall be prepared by creating horizontal grooves that run parallel to the slope using tracked equipment;
(j) Hydroseeding shall not be performed under windy conditions or during periods of rainfall, in standing water, or under other adverse conditions; and
(k) Application rates shall be as follows:

Hydroseeding 'A' (May 1 to September 1)

Seed	100 kg/ha
Fertilizer	625 kg/ha
Mulch (paper)	1350 kg/ha

Hydroseeding 'B' (after September 1)

Seed	100 kg/ha
Fertilizer	625 kg/ha
Mulch (paper)	350 kg/ha

Notes: These rates may vary by ±10% depending on ground conditions, and at the discretion of the Project Engineer.

3.10.5 Erosion Control Blanket

Erosion control blankets are applied to finished slopes, ditches and swales to keep seed in place until vegetation is established. Erosion control blankets are to be used to protect slopes, ditches and swales immediately after they are shaped.

The three main benefits of erosion control blankets are that they:

- prevent seed from washing away; reduce energy of rain;
- minimize erosion; and
- keep the soil under the blanket moist.

While serving the same role as mulch, erosion control blankets have the added benefit that they will remain intact in high wind or heavy rain events provided they are installed as per the manufacturers instructions.

Five types of erosion control blanket are currently acceptable to TPW: jute, excelsior, wood fibre, straw, and polypropylene. The Contractor may employ other blanket types or spray-on applications such as Soil Guard® with the approval of the Project Engineer.

Locations

- ☼ Areas of culvert installation and extensions as shown in CMPs and ECPs;
- ☼ Slopes;
- ☼ Ditch bottoms; and
- ☼ Swales.

Construction

(a) Prior to the placement of the blankets, the area shall have lime, fertilizer and seed placed as per the *Standard Specification* (Division 7, Section 5);

(b) The erosion control blanket shall be installed in accordance with the manufacturer's recommendations and the *Standard Specification* (Division 7, Section 7);

(c) In each area designated for seeding and erosion control blanket, the soil surface shall be prepared not more than 7 days before the seeding and erosion control blanket are installed;

(d) Prior to placement of seed and erosion control blanket, the surface of slopes shall be prepared by creating horizontal grooves that run parallel to the slope using tracked equipment; and

(e) If a delay is anticipated between slope finishing and hydroseeding on slopes requiring erosion control blanket, the Contractor shall install erosion control blanket that can be seeded through to protect the finished slope from erosion until it can be seeded.

Maintenance

The Contractor is responsible for the maintenance of the erosion control blanket until a vegetative cover is established or the completion of the Contract.

3.10.6 Sod

Sod shall be used at locations adjacent to environmentally sensitive areas when immediate stabilization is required to prevent impacts from erosion and sedimentation.

Construction

(a) The Contractor shall rake the slopes to remove large rocks and roots;

(b) Topsoil must be placed prior to sod. A minimum of 75 mm of topsoil shall be placed and uniformly spread;

(c) Lime and fertilizer shall be spread on the topsoil as per Division 7, Section 13 of the *Standard Specification*; and

(d) Sod shall be laid and tamped to a uniform and even surface.

Maintenance

Sod shall be watered twice a day for seven days after laying, and then once a day for the next 14 days (as required, given the weather conditions).

3.11 Borrow and Gravel Pits and Quarries

(a) Locations will be approved by TPW. The Contractor shall adhere to the setback requirements stipulated in NSEL's *Pit and Quarry Guidelines*. All borrow pits and quarries shall be constructed, operated and rehabilitated in accordance with NSEL guidelines;
(b) An ESC Plan for the borrow pit shall be developed by the Contractor for review and approval by the Project Engineer (TPW has a new "Special Provision" that will form the basis for this activity; see Appendix A);
(c) All topsoil removed to access the pit or exposed rock for blasting shall be stockpiled on site for the eventual rehabilitation of the pit. The stockpile shall be seeded to minimize erosion and a sediment barrier shall be installed to contain sedimentation;
(d) Stormwater runoff from the site shall be controlled using the applicable measures described in Section 3.7 so that TSS concentrations in discharges from the site do not exceed 25 mg/L;
(e) All borrow material, gravel pit or quarry aggregates shall be approved by the Project Engineer or NSEL with respect to their acid production/consumption properties and concentration of heavy metals. If an acid production/consumption test is required, the test shall be carried out using the BC Research Test method; and
(f) Sites shall be rehabilitated in accordance with the *Standard Specification* (Division 1, Section 4), the *Pit and Quarry Guidelines,* and this EPP to ensure slope stability and to minimize erosion in the long term.

3.12 Dust Control

The Contractor shall implement dust control measures as required by the Project Engineer. Only water shall be used for dust control. The use of chemicals for dust control is prohibited unless approved by the Project Engineer.

Additional dust control measures will include:
(a) clean-up of mud and dust from paved roads and access points;
(b) establishment of spoil and construction material stockpiles in areas least prone to impact from prevailing winds from the southwest;
(c) cessation of dust generating construction activities during periods of excessive winds; and
(d) timely stabilization of exposed areas prone to wind erosion.

Further advice is provided in a new Environment Canada guideline "Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities (March 2005).

3.13 Noise

Noise complaints are occasionally received by NSEL and TPW staff, especially during periods of construction. The only regulatory requirements for noise control are embodied in municipal by-laws, and these are primarily for construction and nuisance noise. Consequently, TPW and its contractors will abide by all municipal requirements, or where exempt, the spirit and intent of any noise by-law.

In order to protect the acoustic environment and residents' rights to 'peace, comfort and tranquillity', TPW and its contractors will make every effort to carry out the work in a manner which causes

minimum inconvenience to landowners. This commitment will include the implementation of the following 'source, path and receptor control measures' during construction periods:

(a) TPW will notify local residents one week prior to impending construction through newspaper advertisements and electronic postings to the "Highways" page of the TPW website: http://www.gov.ns.ca/tran/highwayops/highwaymain.asp. The notice will contain a telephone number for the reporting of noise complaints;
(b) TPW's Contractor shall maintain, where practical, treed buffer zones along the ROW;
(c) In residential areas, the Contractor shall utilize enclosures around stationary equipment, whenever possible, to reduce noise emission (*e.g.*, power generators);
(d) When construction is planned within 30 m of a home, the Contractor shall schedule construction between 0700 and 2000, Monday to Friday, and 0800 to 1900 on weekends and holidays. Exceptions to this schedule shall be short-term, construction activities that must occur during night-time hours because of construction quality, traffic control and safety concerns (*e.g.*, concrete deck pours, paving, demolition of existing structures), or in specific circumstances when local residents have approved night construction;
(e) The Contractor shall use vehicles and equipment equipped with efficient muffling devices;
(f) The Contractor shall maintain equipment in good working order to minimize noise levels;
(g) The Contractor shall keep idling of construction equipment to a minimum;
(h) Within logistical constraints, the Contractor shall place material storage areas away from noise sensitive locations (residential areas with homes less than 30 m from the storage area);
(i) The Contractor shall conduct noise monitoring at representative residential locations during periods of intense construction activities (as defined by the Project Engineer and based on the Work Progression Schedule) to ensure noise levels are within 15 dBA (L_{eq} [2 hour]) of the average baseline levels (see Section 4.2.2 for further details). Many states in the United States use this level of exceedance to balance construction realities with residents' rights to peace and quiet (U.S. Department of Transportation, 2000). In the U.S., as in most jurisdictions in Canada, there is no mandated definition (or maximum permissible level) that constitutes a "substantial" increase over existing (ambient) noise levels.
(j) In cases of excess noise at the monitoring sites, the Contractor shall either re-schedule construction activities, or restrict intense noisy activities to the hours of 1000 to 1700.

3.14 Petroleum, Oil, Lubricant (POL) and Chemical Handling and Storage

All necessary precautions to prevent and minimize the spillage, misplacement or loss of fuels and other hazardous materials shall be taken. All Acts and Regulations pertaining to special substances shall be followed. The delivery, storage, use and disposal of these hazardous materials will be handled only by trained personnel in accordance with government laws and regulations. In the event of a spill, follow the procedures detailed in Appendix F.

The following precautions will be taken:

(a) Equipment used will be mechanically sound with no oil or gas leaks. The Contractor shall undertake frequent inspection of equipment and repair leaks immediately;
(b) Fuelling, storage and servicing of vehicles and construction equipment is not allowed within 30 m of a watercourse, drainage ditch, areas with a high water table, or exposed and shallow bedrock.

(c) Spill clean-up materials shall be accessible and maintained in the areas of fuel and chemical storage. Any spilled fuel or lubricants shall be promptly cleaned up and disposed of in accordance with NSEL instructions;
(d) No equipment shall be washed within 30 m of a watercourse or wetland;
(e) Storage of petroleum products is not allowed within boundaries for water supply watersheds or designated environmentally sensitive areas. Lubricants, hydraulic fluid, grease, gasoline, diesel or other fuels will not be stored within 30 m of any watercourse;
(f) All tanks shall be protected from collision damage by the use of snow fencing to alert operators, or by the placement of barriers to impede equipment movement near the tank;
(g) Handling and fuelling practices shall ensure that contamination of groundwater will not occur;
(h) Fuel storage areas and transfer lines shall be clearly marked or barricaded to prevent damage from vehicles;
(i) If drums are stored on their sides, the drums shall be stored so that the bungs are in the “9 and 3" position, on level ground and prevented from rolling;
(j) Drum storage areas shall be marked or fenced with temporary fence to avoid impacts;
(k) Day-use quantities can be stored upright or on the side as required. Drip pans lined with absorbent pads shall be used beneath taps;
(l) All stained soil resulting from the use of chemicals or fuels shall be cleaned-up and disposed of prior to leaving the work area; and
(m) Waste oils and lubricants will be retained in a closed container, and disposed of in an environmentally acceptable manner.

3.15 Waste Management

(a) Recyclable materials and materials banned from landfills (paper, cardboard, drink containers, wood, scrap steel, paint, metal and tires) will be collected separately for recycling;
(b) There shall be no burning of wastes generated on the site;
(c) Domestic waste from site offices and camps including food waste shall be gathered daily and stored in closed steel containers for removal and disposal at an approved waste disposal site;
(d) Non-recyclable non-hazardous construction wastes shall be removed from site on an as required basis for disposal at an approved waste disposal site;
(e) Rags used in equipment maintenance and other potentially combustible materials will be kept in a container separate from the above materials until the combustible material can be removed from site for disposal;
(f) Waste oils and lubricants will be stored in a labelled tank or drum and disposed of a disposal facility approved for receiving liquid industrial wastes; and
(g) Solvents, acids and caustic liquid waste will be collected separately and stored for removal and disposed by a waste management company specializing in liquid and hazardous wastes.

3.16 Concrete Batch Plants

This item details additional protection measures applicable to batch plants if employed on a project.

(a) Batch plants for concrete production shall be located away from residential areas and a minimum of 30 m from watercourses, wetlands and other environmentally sensitive areas;
(b) To control runoff from aggregate stockpiles and accumulated cement dust, sediment barriers in combination with perimeter ditching and settlement ponds shall be used to ensure effective sediment control;
(c) To control dust and minimize airborne particulate, water and/or calcium chloride shall be applied to the batch plant area and haul roads;
(d) Trucks shall be washed out into an area that drains to the settlement pond described above or to a settlement pond constructed for that purpose to ensure that TSS levels in discharges from the site do not exceed 25 mg/L;
(e) Care will be taken to ensure runoff pH and other characteristics from ponds and embankment fills are not deleterious to the aquatic environment (*i.e.*, pH between 6.5 and 9.0 and acceptable levels for metals noted in the *Canadian Water Quality Guidelines for the Protection of Aquatic Life*; see http://www.ccme.ca/initiatives/water.html?category_id=41). Note that filtering concrete wash-water or putting it in a settlement pond will not treat the high pH (may yield values of 12.0). Active treatment or off-site processing will be required. Contact the Project Engineer if pH of settlement pond water exceeds 9.0; and
(f) Waste Portland cement concrete can be disposed of in embankment fills with the approval of the Project Engineer.

3.17 Asphalt Plants

All temporary plants employed on a project shall be approved by NSEL. The Contractor shall provide a copy of the approval to the Project Engineer prior to mobilizing the plant to site. The following additional protection measures apply to asphalt plants.

(a) Chemicals associated with the plant shall be stored, handled and disposed of in accordance with Sections 3.15 and 3.16;
(b) Plants shall utilize best available techniques for reducing/minimizing air emissions (see www.ccme.ca/assets/pdf/hot_mix_asphalt_final_meraf_e.pdf);
(c) Settlement ponds if used shall be lined to prevent infiltration. Water shall not be discharged to the environment without testing for suspended solids and total petroleum hydrocarbons. Water shall not be discharged if TSS levels are greater than 25 mg/L or total petroleum hydrocarbons are greater than 15 mg/L;
(d) Care will be taken to ensure run off pH and other characteristics from ponds and embankment fills are not deleterious to the aquatic environment;
(e) Storage tanks containing oil or fuel shall be dyked, or protected, in accordance with NSEL *Petroleum Storage Regulations*;
(f) Tanks shall be located or protected to minimize the potential for collision; and
(g) Waste or excess asphalt may be disposed in embankment fills with the approval of the Project Engineer.

3.18 Road Salt Management Plan

Since a federal environmental assessment on road salt concluded that road salts are "toxic" to the environment, as defined under the *Canadian Environmental Protection Act*, federal and provincial governments are currently developing management instruments to reduce the impacts of road salts on the environment. TPW has taken a pro-active approach to better manage the use of road salts, including:

1. Construction of 22 new salt/sand storage sheds in various locations around the province, and plans for five more in 2005. The new sheds were primarily built to increase the amount of salt/sand mixture storage, as the majority of our road salt is already stored indoors;

2. The installation of 33 "Road Weather Information Systems" (RWIS) and associated highway camera systems (see http://www.gov.ns.ca/tran/webcam/HighwayCameras.stm);

3. In 2001, TPW implemented new winter maintenance standards that require highway crews to provide consistent and measurable ice and snow removal to all areas of Nova Scotia;

4. Conduct of pre-wetting trials near the RWIS sites to reduce the loss of road salts applied to highways due to wind and traffic disturbance. Results to-date indicate savings of up to 10-12% with the same level of service. Further reductions in road salts can be realized if placed just prior to a storm event. This process is usually referred to as "anti-icing" as opposed to "de-icing";

5. TPW has upgraded its entire salt-spreading truck fleet through the installation of computerized (*Compuspread*) salt controls; and

6. TPW has completed its *Salt Management Plan (*SMP; June 2004) to more effectively manage salt usage across the Province and meet the commitments that were previously made to Environment Canada. The three-volume SMP contains detailed information about TPW policy, key responsibilities of various TPW staff, SMP implementation, monitoring and reporting, current winter maintenance practices, salt storage and handling, salt application, salt vulnerable areas, training, and best management practices (BMPs). A digital copy of the Plan is available on TPW's website: *http://iweb.tpw.gov.ns.ca/department/govpublication.asp*

7. In the fall of 2004, TPW started the implementation of the SMP, well ahead of the Environment Canada milestone dates.

4.0 MONITORING AND INSPECTION

There are two general types of monitoring which are considered in determining the environmental impact of activities and the effectiveness of mitigation measures: environmental compliance monitoring (ECM) and environmental effects monitoring (EEM). Compliance monitoring assesses adherence to environmental regulations. Effects monitoring assesses the accuracy of predictions and the effectiveness of proposed mitigation measures.

ECM and EEM programs will be implemented by TPW to ensure that pre-construction commitments are fulfilled; that the highway is built and maintained to the satisfaction of all stakeholders, including regulatory authorities; and that public health, safety, and the environment are protected during the operation and maintenance of the highway.

4.1 Environmental Compliance Monitoring

ECM can be divided into two distinct elements:

- regulatory environmental surveillance; and
- self-regulatory monitoring and inspection.

The component of ECM carried out by regulatory authorities consists of monitoring to verify compliance with applicable legislation and conditions of regulatory authorizations issued in respect of a Project. This monitoring will be carried out by: NSEL, NSNR, DFO, Environment Canada and Transport Canada, as appropriate.

The remaining materials in this section deal specifically with self-regulatory monitoring and inspection activities.

Self-regulatory ECM is that which a proponent undertakes to monitor its own activities against internal commitments, such as those contained in the Conditions of Release/Approval, the Project EPP and ECPs/CMPs, and external environmental standards (*i.e.*, legislation and authorizations). Self-regulatory ECM will involve:

- monitoring of environmentally-sensitive activities by the Contractor and TPW to ensure compliance with applicable laws and regulations, and permits issued in respect of the Project;
- monitoring of environmentally-sensitive activities by the Contractor and TPW to ensure compliance with internal (*i.e.*, EPP/ECP commitments) and external non-regulatory environmental standards;
- coordination and communication with regulatory authorities, and the Public, as required;
- assistance with EEM studies and other environmental programs associated with the Project (see Section 4.2); and
- provision of on-site environmental advice to Project personnel.

The prime vehicles for ECM will be the regulators' Conditions of Release/Approval, the EPP, and permits, authorizations, and letters of advice issued by NSEL and DFO for construction and operation activities (and any other regulatory agencies).

The ECM program will be implemented by carrying out environmental monitoring and inspection, including:

- ensuring compliance with all applicable government acts, regulations, and permits issued in respect of the Project;
- ensuring that the environmental commitments are met; and
- ensuring that established environmental policies, standards and procedures are followed by the Contractor.

The ECM program will ensure that pre-construction commitments made to regulatory agencies and other stakeholder groups are fulfilled during construction and that preventative and protective environmental measures are in place and functioning properly throughout construction. TPW will also conduct periodic inspection of the implementation of habitat compensation/creation measures identified in any compensation proposals for 'harmful alteration, disruption or destruction of fish habitat' (HADD).

Environmental inspection of ESC measures and project activities is essential to ensure the effectiveness of measures taken by the Contractor to protect the environment.

The Contractor shall, as a minimum, carry out daily environmental inspections of the site. For more sensitive aspects of the work, such as culvert installation, inspection shall be carried out at critical times in the process (*e.g.*, storm-weather periods, watercourse diversion, excavation, construction of inlet and outlet channels, and removal of temporary diversions). All ESC measures shall be inspected during and immediately following significant rainfall and snow-melt events. Inspection and monitoring will also be carried out by the Project Engineer and staff from TPW's Environmental Services Section to verify the Contractor's performance.

The following summarizes the items requiring inspection. The Contractor's Environmental Monitor, Project Engineer and TPW Inspectors shall use the Generic EPP, Project EPP, ECPs, CMPs, the *Standard Specification*, and Special Provisions to the tender documents as references for the inspections. An inspection checklist for use during construction is provided in Appendix G. Incident Report Forms are also included here to document significant non-compliance issues, spills and 'near misses'.

(a) Grubbing activities and disposal areas shall be examined for evidence of erosion, siltation, or potential for erosion and siltation. Work close to watercourses shall be monitored closely.
(b) All ESC measures are to be inspected to ensure they have been installed in a location where they are effective.
(c) Inspect site daily to observe installation and maintenance of ESC measures.
(d) Examine sediment control fence, flow checks, and sediment ponds, and ensure they are maintained properly.
(e) Examine diversion ditches to ensure they are installed according to the *Standard Specification* and the EPP/ECPs/CMPs. Examine ditch outlet for any signs of erosion. Diversion ditches shall be in place prior to the excavation of cuts.
(f) Mulch shall have adequate coverage and shall be applied promptly to exposed areas.
(g) Hydroseeding shall have adequate coverage and must be seeded as areas are brought to final grade. Obtain seed certificates to confirm specified seed is being applied.

(h) Determine if erosion control blanket is installed as per manufacturer's instructions and whether the blanket requires repairs.
(i) Review waste management and hazardous material storage to ensure compliance with regulations and this EPP.
(j) Determine if site access and landowner access roads are constructed and maintained in accordance with the EPP.
(k) Monitor dust conditions on site and note whether Contractor has taken action to control dust if it is a concern.
(l) Note de-watering operations, especially at culvert or structure abutment sites. Note location and discharge method or filtering method being used.
(m) Note compliance with steps detailed in ECPs and CMPs for culvert installation and structure abutment excavation and construction.
(n) Note the extent of stained soil observed and its location. If possible, identify the source so that equipment repairs can be made.
(o) Note any water samples collected (location, time, analyses required and rationale).
(p) The inspection shall also include any additional observations related to environmental protection matters.
(q) If deficiencies are noted, the Project Engineer, or designate, shall detail the incidents and manner in which to address them. Where possible, this shall be done as a cooperative effort with the Contractor.
(r) As appropriate, the Project Engineer will also prepare Incident Report Forms for significant non-compliance issues, spills and 'near-misses' and submit them to the Contractor's Construction Supervisor, the Environmental Services Section, and relevant government regulators/inspectors as required by NSEL/DFO approvals and authorizations (forms are provided in Appendix G).

4.2 Environmental Effects Monitoring

EEM is conducted to validate impact predictions, and to evaluate the effectiveness of and identify the need to alter or improve mitigative measures. An EEM program normally involves the collection of repetitive measurements of environmental variables to detect changes caused by external influences directly or indirectly attributable to a specific human activity or development. For federally-funded projects, the need for an EEM program is determined by the responsible authority (RA) and is based upon criteria listed in the *Canadian Environmental Assessment Act* Responsible Authority's Guide (1994). The guide states that follow-up programs are needed in a case of uncertainty or unfamiliarity in either the analysis and predictions of the environmental assessment or in mitigative measures. Follow-up programs may be needed in a case where:

- the project involves new or unproven technology or mitigative measures;
- an otherwise familiar or routine project is proposed for a new or unfamiliar setting;
- the assessment analysis was based on new technique or model (or uncertainty about conclusions); or
- environmental effects could change due to a project scheduling change.

TPW is committed to completing both general EEM and ECM activities for air quality, noise, water supplies, and total suspended sediments (TSS). The programs described below are those which will be included in the Contractor's and TPW's environmental monitoring programs.

4.2.1 Air Quality

The Contractor shall monitor the operation of Contractor-controlled equipment used during the construction phase to ensure it is in good operating condition.

The Contractor is also encouraged to (a) establish non-idling policies for all construction equipment and trucks in order to improve local air quality and reduce greenhouse gas (GHG) emissions, and (b) investigate the use of "biodiesel" whenever possible to further help reduce GHG emissions (contact Marc Sheeran, Environment Canada - Climate Change Division, 902-426-1401).

Dust will be monitored visually both by the Contractor and by the Project Engineer. Dust monitoring according to NSEL and EC guidelines (high-volume sampling of TSP) may be undertaken to address dust complaints. If required, the Project Engineer will provide advice concerning dust control methods.

4.2.2 Noise

Where intensive construction activities are scheduled within 30 m of residential areas, noise shall be monitored by the Contractor in accordance with NSEL's *Guideline for Environmental Noise and Assessment* (1991). As indicated in Section 3.13, the Contractor shall either reschedule construction activities or restrict intense activities to the hours of 1000 to 1700 when noise levels (defined as L_{eq} [2 hours]) exceed pre-construction baseline levels by 15 dBA. Baseline levels shall be those collected as part of the environmental impact assessment process, or new data collected prior to construction when the existing data for daytime, evening and night-time periods are believed to be no longer representative.

Given the variability in ambient noise levels at various sampling locations, the highest average values for daytime and evening periods within a construction 'work area' shall be deemed the base for determining the maximum exceedence value. The Project Engineer will identify appropriate sampling locations for baseline studies and construction monitoring, and ensure resident/landowner notification of impending monitoring surveys. TPW will provide a copy of the preconstruction baseline study to the Contractor to ensure data consistency.

If noise levels are in excess of maximum exceedance levels for a specific work area, the Contractor will immediately cease operations, compare the levels to the Threshold Limit Values (TLVs) published by the NS Workers Compensation Board (http://www.wcb.ns.ca/policymanual/pminoise.html) to ensure compliance with exposure limits, and either reschedule construction activities or restrict noisy operations to the hours of 1000 to 1700. The Contractor shall also immediately inform the Project Engineer of the situation and subsequent actions.

4.2.3 Water Supplies

TPW will carry out a detailed standardized survey of potential water supplies (wells) within 300 m of the centreline prior to the start of construction (*i.e.*, 600 m corridor width). This information will provide the baseline for future comparisons of water quality. The survey database will include the type of water supply and its age, condition and known history based on property owner surveys and information obtained during sample collections. Water samples will be obtained by an independent contractor (currently, *Aqua-Check Inc.*) from the kitchen tap and analysed for pH, general chemistry and metals (RCAp plus metals), as well as fecal and total coliform counts as per NSEL guidelines for sampling domestic wells. Water samples are analysed immediately following collection and are not be frozen before analysis. All results are directed to the Project Engineer and subsequently entered into the provincial *Water Quality Monitoring Program* (WQMP) database. Should any samples indicate fecal coliforms, or concentrations of other parameters in excess of *Drinking Water Standards*, the Project Engineer will immediately notify the landowners.

In the event that blasting is required, additional pre-blast and post-blast surveys of wells will be conducted by the contractor. Monitoring of blasts will be conducted according to municipal by-laws and DFO guidelines and authorizations (Wright and Hopky 1998), and may include measurements of air concussion, ground vibration, and wellwater quality and quantity.

4.2.4 Total Suspended Sediments

The Contractor shall be responsible for the collection of TSS samples from selected watercourses on an event-basis to monitor the efficacy of ESC measures. These events will be defined as storms that are predicted to deliver more than 10 mm of rain or equivalent in snowmelt to areas that have exposed soils (note that soils should be protected at non-active construction sites). The purpose of this monitoring program is to identify areas that require additional protective measures (see also comments on Inspection and Maintenance in the TPW's Standard Specification, Division 1, Section 5, Item 8.0).

All data shall be submitted to the Project Engineer and the Environmental Services Section for further consideration and action (implementation of additional ESC measures). TPW will conduct a number of independent surveys to verify the Contractors results and observations.

Sampling stations will be located within 100 m of the ROW, or the construction activity/point of water discharge, and marked to enable future return to the same upstream and downstream locations. In general, sampling will be initiated at downstream locations 30-60 minutes after the onset of rain to establish baseline conditions (for events that are predicted to start after working hours, collect the first [baseline] sample at the end of the working day). Upstream samples will then be collected. Subsequent samples, at upstream and downstream locations, should be collected as follows:

Sample	Morning Onset of Rain	Afternoon Onset of Rain	Overnight Onset
#1	+30 to 60 minutes	+30 to 60 minutes	End of working day
#2	+6 hours	End of working day	Start of next work-day
#3	End of working day	Start of next work day	Mid-day
#4	Start of next work day	Mid-day	End of working day
#5	Mid-day	End of working day	Start of next day

Previous studies conducted for TPW by Dalhousie University-Centre for Water Resource Studies (Scott and Waller, 2004) indicate the beginning of TSS response to storm runoff ranges from 1 to 18 hours with an average of 5 hours after the onset of rain. Peak TSS levels for storms that deliver more than 20 mm of rainfall occurred 7.5-24 hours after the start of the events.

The sampling and sample handling procedures shall be as follows:

- Use laboratory-supplied bottles and label with date, time, and sample location;
- Sample facing upstream to avoid collecting surface debris and sediment that may have been stirred up by gaining access to the watercourse. Collect water from mid-stream and at mid-depth, whenever possible (if safety is an issue, take a surface sample from as far out in the channel as the sampler can reach; sampler should wear hightop rubber boots if possible to further extend his/her reach; alternatively use a boat);
- Follow laboratory instructions regarding bottle filling. This may include rinsing the sample bottle three times with water to be sampled. Completely fill the bottle being careful not to collect any surface debris or stir up sediment;
- Place bottles upright in a cooler with ice or ice packs. Samples shall be kept chilled (on ice or in a 4^{o}C refrigerator) until received by the analytical laboratory;
- Complete the laboratory-supplied Chain of Custody Form. Retain one copy and ship the cooler as soon as practical following sampling (must be within 4 days for TSS or the sampling day if a turbidity analysis is also required); and
- Prepare field notes to summarize weather conditions/predictions, rainfall amounts, sampling information (date, time, location), replicate samples (one triplicate set per event), and any other anecdotal information (*e.g.*, occurrence of sediment plumes [associated with construction, ATV trails, cattle, etc.], on-going construction activities, and time of apparent recovery of watercourse to background [upstream] conditions).

Following completion of sampling, the Environmental Monitor/Inspector shall visually inspect the ESC measures for signs of problems and note the nature of runoff water passing through/around the installations. Visual inspections shall also be carried out at the non-active construction sites to verify the performance of installed ESC measures. Photographs would be a useful addition to sampling notes. All field notes should be submitted to the Project Engineer with a copy to TPW's Environmental Services Section.

If runoff water is turbid, or problems seem imminent (or have occurred in the past), inform the Contractor's Supervisor and the Project Engineer to ensure remedial action is taken.

5.0 CONTINGENCY PLANS

5.1 Chemical and Fuel Spills

Federal and Provincial acts place the responsibility for spill prevention and mitigation on the owner or controller of products or materials that can be spilled. Spills are defined under these Acts, as, but not limited to:

- spills from containers including drums and tanks;
- spills resulting from breaks in hydraulic or transfer hoses or piping; and
- spills resulting from traffic accidents and fire fighting.

In accordance with these Acts, the Contractor has an obligation to:

- prevent, eliminate or remediate an adverse affect resulting from a spill; and
- report the spill to the Project Engineer and other applicable organizations as requested in NSEL and DFO Approvals, Authorizations, Terms and Conditions, and Letters of Advice.

The Contractor shall reduce the likelihood of spills by implementing effective spill prevention measures such as the careful handling and proper storage of the products in use.

In the event of a spill, the procedures detailed in Appendix F shall be followed to facilitate a quick response. The response plan is established to coordinate action with the local Environmental Response Group and TPW and NSEL emergency response teams.

5.2 Heritage Resources

In the event that a heritage or archaeological feature is encountered during construction, the following measures will be taken to protect the feature(s) from further damage:

(a) All work in the area of the encounter shall cease;
(b) The potential find shall be protected by erection of a snow fence and signed as off limits to construction personnel;
(c) The Contractor shall contact the Environmental Services Section (TPW - Tel: 424-4080, Fax: 424-0570), and the Provincial Archaeologist or Curator of Special Places (Nova Scotia Museum -Tel: 424-6475, Fax: 424-0560). TPW's Environmental Services Section will subsequently inform either the Confederation of Mainland Mi'kmaq (Michael Cox, Director of Lands, Environment & Natural Resources at 895-6385), or the Union of Nova Scotia Indians (Kim Paul, Environmental Technical Services at 539-4107); and
(d) Work at the site will not be recommence until permission to proceed has been granted by the Nova Scotia Museum.

In the event that human remains are encountered, work shall immediately stop, and the Police and Nova Scotia Museum shall be notified.

5.3 Contaminated Sites

In the event that buried debris or contaminated soil is encountered during highway construction, the following procedure shall be followed:

(e) On detection, cease excavation activity in the area of the discovery and contact the Project Engineer. Under no circumstances shall the material be excavated without authorization of the Project Engineer;
(f) The Project Engineer or a representative of TPW's Environmental Services Section will visually inspect the material to assess potential for hazardous materials;
(g) If hazardous materials are suspected, the Project Engineer shall obtain samples following safe sampling practices;
(h) Contaminated soil or debris containing regulated material, suspected asbestos containing material, or other hazardous materials, shall be covered until a management plan is developed and a contractor appropriately trained in the handling of hazardous materials is retained; and
(i) The Project Engineer shall consult with NSEL on the appropriate clean-up program and disposal requirements.

5.4 Acid Generating Bedrock

In the event that coal-bearing bedrock or bedrock of the Meguma Group (Halifax and Goldenville formations; slates, quartzite and greywacke) are exposed during construction, the Contractor will immediately contact the Project Engineer for advice on how to proceed. Samples will be required for subsequent testing of acid-generating potential. High levels will mandate NSEL, DFO and Environment Canada notification and the preparation of an ECP to treat/handle the materials in accordance with the "*Sulfide Bearing Material Disposal Regulations*." Some of the concerns and contingency plans are outlined below.

5.4.1 General Protection Measures

(a) The volume of sulfide bearing bedrock disturbed shall be minimized. It should be noted that the volume disturbed is contingent on the contingency plan approved by NSEL. The approved plan may increase the volume of rock disturbed over that which would be disturbed in typical rock excavation;
(b) The length of time the rock is exposed shall be less than 30 days unless a written request for additional time is approved by NSEL;
(c) Temporarily exposed slates shall be covered and newly exposed slate surfaces shall be sealed and stabilized using a method pre-approved by NSEL;
(d) Surface runoff leading to the disturbed bedrock shall be diverted away from the disturbed area;
(e) Runoff from the sulfide bearing bedrock shall be directed to centralized points before leaving the ROW. The runoff from the site shall be monitored for acidity and metals during and after construction in accordance with an approved ECP (to be developed in association with NSEL, DFO and EC). If treatment is required, the Project Engineer will direct the Contractor on treatment method to be employed; and

(f) Sulfide bearing bedrock shall not be used for construction purposes unless its use has been approved in writing by NSEL, but instead disposed of as soon as possible in accordance with the "Sulfide Bearing Material Disposal Regulations" of the Nova Scotia *Environment Act*. Note that disposal of material in excess of 500 m^3 *in situ* or 1300 tonnes requires an approval from the NSEL**.**

5.4.2 Drainage Control and Excavation Plans

(a) Measures to divert water away from or collect water draining through the excavation site shall be in place prior to excavation of the rock;

(b) Excavation shall first be attempted by digging and ripping prior to proceeding with blasting. Digging and ripping, if practical is the preferred excavation method;

(c) In blasting, maximize the blast rock size and minimize the amount of overbreak through the use of (1) nitroglycerin rather than emulsion explosives, (2) pre-shear blasting techniques, and/or (3) lower blasting charges per hole;

(d) The Contractor shall take all measures to minimize the excavation of rock beyond the required grading limits,

(e) Remove all exposed loose material to the greatest extent possible,

(f) The Contractor shall not proceed with placement of the low permeability cap until the surface has been approved by the Project Engineer,

(g) Excavation of blasted material shall be carried out within 10 days of blasting, and

(h) Rock shall be loaded and removed to the burial or disposal site as it is excavated.

5.4.3 Placement of Low Permeability Cap

(a) Cap material shall consist of site material or imported borrow that has a maximum particle size of 100 mm and greater than 30% passing an 80 micrometer sieve. The material shall have a permeability of less than 1 x 10^{-6} when compacted to 95% Standard Proctor maximum dry density;

(b) For each 500 m^3 of material used, the following tests are required. All results are to be submitted to the Project Engineer;

Grainsize	ASTM C136, C117
Natural Moisture Content	ASTM D2216
Standard Proctor	ASTM D698
Permeability	ASTM D5084
Atterburg Limits	ASTM D4318

(c) Exposed rock surfaces shall be covered within 10 days of being exposed and be completed within 30 days unless a written request for time extension is approved by NSEL and EC;

(d) The cap will have a minimum thickness of 1000 mm and each lift of material placed to achieve this thickness shall be compacted to at least 95% of Standard Proctor maximum dry density (*i.e*., cap equivalent to a 1000 mm layer of 1 x 10^{-6}). The minimum cap thickness can potentially be reduced if the exposed bedrock is considered to be in a protected area (*e.g*., the highway base). Since the area will be overlaid by additional gravel and pavement, a thinner cap may be allowed. The Contractor shall consult with the Project Engineer for further advice;

(e) The vibratory roller shall be drum driven to enable the roller to climb and compact on a 3H:1V slope and deliver a dynamic force of at least 70 kN;

(f) Each lift shall be tested for density using a Nuclear Densometer. Each lift shall be approved by the Project Engineer prior to placing the next lift;

(g) The cap shall be covered with 100 mm of topsoil and hydroseeded in accordance with TPW's *Standard Specification* and the ECP; and

(h) The cap for protected areas under the road shall be covered by geotextile and a minimum 300 mm layer of Type 2 gravel.

5.5 Failure of ESC Measures

Having a contingency plan and the resources for emergencies is the last of the TPW *Principles of Erosion and Sediment Control* (see Section 3.2). The Contractor shall provide an outline of an appropriate Contingency Plan to the Project Engineer and the Environmental Services Section. This plan shall deal with extreme or long duration rainfall events (during all construction seasons) and the failure of ESC measures, especially those in or near watercourses. Essential components of the plan shall include the following:

- Staff training (e.g., tailgate/toolbox safety and environmental meetings to inform/educate staff of potential problems and hazards; include list of personnel with *TPW Green Card*);
- Storm preparedness (conditions for work stoppages, pre-storm staff meetings, inspection of all ESC measures, preventative maintenance of ESC measures, cover applied to highly erodible areas, clean-out of settlement ponds and check dams, and proactive measures that the Contractor shall implement to ensure critical ESC measures at or in watercourses will withstand storm runoff and wind conditions);
- Confirmed availability of equipment and operators that can be mobilized on short notice to create/repair berms, dams, diversion ditches, settlement ponds and turbidity curtains;
- Stockpiles of ESC materials (include quantities and locations for strategic placements);
    - straw/hay bales, compost, and/or bark (to be used as mulch/cover material)
    - ESC blankets/matting and staples (or tarps/plastic sheeting)
    - Sandbags, clear stone
    - Water pumps, hoses and fuel (the latter to be stored in a 'safe' location)
    - Turbidity curtains
- Typical approaches for temporary control of water flow and erosion until new ESC measures can be implemented (*e.g.*, excavation of cross ditches to divert runoff away from waterbodies and into settlement ponds or vegetated areas, excavation of temporary water storage areas, berm construction, bank stabilization, and deployment of backup turbidity curtains). Note that approaches will vary depending upon season, and the Contractor shall indicate approaches for (a) summer, low flow periods, (b) spring-fall, high flow periods, and (c) frozen ground, high-flow periods;
- Standard protocols for notification of ESC failure to the Project Engineer, TPW's Environmental Services Section, and NSEL/DFO inspectors; and
- Incident and 'Near Miss' reporting to the Project Engineer and Environmental Services Section to provide documentation of ESC failure (a *Near Miss Report* details failures that did not result in the loss/release of sediment; the intention is identify the cause and help prevent future occurrences).

6.0 REFERENCES

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