

Introduction

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INTRODUCTION:

This guidelines document is issued under Section 46 of the *Mineral Regulations* (CNLR 1143/96) under the *Mineral Act* (SNL 1990 c M-12) and applies to mineral exploration.

In addition, the terms and conditions of quarry materials exploration licences (“QMELs”) issued under the *Quarry Materials Act, 1998* (SNL 1998 c Q-1.1) require that this guidelines document shall apply to exploration for quarry materials carried out within the area of the licence.

Guidelines in this document are subdivided into “Requirements”, which are mandatory and shall be enforced, and “Recommendations”, which are provided as suggestions to be considered.

This document occasionally references regulatory, permitting, and policy requirements other than those administered by the Mines Branch, Department of Natural Resources, however such information is provided as a convenience only, is not exhaustive, and no guarantee is made with respect to its accuracy and completeness. Approval holders are referred to their exploration approval letter for project-specific requirements and for guidance concerning requirements that may apply under other legislation, regulations, or policy. Parties seeking to conduct exploration are strongly advised to establish early contact with those government agencies responsible for administering or enforcing permitting, regulatory, and policy requirements that their activities may be subject to.

This document replaces and supersedes a previous document titled *Environmental Guidelines for Construction and Mineral Exploration Companies*.

The Requirements and Recommendations set out in this document apply to all mineral exploration taking place within the province on mineral licences, mining leases, and impost lands, with the exception of within Labrador Inuit Lands where the *Mineral Exploration Standards Regulations*, NLR 39-07, under the *Labrador Inuit Land Claims Agreement Act*, SNL 2004 c L-3.1, have precedence over these Requirements and Recommendations in the event of a conflict between them.

All parties involved in mineral exploration and all parties involved in quarry materials exploration on a quarry materials exploration licence are responsible for adhering to the applicable Requirements and for being aware of the applicable Recommendations. In the case of mineral exploration carried out on a mineral licence, ultimately the current licence holder is responsible for outstanding Requirements incurred in the course of mineral exploration from the recording date of the licence within which the activities occurred.

This document is presented in modular format for maximum ease of reference, however as a legal document must be interpreted as a whole.

Requirements and Recommendations dealing with fuel and oil (most of which are in Sections 12 and 13) shall apply except in situations where there is a disagreement with another piece of legislation, a policy of the Department of Municipal Affairs and Environment, Service NL, or Fisheries and Oceans Canada, or the terms and conditions of another government permit (e.g., fuel cache approval, water use licence / permit, exploration approval), or a work plan approval issued by the Nunatsiavut Government.

Nothing in these Requirements and Recommendations shall necessitate that the Operator or any person acting under their direction undertake an activity that would be considered unsafe under the circumstances. The Operator and persons acting under their direction shall continue to comply with the requirements and standards established by the *Occupational Health and Safety Act*, RSNL 1990 c O-3 (as amended), and its associated Regulations. The Occupational Health and Safety Division of Service NL provides a document *Safety Guidelines for Mineral Exploration in Newfoundland and Labrador*, available at: <http://www.servicenl.gov.nl.ca/ohs/OHS%20Mineral%20Exploration%20Guide%202014.pdf>

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The goal of the Department of Natural Resources is that all exploration sites be left in a condition conducive to natural re-vegetation, and this goal informs many of the Requirements and Recommendations contained herein. The current version of this document is available at <http://>

SOME DEFINITIONS:

Most mineral exploration in the province is carried out on mineral licences, mining leases, or impost lands. However, since mineral licences are the most common form of mineral tenure, mining leases and impost lands are not mentioned again in this document but are to be understood as included along with “licence” where mentioned when applying to mineral exploration. When applying to exploration for quarry materials, “licence” where mentioned refers to the quarry materials exploration licence.

“Exploration site” means any location utilized for exploration purposes, including but not limited to drill sites, trench sites, test pit sites, access trails, camp sites, laydown areas, fuel storage sites, helicopter landing sites, cut lines, channel sample sites, bulk sample sites, and water intake sites.

“Department” unless indicated otherwise means the Department of Natural Resources.

“Approval holder” means the party holding an ‘exploration approval’ issued under the Mineral Act when applying to mineral exploration or issued under a condition of the quarry materials exploration licence when applying to exploration for quarry materials.

“Operator” means the party with the day-to-day responsibility for carrying out an exploration program, and includes all parties acting under the direction of the Operator in carrying out an exploration program. The Operator is typically the holder of the exploration approval under which the exploration work is authorized. In mineral exploration, the Operator is typically an exploration company, but may also be a geophysical survey company, prospecting business, consulting company, etc. In exploration for quarry materials, the Operator is typically a construction company which operates one or more quarries or a consultant.

Additional definitions are introduced elsewhere in the document, however, apply throughout the document.

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General Practices

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The Department of Natural Resources promotes:

GOOD PLANNING

A well-planned exploration program will minimize your rehabilitation requirements.

ADEQUATE SUPERVISION

The Operator is responsible for supervising the work of all employees and contractors.

BUDGETING FOR REHABILITATION

If you budget for the work, budget for rehabilitation. Rehabilitation work counts for assessment credit.

PROGRESSIVE REHABILITATION AND CLEAN-UP

Do not accumulate outstanding environmental requirements – rehabilitate and clean up as you go.

COMMUNICATION WITH THE MINERAL LANDS DIVISION

Keep us updated and ask questions – we are here to help.

ENVIRONMENTAL AND SOCIAL RESPONSIBILITY

Responsibly represent your industry to regulators and the public.

READING AND UNDERSTANDING YOUR PERMITS

Your exploration program is approved on terms and conditions – read them up front. Ensure that everyone involved in the program understands what is required of them to comply with the terms and conditions of your approval. If clarification is required, please ask us or the department responsible for those requirements.

1. Basic Documentation

(sheet 1 of 1)

BACKGROUND:

It is not possible for the Department to inspect each site and the Department may issue a request for information regarding completed, ongoing, or planned exploration and rehabilitation work. In order to be able to respond in a timely fashion with comprehensive information, standardized photographic documentation should be maintained for this purpose.

Note that rehabilitation expenditures are eligible for assessment credit provided that the work is documented in the assessment report. The photographic documentation recommended below will be suitable for that purpose.

The photographic documentation recommended below will also be valuable as internal records for monitoring environmental performance, as an indication of the potential environmental liabilities attached to the property, and as documentation that can be provided to government agencies or Indigenous governments or organizations.

Nothing in these Requirements and Recommendations shall necessitate that the Operator or any person acting under their direction undertake an activity that would be considered unsafe under the circumstances. The Operator and persons acting under their direction shall continue to comply with the requirements and standards established by the *Occupational Health and Safety Act* and its associated Regulations. The Occupational Health and Safety Division of Service NL provides a document *Safety Guidelines for Mineral Exploration in Newfoundland and Labrador*, available at: <http://www.servicenl.gov.nl.ca/ohs/OHS%20Mineral%20Exploration%20Guide%202014.pdf>

RECOMMENDATIONS:

1.1. Before, during, and after photographs should be taken of all exploration sites and representative sections of access trail:

“Before” photographs should be taken after the removal of trees (if any) and before the arrival of equipment. It is especially important to take “before” photographs of sites previously used for exploration, to serve as a baseline for distinguishing the environmental impact of current exploration activity.

“During” photographs should be taken once the drill is set up and running, the trench excavated and washed, etc.

“After” photographs should be taken once equipment and waste are removed and rehabilitation completed as required.

1.2. Photographs should be taken in high resolution although they may be re-sampled for email and reports.

1.3. “Before”, “during”, and “after” photographs should be taken from the same vantage each time and from a vantage that is neither too close nor too far away.

1.4. Photographs should display a date stamp if the camera is capable of producing one.

1.5. Photographs should be accompanied by a map showing photographed locations or a list of UTM coordinates of the same (with datum indicated, e.g., NAD 83).

2. Cutting Trees

(sheet 1 of 1)

BACKGROUND:

Cutting of trees on Crown land for exploration purposes requires a cutting permit which may be obtained from the local Forestry District Office. In addition, an operating permit is required to carry out mechanized activities on forested land during the forest fire season. Forestry District Office addresses are listed at:

http://www.flr.gov.nl.ca/department/contact_forestry.html

Nothing in these Requirements and Recommendations shall necessitate that the Operator or any person acting under their direction undertake an activity that would be considered unsafe under the circumstances. The Operator and persons acting under their direction shall continue to comply with the requirements and standards established by the *Occupational Health and Safety Act* and its associated Regulations. The Occupational Health and Safety Division of Service NL provides a document *Safety Guidelines for Mineral Exploration in Newfoundland and Labrador*, available at: <http://www.servicnl.gov.nl.ca/ohs/OHS%20Mineral%20Exploration%20Guide%202014.pdf>

REQUIREMENTS:

2.0. The Operator shall ensure that each person involved in cutting is fully informed of the following Requirements and Recommendations, as applicable.

2.1. Cutting of the largest trees shall be avoided unless necessary to ensure a safe work site.

2.2. Stumps shall be cut as low as conveniently possible and in compliance with the *Cutting of Timber Regulations* under the *Forestry Act*. Where stumps are used to place structures such as camp buildings, drill rigs, and decking, stumps need only meet this requirement upon the removal of the structure.

2.3. Trees and other woody debris shall not be felled or discarded into streams or waterbodies. Woody debris should be piled above the high water mark so that this material cannot enter the watercourses during periods of peak flow.

2.4. Unless required for drill cribbing or in the construction of small structures, tree trunks and branches cut to clear an exploration site (including access trails) shall be utilized for the following purposes, in decreasing order of priority:

- a) For corduroy and brush-matting to lay down over sections of access trail located on wet or otherwise soft ground, before using the trail for the first time and thereafter as may be needed.
- b) For spreading over disturbed sites, active or inactive, that could cause siltation into nearby streams or waterbodies. Refer to Appendix A for more information on erosion and sediment control.
- c) For spreading over disturbed sites having been backfilled or re-contoured.

RECOMMENDATIONS:

2.5. Tree trunks and brush spread for erosion control or rehabilitation purposes should not be piled to a thickness greater than 30 cm.

2.6. Cutting should not extend to the perimeter of watercourses; an effective buffer zone of undisturbed vegetation should be maintained for all activities adjacent to a watercourse.

3. Vehicles and Equipment

(sheet 1 of 1)

BACKGROUND:

The use of vehicles or machinery on forested land during the forest fire season requires an operating permit which may be obtained from the local Forestry District Office. Forestry District Office addresses are listed at: http://www.flr.gov.nl.ca/departement/contact_forestry.html

Winter drilling on ice is not addressed in this document however is addressed during the exploration approval process.

Nothing in these Requirements and Recommendations shall necessitate that the Operator or any person acting under their direction undertake an activity that would be considered unsafe under the circumstances. The Operator and persons acting under their direction shall continue to comply with the requirements and standards established by the *Occupational Health and Safety Act* and its associated Regulations. The Occupational Health and Safety Division of Service NL provides a document *Safety Guidelines for Mineral Exploration in Newfoundland and Labrador*, available at: <http://www.servicenl.gov.nl.ca/ohs/OHS%20Mineral%20Exploration%20Guide%202014.pdf>

REQUIREMENTS:

3.0. The Operator shall ensure that each person involved in the activities described below is fully informed of the following Requirements and Recommendations, as applicable.

3.1. The use of skidders shall be strictly limited to dry, firm ground resistant to rutting and established access roads.

3.2. Vehicles and equipment involved in mineral exploration shall be kept clean of potential pollutants (e.g., spilled fuel or oil) and maintained in good working order.

3.3. Equipment maintenance, fueling and washing – other than emergency repairs – shall not be carried out within 30 m of a waterbody. The only exception to this requirement is that drill rigs and water pumps may be refueled within 30 m of a waterbody, however no more than the amount of fuel required to supply the drill and water pump for the drilling of the current hole shall be stored within 30 m of the waterbody.

3.4. Water pumps shall be located on stable ground and shall not be placed closer to the waterbody than necessary given the length of the intake hose. The only exception to this distance requirement is at locations where the only stable site for a water pump is at the bottom of a slope.

3.5. All water pumps shall be underlain by effective secondary containment (e.g., a drip tray) lined with absorbent pads. Absorbent pads shall be changed before becoming saturated. Secondary containment where the containment rim is broken or otherwise ineffective must be replaced or placed within additional containment (e.g., a tarp-lined wooden tray) without delay.

RECOMMENDATIONS:

3.6. Vehicles and drill rigs with wide tracks are the preferred mode of transportation on exploration access trails. Nodwell-, Morooka- and Muskeg-type vehicles are examples. Rubber-tracked vehicles are preferable to steel-tracked vehicles, where possible.

3.7. Excavators are the preferred vehicle for carrying out excavation and leveling, where necessary. Excavators are also the preferred vehicle for backfilling and trail restoration.

4. Access trails (sheet 1 of 4)

BACKGROUND:

“**Exploration access trail**” means a temporary, low-impact route for which preparation and maintenance activities in support of using the route for exploration purposes is limited to one or more of the following:

- a) Clearing trees.
- b) Laying down corduroy or brush-matting to prevent disturbance of wet or soft areas.
- c) Vehicle use to the extent that the natural ground cover is disturbed and a conspicuous path of travel established.
- d) Minimal amounts of local in-filling (“minimal” meaning only at specific locations where it can be demonstrated that it would have been unsafe or impractical for an all-terrain vehicle to drive over the original topography).
- e) Minimal amounts of local grubbing (“minimal” meaning only at specific locations where it can be demonstrated that it would have been unsafe or impractical for an all-terrain vehicle to drive over the vegetation).

If vehicle use does not involve any of the above activities – or involves them only very sparsely – then no mineral exploration access trail is considered to have been established. Tracked vehicle travel over snowpack is an example of off-road vehicle use where no exploration access trail is established.

Exploration access trails qualify as resource roads with respect to the *Motorized Snow Vehicles and All-Terrain Vehicles Regulations* under the *Motorized Snow Vehicles and All-Terrain Vehicles Act*. Exploration access trails are therefore “approved areas” for all-terrain vehicle traffic as defined by Section 2(c) of those Regulations. To distinguish exploration access trails from those roads which involve higher impact preparation and maintenance activities (e.g., significant in-filling, emplacement of a road bed, grading, ditching, or installing metal culverts) exploration access trails may be referred to as **temporary, low-impact resource roads**.

“**Exploration access road**” means a route that involves preparation and maintenance activities in support of using the route for exploration purposes beyond or in excess of those specified above for exploration access trails. Examples of road preparation activities are significant in-filling, emplacement of a road bed, grading, ditching, and installing metal culverts. The development of an exploration access road may invoke regulatory requirements that do not apply to exploration access trails. If an exploration project reaches a stage where it becomes impractical to continue travelling a route that falls within the definition of an access trail, that is, without significant upgrading, maintenance, or road preparation activities, then the required permits must be sought to approve road construction including (but not necessarily limited to) a permission to construct from Crown Lands. Exploration access roads qualify as resource roads however should not be confused with “temporary, low-impact resource roads” which refer specifically to exploration access trails.

“Access trail” and “trail” in this document are shorthand for “exploration access trail” as defined above. “Access road” and “road” are likewise used as shorthand for “exploration access road”.

Subsections 42(1)(f) and (g) of the *Mineral Regulations* requires that all applications for exploration approval must “identify the location of all existing roads, woods roads or trails that will be used to access the site or move to and from locations within the project area” and “the location of all new trails to be prepared to facilitate the planned program”. Subsection 42(3) requires that “Exploration work is to be carried out without deviation from the exploration plan.”

All crossings of watercourses must be authorized by a permit issued under Section 48 of the *Water Resources Act*, issued by the Department of Municipal Affairs and Environment. Note that ice roads, snow dams and bridges are considered water crossings.

4. Access trails (sheet 2 of 4)

Nothing in these Requirements and Recommendations shall necessitate that the Operator or any person acting under their direction undertake an activity that would be considered unsafe under the circumstances. The Operator and persons acting under their direction shall continue to comply with the requirements and standards established by the *Occupational Health and Safety Act* and its associated Regulations. The Occupational Health and Safety Division of Service NL provides a document *Safety Guidelines for Mineral Exploration in Newfoundland and Labrador*, available at: <http://www.servicenl.gov.nl.ca/ohs/OHS%20Mineral%20Exploration%20Guide%202014.pdf>

REQUIREMENTS:

4.0. The Operator shall ensure that each person involved in exploration activities involving ground access is informed of these Requirements and Recommendations, as applicable.

4.1. Insofar as possible without greatly increasing the length of the planned route, trails shall be planned to:

- a) Avoid wetland areas (bogs, fens, saltwater and freshwater marshes, swamps, shallow water areas) or any other ground susceptible to significant rutting;
- b) Avoid close approaches to waterbodies and watercourses (note that establishing an access trail within 15 m of a waterbody may require a permit under the *Water Resources Act*);
- c) Fit the topography by following natural benches, ridge tops and flatter slopes in order to minimize the need for in-filling; and
- d) Avoid steep grades.

4.2. Documentation such as maps or aerial photographs demonstrating that planned access trail routes – whether new or pre-existing – comply with a) through d) of Requirement 4.1 shall be included in the application for exploration approval. As required by subsections 42(4) and (5) of the *Mineral Regulations*, the Mineral Lands Division must be informed of any changes to the initial trail plan, especially any changes that affect compliance with Requirement 4.1.

4.3. Access trails or roads branching off of thoroughfares used by the public, tourists, or outfitters shall be dog-legged at the entrance to reduce the visibility of the access.

4.4. Access trails and access roads shall not branch off of the public highway system except where approved by the Department of Transportation and Works and in accordance with their Policy for Highway Access Management.

4.5. **Preparation of access trails by grubbing** (that is, the pushing aside of vegetation and topsoil) is permitted only locally, at specific locations where it can be demonstrated that it would have been unsafe or impractical for an all-terrain vehicle to drive over the vegetation.

4.6. Grubbed areas shall be rehabilitated once there are no longer documented plans to use or potentially use the affected sections of access trail to support mineral exploration or earlier still if required by the Department to address an environmental impact or to preclude the risk of abandonment without rehabilitation. Grubbed areas are rehabilitated by placing the grubbed materials back over the trail surface.

4.7. **Preparation of access trails by in-filling** is permitted only locally, at locations where it can be demonstrated that it would have been unsafe or impractical for an all-terrain vehicle to drive over the original topography. Material for in-filling shall be sourced immediately adjacent to the area to be in-filled, whether from a small borrow pit or by grading a short section of trail so that material from higher areas is pushed or pulled into lower areas. Borrow pits excavated for this purpose shall be shallow and broad rather than deep.

4.8. In-filled areas and borrow pits shall be rehabilitated once there are no longer documented plans to use or

4. Access trails (sheet 3 of 4)

potentially use the affected sections of access trail to support mineral exploration or earlier still if required by the Department to address an environmental impact or to preclude the risk of abandonment without rehabilitation. In-filled sections of access trail and associated borrow pits shall be rehabilitated by re-contouring the site and spreading the original organic cover (topsoil, ground vegetation, and any trees not used for other purposes) back over the re-contoured site. If the original organic cover proves insufficient to completely re-cover the site then an organic mulch or seeding must be used in addition to complete the process, provided that no invasive species are introduced. Organic mulches and seeding are described in detail in Appendix A. Seeding that is unsuccessful in the opinion of the Department shall not be considered sufficient to meet this requirement.

4.9. Sections of access trail require rehabilitation as per Requirements 4.6 and 4.8 only to the extent necessary to restore the topography and extent of organic ground cover which existed before the section of access trail was first used for exploration purposes since the issuance date of the mineral licence or, in the case of exploration for quarry materials, since the onset of exploration for quarry materials by the holder of the quarry materials exploration licence or their subsidiary, parent, or sister company.

4.10. **Access trails located on wet or soft ground** are permitted only if the route has been surfaced with corduroy or brush-matting before first pass by a motor vehicle. Trees cut in the exploration area to prepare exploration sites (e.g., to clear trench sites, drill sites, access trails, etc.) shall provide the materials for corduroy and brush-matting. Corduroy and brush-matting shall be replaced or topped up as necessary to maintain effective protection of the wet or soft ground beneath. Plywood, planks, pallets, coreboxes, etc. (however not creosoted or chemically treated wood), may be used instead of corduroy and brush-matting and these may be the only options in treeless areas. Unlike corduroy and brush-matting, manufactured ground covers must be removed before the access trails are decommissioned.

4.11. If surfacing materials are too scarce or too costly to import for Requirement 4.10 to be feasible, then one of the following shall apply:

- a) In locations where the landscape is variable on a fine scale (e.g., small hummocks and bogs) the route shall be planned at a fine scale to avoid the wettest patches, even if this increases the length of the route considerably, and any scarce surfacing materials that may be available shall be reserved for the wettest or softest sections of the route.
- b) In locations where large expanses of wet or soft ground need to be crossed, the expanses shall be bypassed instead (e.g., by routing the trail inland of the bog), even if this increases the length of the route considerably.

Situations where this Requirement applies (i.e., where Requirement 4.10 is not feasible) shall be clearly indicated in the application for exploration approval.

4.12. **Access trail routes may be changed without prior notification** in cases where the planned and approved route encounters unanticipated wet or soft ground and, rather than submitting to Requirement 4.10, the Operator decides to change the route to avoid the wet or soft ground. The Mineral Lands Division shall be notified without undue delay of the revised trail route, thereby satisfying Section 42 of the *Mineral Regulations*, however the Mineral Lands Division reserves the right to require that the revised route be re-approved before continued use.

4.13. The purpose of Requirements 4.10 to 4.12 is to prevent rutting of wet and soft ground. If significant rutting occurs, even despite reasonable efforts to meet Requirements 4.10 to 4.12, the **rutting shall be rehabilitated before the end of the exploration season** or earlier still if required by the department to address an environmental impact. Ruts are rehabilitated by collapsing them in. This can be accomplished using an excavator. Even though the excavator will cause temporary additional ground disturbance, it will leave the ground restored in its wake. For peaty ground having been significantly churned by rutting, a layer of scattered organic mulch (e.g., straw) shall be applied to the restored ground to facilitate re-vegetation. Organic mulches are described in Appendix A.

4.14. **Ruts that have intersected local drainage and become streams** shall be in-filled with bundles timber and

4. Access trails (sheet 4 of 4)

brush (or clean gravel) as soon as it is possible to do so. This practice and the problem of channelized runoff are further addressed in Appendix A (bottom half of sheet 9). The purpose of bundles or timber and brush is to slow the flow of water, and thereby reduce erosion rates and sediment loads, as well as restore the ground surface. Erosion and sediment control methods shall be employed as necessary as per Requirement 4.15. If the water flowing through ruts intercepts an existing watercourse (even if only a small stream or intermittent channel), then the ruts located immediately upstream of the outflow location shall be in-filled with bundles of timbers and brush (or clean gravel) before others.

4.15. Sections of access trail that have been grubbed, in-filled, or rutted, or that are otherwise associated with ground disturbance, are susceptible to erosion and could become a source of waterborne sediment that could flow into a nearby waterbody or watercourse, including by way of small streams or intermittent channels that may not appear on 1:50,000 scale maps but are nonetheless capable of carrying waterborne sediment into a larger waterbody. **To the extent that may be necessary to prevent waterborne sediment eroded from an access trail entering into a waterbody or watercourse**, the Operator shall employ some combination of erosion and sediment control measures:

- a) Erosion control: To the extent that may be necessary, the trail shall be covered with corduroy or brush-matting and shall be monitored frequently enough to ensure continued effectiveness of the corduroy or brush-matting in preventing waterborne sediment proceeding from the trail, and the corduroy or brush-matting topped up or extended as may necessary.
- b) Sediment control: To the extent that may be necessary, sediment fences or sediment retention ponds shall be installed proactively at locations beside the trail where water exits or may be expected to exit the trail, including during times of higher runoff. With respect to sediment fences, in order to be effective, they must be installed parallel to contour across level ground rather than across existing channels or channels formed by the runoff. Sediment control methods must be monitored frequently enough to ensure continued effectiveness and replaced or redoubled if necessary.

Appendix A contains detailed information about erosion and sediment control methods and should be consulted before the planning and installation of these methods. The combination of erosion and sediment control methods chosen and the relative proportions in which they are employed (including the option that only one method of either erosion or sediment control is chosen) are at the discretion of the Operator provided that the method(s) are effective in preventing waterborne sediment from entering a waterbody or watercourse. Should the Department be of the opinion that the method(s) employed are not effective or are inadequate for meeting this Requirement, then the Operator shall abide by the direction of the Department in remedying the situation. Significant production of waterborne sediment from a grubbed, in-filled, rutted, or otherwise disturbed section of trail may constitute grounds for the department to require early rehabilitation under Requirements 4.6, 4.8, and 4.13.

4.16. Sediment fences and sediment retention ponds installed to comply with Requirement 4.15 shall be removed or rehabilitated, respectively, once the corresponding section of access trail is required to be rehabilitated or if there are no longer documented plans to use or potentially use the corresponding section of access trail to support mineral exploration, whichever occurs earlier. Sediment fences are removed by cutting the fence fabric off at the ground level and pulling the posts. Once rehabilitation is due, sediment retention ponds shall be rehabilitated according to the process required for trenches and test pits (Section 6 of this document).

RECOMMENDATIONS:

4.17. Trails should be ground-truthed by the Operator before any trail preparation activity begins (e.g. cutting) and no later than the first pass by a vehicle. The main purpose of ground-truthing is to verify compliance with Requirement 4.1.

4.18. Where trail surfaces devoid of vegetation have become compacted, the trail surfaces should be scarified to facilitate re-vegetation. Scarification is the use of an excavator or rake to roughen, loosen, or create small rows upon compacted soil.

5. Trench and Test Pit Preparation

(sheet 1 of 2)

BACKGROUND:

“Trench” means any excavation made for the purpose of studying or sampling the underlying bedrock, soil, or till, however does not include test pits as defined below. Stripped areas and grubbed areas meeting this definition are considered trenches. “Test pit” means an excavation that is excavated and backfilled either the same day or without the excavator having departed the test pit site. Trenches are typically associated with mineral exploration and test pits typically with exploration for quarry materials.

“Organic cover” means all vegetation and topsoil remaining after trees have been cut to clear a site.

Nothing in these Requirements and Recommendations shall necessitate that the Operator or any person acting under their direction undertake an activity that would be considered unsafe under the circumstances. The Operator and persons acting under their direction shall continue to comply with the requirements and standards established by the *Occupational Health and Safety Act* and its associated Regulations. **Note that there are specific Occupational Health and Safety Regulations related to trenching, as well as blasting.** The Occupational Health and Safety Division of Service NL provides a document *Safety Guidelines for Mineral Exploration in Newfoundland and Labrador*, available at: <http://www.servicenl.gov.nl.ca/ohs/OHS%20Mineral%20Exploration%20Guide%202014.pdf>

REQUIREMENTS:

5.0. The Operator shall ensure that each person involved in trench or test pit preparation is informed of the following Requirements and Recommendations, as applicable.

5.1. Before trenching or test pitting, the site shall be cleared to a sufficient width so that all requirements related to stockpiling, including those under the Occupational Health and Safety Regulations, may be met.

5.2. The organic cover shall be grubbed (i.e., excavated) and stockpiled before deeper excavation occurs and shall be stockpiled separately from the deeper materials (e.g., subsoil, till) that are excavated. The reason for this requirement is that if the organic cover is stockpiled together with deeper materials, it may not be practical to separate out the components before backfilling in order to meet requirement 6.2 for rehabilitation. Trees and branches cut to clear the site shall also be stockpiled, whether with the organic cover or on their own (so that they may be accessible for other purposes such as those listed in Requirement 2.4, if necessary). This Requirement implies nothing about the absolute distances that excavated material, woody material, or overburden in general must be kept from the excavation; please refer to the Occupational Health and Safety Regulations.

5.3. Where the organic cover is less than 30-40 cm thick, removal of the upper 30-40 cm of ground material shall be considered acceptable to comply with Requirement 5.2. to separately stockpile the organic cover.

5.4. Excavated materials shall not be stockpiled in standing trees or other locations from which they would be difficult to retrieve during rehabilitation. This requirement makes no implication about the absolute distances that excavated material, woody material, or overburden in general must be kept from the excavation; please refer to the Occupational Health and Safety Regulations.

5.5. All trenches shall be designed to allow for easy exit of people and large animals such as caribou. In practice this means ensuring that a person or large animal can exit the trench by walking rather than climbing.

5.6. Trench walls and stockpiles are susceptible to erosion and could become a source of waterborne sediment that could flow into a nearby waterbody or watercourse, including by way of small streams or intermittent channels that may not appear on 1:50,000 scale maps but are nonetheless capable of carrying waterborne sediment into a larger waterbody. **To the extent that may be necessary to prevent waterborne sediment eroded from a trench or stockpile entering into a waterbody or watercourse**, the Operator shall employ some combination of erosion and

5. Trench and Test Pit Preparation

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sediment control measures:

- a) Erosion prevention: To the extent that may be necessary, trench walls and stockpiles of excavated material shall be covered with organic mulch (e.g., straw) or brush-matting. Trenches and their stockpiles shall be monitored frequently enough to ensure continued effectiveness of erosion control methods, and erosion control methods augmented (e.g., organic mulch or brush-matting topped up) or extended as may be necessary.
- b) Sediment control: To the extent that may be necessary, sediment fences or sediment retention ponds shall be installed proactively where water exits or may be expected to exit the trench, and downslope of stockpiles. To clarify, expanses of densely vegetated flat ground provide an effective natural means of sediment control, and where present, it may not be necessary to use other sediment control methods. With respect to sediment fences, in order to be effective, they must be installed parallel to contour across level ground rather than across existing channels or channels formed by the runoff. One form of sediment retention pond applicable in this context is a tapered ditch located at the downslope end of the trench. Sediment control methods must be monitored frequently enough to ensure continued effectiveness and replaced, augmented, or extended if necessary.

Appendix A contains detailed information about erosion and sediment control methods and should be consulted before the planning and installation of these methods. The combination of erosion and sediment control methods chosen and the relative proportions in which they are employed (including the option that only one method of either erosion or sediment control is chosen) are at the discretion of the Operator provided that the method(s) are effective in preventing waterborne sediment from entering a waterbody or watercourse. Should the Department be of the opinion that the method(s) employed are not effective or are inadequate for meeting this Requirement, then the Operator shall abide by the direction of the Department in remedying the situation.

RECOMMENDATIONS:

5.7. Organic cover may be stockpiled on one side of the trench or test pit and deeper materials stockpiled on the other. Alternately, organic cover may be stockpiled at a greater distance from the trench or test pit than deeper materials, for example, forming outer and inner stockpiles surrounding the trench (or test pit), respectively. This Recommendation makes no implication about the absolute distances that excavated material must be kept from the excavation; please refer to the Occupational Health and Safety Regulations.

5.8. For each trench deep enough to pose a possible safety hazard, a sign should be posted in a conspicuous place alerting the public to the presence of an open trench and displaying the name of the Operator and contact information.

6. Trench Rehabilitation

(sheet 1 of 2)

BACKGROUND:

“Trench” means an excavation for the purpose of studying or sampling the underlying bedrock, soil, or till, however does not include test pits as defined below. Stripped areas and grubbed areas meeting this definition are considered trenches. “Test pit” means an excavation that is excavated and backfilled either the same day or without the excavator having departed the test pit site. Trenches are typically associated with mineral exploration and test pits typically with exploration for quarry materials.

“Organic cover” means all vegetation and topsoil remaining after trees have been cut to clear a site.

Nothing in these Requirements and Recommendations shall necessitate that the Operator or any person acting under their direction undertake an activity that would be considered unsafe under the circumstances. The Operator and persons acting under their direction shall continue to comply with the requirements and standards established by the Occupational Health and Safety Act and its associated Regulations. The Occupational Health and Safety Division of Service NL provides a document *Safety Guidelines for Mineral Exploration in Newfoundland and Labrador*, available at: <http://www.servicenl.gov.nl.ca/ohs/OHS%20Mineral%20Exploration%20Guide%202014.pdf>

REQUIREMENTS:

6.0. The Operator shall ensure that each person involved in trench and test pit rehabilitation is fully informed of the following Requirements and Recommendations, as applicable.

6.1. Trench rehabilitation as per these Requirements shall be completed before the expiry date of the exploration approval unless the Department has indicated in writing that a later rehabilitation due date is acceptable for the specific trench in question. If it would be impractical, considering the logistics and timelines of the exploration program, including with regard to deposit appraisal and promotional efforts, for the approval holder to rehabilitate one or more trenches before the expiry date of the exploration approval then application must be made to the Mineral Lands Division, Department of Natural Resources, requesting an extension of time to leave the trench or trenches unrehabilitated and the reasons for the request. In granting approval for such a request, the Department may impose additional terms and conditions considered appropriate under the circumstances.

6.2. Test pit rehabilitation as per these Requirements shall be completed either the same day or without the excavator having departed the test pit site. While a party possessing an exploration approval for test pitting is required to adhere to this Requirement, test pits for which this rehabilitation timeline is not met shall become subject to the following additional Requirements and considered as “trenches” for the purpose of interpreting these Requirements: 5.5, 5.6, 6.5, 6.6. In such a case, a sign shall be posted in a conspicuous place alerting the public to the presence of an open excavation and displaying the name of the Operator and contact information.

6.3. Trenches and test pits shall be rehabilitated by completely backfilling stockpiled deeper materials (e.g., subsoil, till) then covering the backfilled site with stockpiled organic cover and any additional organic materials that may be required (as per Requirement 6.4) to completely re-cover the site.

6.4. Organic cover stockpiled during preparation shall be placed on top of the backfilled trench or test pit. Unless used or set aside for another purpose advocated in this document or otherwise approved by a regulatory agency, trees and branches cut to clear the trench site shall also be placed on top of the backfilled trench or test pit. If additional organic material is needed to completely re-cover the site to achieve compliance with Requirement 6.3 then one or more of the following materials may be used:

- a) Trees and branches already having been cut for exploration purposes elsewhere in the exploration area (e.g., trees cut for access trails, cut lines, or drill sites).

6. Trench Rehabilitation

(sheet 2 of 2)

- b) Hay, straw, woodchips, or any other organic mulch provided that it does not introduce an invasive species.
- c) Vegetation produced by seeding provided that the seeding does not introduce an invasive species. Seeding that is unsuccessful in the opinion of the Department shall not be considered sufficient to meet this requirement.

Organic mulches and seeding methods are addressed in Appendix A (sheets 2 and 6, respectively).

6.5. Once a trench is rehabilitated, barriers and signage no longer needed shall be removed from the site.

6.6. Sediment fences associated with trenches shall be removed once the corresponding trench is required to be rehabilitated. Sediment fences are removed by cutting the fence fabric off at the ground level and pulling the posts.

6.7. Sediment retention ponds associated with trenches shall be backfilled seasonally with rehabilitation completed (i.e., organic cover and (or) a substitute material spread over the backfilled site) once the corresponding trench is required to be rehabilitated. Sediment retention ponds shall be rehabilitated according to the process as required for trenches and test pits (Requirements 6.3 and 6.4).

RECOMMENDATION:

6.8. Except for what is required to approximately re-establish original site topography, the surface of a backfilled trench or test pit should not be smoothed or compacted.

7. Drill Site Preparation

(sheet 1 of 2)

BACKGROUND:

The goal of the Department is that all exploration sites be left in a condition conducive to natural re-vegetation. Sites where the organic cover has been removed will naturally re-vegetate much slower than sites where organic material, in some form, has been spread back over the site.

Drill sites prepared by removing the organic cover to create a level surface are subject to rehabilitation requirements.

Winter drilling on ice is not addressed in this document however is addressed during the exploration approval process.

Nothing in these Requirements and Recommendations shall necessitate that the Operator or any person acting under their direction undertake an activity that would be considered unsafe under the circumstances. The Operator and persons acting under their direction shall continue to comply with the requirements and standards established by the Occupational Health and Safety Act and its associated Regulations. The Occupational Health and Safety Division of Service NL provides a document *Safety Guidelines for Mineral Exploration in Newfoundland and Labrador*, available at: <http://www.servicenl.gov.nl.ca/ohs/OHS%20Mineral%20Exploration%20Guide%202014.pdf>

REQUIREMENTS:

7.0. The Operator shall ensure that each person involved in preparing a drill site is fully informed of the following Requirements and Recommendations, as applicable.

7.1. For drill sites prepared by removing the organic cover (e.g., by leveling, by cut-and-fill), the organic cover shall be stockpiled separately from deeper excavated materials (e.g., subsoil, till). Trees and branches cut to clear the site shall also be stockpiled, whether with the organic cover or on their own (so that they may be accessible for other purposes such as those listed in Requirement 2.4, if necessary).

7.2. For drill sites prepared by removing the organic cover (e.g., by leveling, by cut-and-fill), excavated materials shall not be stockpiled in standing trees or other locations from which they would be difficult to retrieve during rehabilitation.

7.4. Drill sites prepared by removing the organic cover, even if only from a portion of the site, are susceptible to erosion and could become a source of waterborne sediment that could flow into a nearby waterbody or watercourse, including by way of small streams or intermittent channels that may not appear on 1:50,000 scale maps but are nonetheless capable of carrying waterborne sediment into a larger waterbody. **To the extent that may be necessary to prevent waterborne sediment from a drill site from entering a waterbody or watercourse**, the Operator shall employ some combination of erosion and sediment control measures:

- a) Erosion prevention: To the extent that may be necessary, portions of the drill site where the organic cover has been removed and any stockpiles of excavated material shall be covered with organic mulch (e.g., straw) or brush-matting. Drill sites and any associated stockpiles shall be monitored frequently enough to ensure continued effectiveness of erosion control methods, and erosion control methods augmented (e.g., organic mulch or brush-matting topped up) or extended as may be necessary.
- b) Sediment control: To the extent that may be necessary, sediment fences or sediment retention ponds shall be installed proactively downslope of the drill site and any stockpiles. To clarify, expanses of densely vegetated flat ground provide an effective natural means of sediment control, and where present, it may not be necessary to use other sediment control methods. With respect to sediment fences, in order to be effective, they must be installed parallel to contour across level ground rather than across existing channels or channels formed by the runoff. Sediment retention ponds are commonly used for sediment control at drill sites and are sometimes referred to as "sump pits". Sediment control methods must be monitored frequently enough to

7. Drill Site Preparation

(sheet 2 of 2)

ensure continued effectiveness and replaced, augmented, or extended if necessary.

Appendix A contains detailed information about erosion and sediment control methods and should be consulted before the planning and installation of these methods. The combination of erosion and sediment control methods chosen and the relative proportions in which they are employed (including the option that only one method of either erosion or sediment control is chosen) are at the discretion of the Operator provided that the method(s) are effective in preventing waterborne sediment from entering a waterbody or watercourse. Should the Department be of the opinion that the method(s) employed are not effective or are inadequate for meeting this Requirement, then the Operator shall abide by the direction of the Department in remedying the situation.

7.2. Sediment retention ponds (or “sump pits”) excavated to contain water runoff from drilling and shall be prepared according to Requirements 5.1, 5.2, 5.3, and 5.4, and considered as “trenches” for the purpose of interpreting these Requirements.

RECOMMENDATIONS:

7.3. Drill sites should be prepared with the minimum ground disturbance necessary to ensure practical and safe working conditions. Ideally, drill sites should be prepared by clearing the trees and then cribbing the drill rig on timbers or lumber – no ground disturbance necessary. Helicopter-accessed drill sites are generally prepared in this way. Ground-accessed drill sites should be prepared in the same way insofar as working conditions remain practical and safe.

7.4. Drill sites should not be cleared of trees to widths any greater than necessary for practical and safe working conditions.

8. Active Drilling

(sheet 1 of 2)

BACKGROUND:

The main environmental concerns presented by active drilling are the potential for drill cuttings and drilling additives to enter a waterbody or watercourse and for petroleum spills.

The most common type of petroleum spill which occurs on active drill sites are of hydraulic oil, characterized by one or more dark stains located within several metres of the casing. Deposits of used drill grease are also common, generally located at the base of the casing.

Fuel spills at water pump sites are also common, and while generally very small in volume, present the most direct opportunity for petroleum contamination of a waterbody.

Spills into a waterbody or with the potential to enter a waterbody and spills greater than 70 litres or of an unknown or unrecoverable volume on land must be reported without delay by calling the 24-hour Emergency Spill Report line: (709) 772-2083 or 1-800-563-9089.

General requirements for addressing fuel and oil spills are included in Section 13 of this document. Some requirements in the present section are repeated in other sections of this document.

Winter drilling on ice is not addressed in this document however is addressed during the exploration approval process.

Nothing in these Requirements and Recommendations shall necessitate that the Operator or any person acting under their direction undertake an activity that would be considered unsafe under the circumstances. The Operator and persons acting under their direction shall continue to comply with the requirements and standards established by the Occupational Health and Safety Act and its associated Regulations. The Occupational Health and Safety Division of Service NL provides a document *Safety Guidelines for Mineral Exploration in Newfoundland and Labrador*, available at: <http://www.servicenl.gov.nl.ca/ohs/OHS%20Mineral%20Exploration%20Guide%202014.pdf>

REQUIREMENTS:

8.0. The Operator shall ensure that each person involved in active drilling is fully informed of the following Requirements and Recommendations, as applicable.

8.1. Waterborne drill cuttings and drilling additives shall not be permitted to enter a waterbody or watercourse, including into a small stream or intermittent channel, irrespective of whether it is displayed on the 1:50,000 scale NTS map. The most certain way to meet this requirement is to ensure that drilling discharge waters are not be permitted to flow overland into a waterbody or watercourse. Measures such as the following shall be employed as necessary to ensure compliance with this requirement:

- a) Sediment retention ponds (or “sump pits”) for settling drill cuttings and allowing the discharge waters to dissipate into the ground. Refer to Requirement 7.2.
- b) Pumping discharge waters onto forested or otherwise well-vegetated ground, provided that from there the discharge does not find a channel or small stream by which to travel into a waterbody.
- c) Settling tanks to collect drill cuttings.
- a) Sediment fences to intercept drill discharge waters. With respect to sediment fences, in order to be effective, they must be installed parallel to contour across level ground rather than across existing channels or channels formed by the runoff.

8. Active Drilling

(sheet 2 of 2)

Methods used to prevent drilling discharge waters and their contents from entering a waterbody must be monitored frequently enough to ensure continued effectiveness and replaced, augmented, or extended if necessary. Appendix A contains detailed information about sediment control methods that can be used for meeting this Requirement and should be consulted before the planning and installation of these methods. Should the Department be of the opinion that the method(s) employed are not effective or are inadequate for meeting this Requirement, then the Operator shall abide by the direction of the Department in remedying the situation.

8.2. Drilling additives shall be fully biodegradable and used only in the amounts necessary as prescribed by the manufacturer. This requirement does not apply to brine used for drilling salt and potash.

8.3. Water pumps shall be located on stable ground and shall not be placed closer to the waterbody than necessary given the length of the intake hose. The only exception to this distance requirement is at locations where the only stable site for a water pump is at the bottom of a slope.

8.4. All water pumps shall be underlain by effective secondary containment (e.g., a drip tray) lined with absorbent pads. Absorbent pads shall be changed before becoming saturated. Secondary containment where the containment rim is broken or otherwise ineffective must be replaced or placed within additional containment (e.g., a tarp-lined wooden tray) without delay.

8.5. All reasonable means shall be employed to prevent spills of petroleum, including spills of hydraulic oil beneath drill rigs.

8.6. Petroleum spills shall be completely cleaned up without delay. Spills related to active drilling are typically cleaned up in the following ways:

- a) For spills on land, including spills of hydraulic oil beneath a drill rig and spills of fuel alongside a water pump, excavate all contaminated materials (e.g., soil, vegetation) and place into empty drums or similar containers. Be sure to excavate deep enough to retrieve all of the contaminated soil.
- b) For spills on water, keep adding absorbent pads and remove them as they become saturated with petroleum. Place the contaminated absorbent pads in empty drums or similar containers.

The clean up of petroleum spills and the disposal of petroleum-contaminated materials is addressed further in Section 13 of this document.

8.7. Spills shall be reported to the Mineral Lands Division.

8.8. Immediately after demobilization from a drill site, the site shall be inspected for spills of hydraulic oil or fuel, deposits of drill grease, garbage, and waste equipment, and these shall be cleaned up in their entirety without delay. Be sure to excavate deep enough to retrieve all of the contaminated soil. Soil contaminated by hydraulic oil or fuel shall be excavated and disposed of at an approved waste disposal site. Contact the nearest Government Service Centre to find out the location of the nearest approved waste disposal site accepting the materials you have cleaned up. Government Service Centres are listed at: <http://www.serviceni.gov.nl.ca/department/contact.html#locations>. Refer to Requirements 13.5 and 13.6 which describe special cases involving petroleum-contaminated materials which may modify this Requirement.

9. Drill Site Rehabilitation

(sheet 1 of 2)

BACKGROUND:

The goal of the Department is that all exploration sites be left in a condition conducive to natural re-vegetation. Sites where the organic cover has been removed will naturally re-vegetate much slower than sites where organic material, in some form, has been spread back over the site.

Drill sites prepared by removing the organic cover to create a level surface are subject to rehabilitation requirements.

Nothing in these Requirements and Recommendations shall necessitate that the Operator or any person acting under their direction undertake an activity that would be considered unsafe under the circumstances. The Operator and persons acting under their direction shall continue to comply with the requirements and standards established by the *Occupational Health and Safety Act* and its associated Regulations. The Occupational Health and Safety Division of Service NL provides a document *Safety Guidelines for Mineral Exploration in Newfoundland and Labrador*, available at: <http://www.servicenl.gov.nl.ca/ohs/OHS%20Mineral%20Exploration%20Guide%202014.pdf>

REQUIREMENTS:

9.0. The Operator shall ensure that each person involved in demobilizing from a drill site or rehabilitating a drill site is fully informed of the following Requirements and Recommendations, as applicable.

9.1. Unless the site has been re-approved under another exploration approval for additional drilling, drill sites shall be rehabilitated before the expiry date of the exploration approval.

9.1. Drill sites prepared by removing the organic cover (e.g., by leveling, by cut-and-fill) shall be rehabilitated as follows:

- a) The site shall be re-contoured so as to approximately restore the original site topography. In meeting this requirement, it is acceptable to leave a depression around the casing if required to keep the casing exposed for possible future work.
- a) The original organic cover (topsoil, ground vegetation) and any trees and branches not used for other purposes shall be spread back over the re-contoured site. If these materials prove insufficient to completely re-cover the site then an organic mulch or seeding must be used in addition to complete the process, provided that no invasive species are introduced. Organic mulches and seeding are described in detail in Appendix A. Seeding that is unsuccessful in the opinion of the Department shall not be considered sufficient to meet this requirement.

9.2. Sediment retention ponds (or "sump pits") associated with drill sites shall be backfilled seasonally, with the organic cover to be replaced no later than when the associated drill site(s) is rehabilitated.

9.3. For drill sites located in open areas accessible to ATVs and snowmobiles, including in the middle of an access route, the casing shall either be removed or cut off at ground level. Visibility markers or signage are not affected by this requirement. Drill holes that are required to be sealed, for example as per Requirement 9.6, shall be sealed before the casing is cut off.

9.4. Immediately after demobilization from a drill site, the site shall be inspected for spills of hydraulic oil or fuel, deposits of drill grease, garbage, and waste equipment and these shall be cleaned up in their entirety without delay. Soil contaminated by hydraulic oil or fuel shall be excavated and disposed of at an approved waste disposal site. Contact the nearest Government Service Centre to find out the location of the nearest approved waste disposal site accepting the materials you have cleaned up. Government Service Centres are listed at: <http://www.servicenl.gov.nl.ca/department/contact.html#locations>. Refer to Requirements 13.5 and 13.6 which

9. Drill Site Rehabilitation

(sheet 2 of 2)

describe special cases involving petroleum-contaminated materials which may modify this Requirement.

9.5. Casings shall be capped before the end of the exploration season. Capping means any effective and durable means of completely covering the casing opening, excluding the use of natural materials for this purpose (e.g., placing a rock over the casing, stuffing with large branch or piece of wood). Sawn off casings may be capped using steel caps with bolts. Drill holes for which the casing is pulled shall be covered over at the surface with material containing a large proportion of gravel coarser than the hole diameter (to limit subsidence of surface materials into the hole).

9.6. Drill holes which produce artesian water at the surface (i.e., water flowing out of the top of the casing) while the drill rig is present on site shall be plugged before the drill rig departs from the site. The drill hole shall be plugged with high-swelling bentonite, cement, or another material with suitable properties. Capping is not a substitute for plugging, since many caps cannot fully stop the water and the caps will eventually break due to freeze-thaw cycles. If downhole geophysics is being considered for the exploration project, the Operator and Approval Holder are advised to take this contingency into consideration, and may wish to be ready to carry out downhole geophysics before plugging the hole and the drill rig departing the site in the event that a hole producing artesian water is encountered.

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10. Uranium

(sheet 1 of 1)

BACKGROUND:

These guidelines are based in part on those developed by the Government of Saskatchewan.

Scintillometers that measure radiation in counts per second must have the measurements converted to microsieverts per hour ($\mu\text{Sv} / \text{hr}$) according to the specifications of the instrument. Concentrations specified are by weight.

Nothing in these Requirements and Recommendations shall necessitate that the Operator or any person acting under their direction undertake an activity that would be considered unsafe under the circumstances. The Operator and persons acting under their direction shall continue to comply with the requirements and standards established by the *Occupational Health and Safety Act* and its associated Regulations. The Occupational Health and Safety Division of Service NL provides a document *Safety Guidelines for Mineral Exploration in Newfoundland and Labrador*, available at: <http://www.servicnl.gov.nl.ca/ohs/OHS%20Mineral%20Exploration%20Guide%202014.pdf>

REQUIREMENTS:

10.0. The Operator is responsible for ensuring that each person involved in exploration for uranium is fully informed of the following Requirements and Recommendations, as applicable.

10.1. Following the rehabilitation of a trench or other excavation, gamma radiation levels must not exceed $1.0 \mu\text{Sv} / \text{hr}$ at one metre above ground level or the natural background radiation level characterizing the area, whichever is greater .

10.2. Drill cuttings or other solid discharge with a uranium equivalent concentration ($e\text{U3O8}$ = radiometric equivalent U3O8 concentration) greater than 0.05 percent are to be collected and disposed of down the drill hole and the hole pugged with cement or another material with similar properties. Before being collected, drill cuttings meeting this description shall not be permitted to flow beyond the immediate vicinity of the drill setup, and one or more settling tanks may be required to ensure that this does not happen.

10.3. Drill cuttings representing rock for which gamma ray logs or assays have not yet been produced but that may reasonably be expected to meet the description in Requirement 10.2 shall be handled as per requirement 10.2. The same shall apply in instances where the Operator is uncertain of whether the drill cuttings meet the description in requirement 10.2.

10.4. Drill waters proceeding from cuttings meeting the description in requirement 10.2 or 10.3 shall not be permitted to flow above ground into a waterbody or watercourse, including any small streams or intermittent channels that may be present.

10.5. Drill holes that encounter rock with a uranium equivalent concentration ($e\text{U3O8}$) greater than 1.0 percent over a length of at least 1 metre shall be sealed with cement over the entire length of each mineralized zone and not less than 10 metres above and below each mineralized zone.

10.6. Drill holes that intersect mineralized zones for which gamma ray logs or assays have not yet been produced but that may be reasonably be expected to meet the description in Requirement 10.5 shall be handled as per Requirement 10.5. The same shall apply in instances where the Operator is uncertain of whether the mineralized zones within the hole meet the description in Requirement 10.5.

10.7. In locations where the local bedrock is characterized by higher concentrations than those specified in Requirements 10.2 and 10.5 the drill cuttings may be deposited at surface, however not into a waterbody or watercourse, and the drill hole may be left unsealed provided it is not producing water.

11. Camps and Laydown Areas

(sheet 1 of 2)

BACKGROUND:

'Fly camp' means a camp occupying a site for up to 90 days and not involving significant ground disturbance. An example of significant ground disturbance would be the deliberate or inadvertent removal of ground vegetation or topsoil over an area greater than several square metres.

'Base camp' means a camp occupying a site for greater than 90 days or involving significant ground disturbance.

Occupation of a site means not only the presence of people, but also the presence of structures, equipment, garbage, fuel or any other imported materials.

Base camps require a Licence to Occupy (LTO) under the *Lands Act*, whereas fly camps require 'exploration approval' under the *Mineral Act*. The use of personal-size tents for prospecting and mapping is not considered a fly camp.

The Pollution Prevention Division of the Department of Environment and Conservation has established specific waste management requirements for exploration camps in the guidance document *Environmental Standards for Waste Management at Remote Camps*, available at:

http://www.env.gov.nl.ca/env/env_protection/waste/guidancedocs/remote_exploration_camps.pdf

Exploration camps are subject to the *Sanitation Regulations* under the *Public Health Act* and sanitation requirements in addition to those given below may apply. Exploration camps where food is served are subject to the *Food Premises Regulations* under the *Food Preparation Act*. For inquiries concerning sanitation requirements or food storage and preparation requirements, please contact Service NL:
<http://www.servicentl.gov.nl.ca/department/contact.html>

Nothing in these Requirements and Recommendations shall necessitate that the Operator or any person acting under their direction undertake an activity that would be considered unsafe under the circumstances. The Operator and persons acting under their direction shall continue to comply with the requirements and standards established by the *Occupational Health and Safety Act* and its associated Regulations. The Occupational Health and Safety Division of Service NL provides a document *Safety Guidelines for Mineral Exploration in Newfoundland and Labrador*, available at: <http://www.servicentl.gov.nl.ca/ohs/OHS%20Mineral%20Exploration%20Guide%202014.pdf>

REQUIREMENTS:

11.0. The Operator shall ensure that each person involved in the setup or maintenance of a mineral exploration camp is fully informed of the following Requirements and Recommendations, as applicable.

11.1. All structures and other imported materials, including fuel and equipment, shall be removed upon abandonment of a camp site. Fly camp sites shall be abandoned at the end of the season and prior to 90 days occupancy.

11.2. Base camps shall not be located within 30 metres of a waterbody.

11.3. Pit privies shall be located at least 25 metres from the camp in a direction away from waterbodies (including intermittent streams) and shall be backfilled upon abandonment of the pit privy. Further requirements or recommendations for pit privies may be specified by Service NL.

11.4. Dishwater and wash water (i.e., grey water) shall be disposed of in a pit large enough to contain the volume of water discarded, located at least 30 metres away from waterbodies (including intermittent streams), and backfilled upon abandonment of the pit.

11.5. Where the camp is equipped with a water distribution system and this system provides water to plumbing

11. Camps and Laydown Areas (sheet 2 of 2)

fixtures, then all wastewater (including from the kitchen sinks, bathroom sinks, showers, clothes washer and toilets) shall be disposed of by means of a sewage disposal system approved by Service NL.

11.6. Garbage, used consumables, packaging and all other wastes shall be properly contained and handled, and shall be removed on a sufficiently regular basis to a waste disposal site approved to handle the type(s) of waste being disposed of. For base camps, waste shall not be left on site later than the seasonal departure of personnel. More specific waste disposal requirements are set out in the guidance document *Environmental Standards for Waste Management at Remote Camps*.

11.7. Ground preparation and rehabilitation of camp sites and laydown areas prepared by ground disturbance (e.g., bulldozing, trenching, in-filling) shall proceed as follows:

- a) The organic cover (topsoil and ground vegetation), as well as any trees and branches not used for other purposes, shall be stockpiled separately from deeper excavated materials (e.g., subsoil, till).
- b) Excavated materials shall be stockpiled in locations where they can be easily retrieved during rehabilitation.
- c) Once structures and other imported materials are removed, the site shall be re-contoured so as to approximately restore the original site topography.
- a) The original organic cover and any trees and branches not used for other purposes shall be spread back over the re-contoured site. If these materials prove insufficient to completely re-cover the site then an organic mulch or seeding must be used in addition to complete the process, provided that no invasive species are introduced. Organic mulches and seeding are described in detail in Appendix A. Seeding that is unsuccessful in the opinion of the Department shall not be considered sufficient to meet this requirement.

11.8. All horizontal drums of heating fuel connected to a stove shall have positioned beneath the connection a drip tray lined with one or more absorbent pads, and the absorbent pads shall be changed before becoming saturated. This requirement does not apply if the horizontal drum is placed in a protective case that would contain any leakage from the connection.

11.9. Base camps shall be equipped to fight fires.

RECOMMENDATIONS:

11.10. To increase the fire protection for base camps, camp buildings should be spaced widely apart and the camp site should be widely separated from surrounding forest.

11.11. To reduce the likelihood of eroded sediments and organic particles entering a waterbody or watercourse, stockpiles of organic cover and other excavated materials should be located at least 50 m from the nearest waterbody or watercourse.

12. Fuel & Oil Storage & Handling

(sheet 1 of 2)

BACKGROUND:

Storage of 5 or more drums requires a fuel cache approval from Service NL. Application forms can be obtained from the nearest Government Service Centre: <http://www.servicenl.gov.nl.ca/department/contact.html#locations>

The Requirements and Recommendations in this section shall apply except in situations where there is a disagreement with another piece of legislation or regulation, a policy of or set of instructions provided by the Department of Municipal Affairs and Environment, Service NL, or Fisheries and Oceans Canada, the terms and conditions of another government permit (e.g., fuel cache approval, water use licence / permit, exploration approval), or a work plan approval issued by the Nunatsiavut Government.

Nothing in these Requirements and Recommendations shall necessitate that the Operator or any person acting under their direction undertake an activity that would be considered unsafe under the circumstances. The Operator and persons acting under their direction shall continue to comply with the requirements and standards established by the *Occupational Health and Safety Act* and its associated Regulations. The Occupational Health and Safety Division of Service NL provides a document *Safety Guidelines for Mineral Exploration in Newfoundland and Labrador*, available at: <http://www.servicenl.gov.nl.ca/ohs/OHS%20Mineral%20Exploration%20Guide%202014.pdf>

REQUIREMENTS:

12.0. The Operator shall ensure that each person working with fuel or oil is fully informed of the following Requirements and Recommendations, as applicable.

12.1. All fuel storage sites, active drill sites, and heavy equipment laydown areas shall be equipped with a spill kit containing *at minimum* the following contents or equivalent:

- a) One recovery container such as an empty 205 litre drum or large plastic drum (the spill kit contents may be stored in the recovery container).
- b) One shovel.
- c) One hand-operated fuel pump.
- d) One pair of neoprene oil / chemical resistant gloves.
- e) One pair of protective goggles.
- f) 25 absorbent pads – approximately 46 x 46 cm each.

These contents are in addition to spill kit items required by other permits (e.g., permit for development in a protected water supply area, fording permits) or the jurisdiction (e.g., Labrador Inuit Lands). Additional items may include absorbent blankets, containment booms, bags of peat moss, a pickaxe, and a thick-walled polyethylene bag.

12.2. All spill kits associated with active drill sites located in within 30 m of a waterbody must be additionally equipped with, *at minimum*:

- a) One rope at least 15 metres long.
- b) Six metres of absorbent containment boom or water-buoyant socks.

12.3. A person carrying out fuelling, or replacing oil, or transferring fuel or oil from one container to another must be at

12. Fuel & Oil Storage & Handling

(sheet 2 of 2)

all times in a position to immediately shut off flow if necessary.

12.4. Hoses and fuel pumps shall be maintained to be free of leaks and in good working condition.

12.5. Unless specifically allowed by another permit or regulation and except where fuel is delivered by plane, boat, or barge, fuel may only be stored within 30 m of a waterbody during active drilling and no more fuel shall be stored within 30 m of a waterbody than the amount required to supply the drill and water pump for the drilling of the current hole.

12.6. When stored within an exploration area longer than one season, drums shall be stored on their sides with each drum rotated so that the bung is located in the 3 o'clock or 9 o'clock position.

12.7. Drums with significant damage such as denting, rusting, corrosion, expanded heads, and damaged rings shall be replaced as soon as possible.

12.8. All horizontal drums of heating fuel connected to a stove shall have positioned beneath the connection a drip tray lined with one or more absorbent pads, and the absorbent pads shall be changed before becoming saturated. This requirement does not apply if the horizontal drum is placed in a protective case that would contain any leakage from the connection.

12.9. Petroleum-contaminated water shall not be discharged or permitted to drain into the environment. Where drums are placed together in secondary containment (e.g., impermeable berms), some means shall be employed to remove petroleum from accumulated rain water and melt water before discharging the water into the surroundings. Using an excessive amount of absorbent pads is one option. Another option is to use a device designed to filter petroleum from water (e.g., RainDrain™). For advice on disposal of hydrocarbons or contaminated materials please contact Service NL.

12.10. All water pumps shall be underlain by effective secondary containment (e.g., a drip tray) lined with absorbent pads. Absorbent pads shall be changed before becoming saturated. Secondary containment where the containment rim is broken or otherwise ineffective must be replaced or placed within additional containment (e.g., a tarp-lined wooden tray) without delay.

RECOMMENDATIONS:

12.11. On any given site, empty fuel containers should be stored separately from non-empty containers so that easy estimates can be made of the amount of fuel stored on site.

12.2. Drums stored in an upright position should be stably raised on one side (e.g., by a 2 x 4 beneath that side) and the bung and vent located in the 3 o'clock and 9 o'clock positions so that water will drain off the top of the drum and not get pulled into the bung or vent.

13. Fuel & Oil Spills & Cleanup

(sheet 1 of 2)

BACKGROUND:

Storage of 5 or more drums requires a fuel cache approval from Service NL. Application forms can be obtained from the nearest Government Service Centre: <http://www.servicenl.gov.nl.ca/department/contact.html#locations>

The Requirements and Recommendations in this section shall apply except in situations where there is a disagreement with another piece of legislation or regulation, a policy of or set of instructions provided by the Department of Municipal Affairs and Environment, Service NL, or Fisheries and Oceans Canada, the terms and conditions of another government permit (e.g., fuel cache approval, water use licence / permit, exploration approval), or a work plan approval issued by the Nunatsiavut Government.

Nothing in this document shall be interpreted as precluding the timely reporting of spills to another government agency or any other party that may be required to be notified.

Nothing in these Requirements and Recommendations shall necessitate that the Operator or any person acting under their direction undertake an activity that would be considered unsafe under the circumstances. The Operator and persons acting under their direction shall continue to comply with the requirements and standards established by the *Occupational Health and Safety Act* and its associated Regulations. The Occupational Health and Safety Division of Service NL provides a document *Safety Guidelines for Mineral Exploration in Newfoundland and Labrador*, available at: <http://www.servicenl.gov.nl.ca/ohs/OHS%20Mineral%20Exploration%20Guide%202014.pdf>

REQUIREMENTS:

13.0. The Operator shall ensure that each person working with fuel or oil is fully informed of the following Requirements and Recommendations, as applicable.

13.1. **In the event of a spill or leak**, the Operator or the person(s) in control of the situation must make every effort to:

STEP 1: Prevent further spillage or leakage.

STEP 2: Contain the spill – above all, prevent the spill from entering a waterbody or watercourse.

ON LAND:

- Dig a trench to intercept the flow.
- Use absorbents, e.g., absorbent pads, snow, gravel, hay, straw, sawdust, moss.

ON WATER:

- Use fixed barriers spanning the water body, e.g., absorbent booms, floating hoses, floating rope, floating logs, fencing, rope, or wire with absorbents attached.

BENEATH ICE:

- Cut slots in the ice in the path of the spill.

STEP 3: Report the spill to the required parties and take additional steps as per the Requirements below.

13.2. All spills shall be reported to the Operator, and the Operator shall keep documentation of the spills reported to them or having otherwise come to their attention. The Operator's documentation shall record such details as date, time, location, cause, containment measures, cleanup measures, current situation, and plans for future measures (if any).

13. Fuel & Oil Spills & Cleanup

(sheet 2 of 2)

13.3. Spills into or having entered a waterbody or watercourse or with the potential to enter a waterbody or watercourse and spills greater than 70 litres or of an unknown or unrecoverable volume on land must be reported without delay by calling the 24-hour Emergency Spill Report line: (709) 772-2083 or 1-800-563-9089.

13.4. Petroleum spills shall be completely cleaned up without delay. Relatively small spills related to exploration are typically cleaned up in the following ways:

- a) For spills on land, including spills of hydraulic oil beneath a drill rig and spills of fuel alongside a water pump, excavate all contaminated materials (e.g., soil, vegetation) into empty drums or similar containers. Be sure to excavate deep enough to retrieve all of the contaminated soil.
- b) For spills on water, keep adding absorbent pads and remove them as they become saturated with petroleum. Place the contaminated absorbent pads in empty drums or similar containers.

13.5. Petroleum contaminated soil shall be disposed of at an approved waste disposal site provided that the quantity of soil is less than 150 tonnes or has a total petroleum hydrocarbon concentration of less than 1000 ppm. Contact the nearest Government Service Centre to find out the location of the nearest approved waste disposal site that will accept petroleum-contaminated soil. Quantities of soil exceeding 150 tons and having a total petroleum hydrocarbon concentration exceeding 1000 ppm require treatment at a licenced facility; in such a scenario, contact the Pollution Prevention Division of the Department of Municipal Affairs and Environment for further instructions.

13.6. Absorbent materials used to clean up a petroleum spill shall be disposed of at an approved landfill provided that the waste does not contain any free (i.e., liquid) product and the volume does not exceed the equivalent of two (205 L) barrels. For instructions on how to handle, transport, and dispose of quantities of petroleum-contaminated waste larger than two (205 L) barrels or on how to dispose of free (i.e., liquid) petroleum products, contact the Pollution Prevention Division of the Department of Municipal Affairs and Environment.

13.7. Spills shall be reported to the Mineral Lands Division. The preferred contacts for reporting spills to the Mineral Lands Division are the Mineral Exploration Site Inspector and Exploration Approvals Geologist.

INTRODUCTION:

This Appendix is for information purposes only and is supplementary to the sections containing Requirements and Recommendations. To clarify, this Appendix does not modify requirements set out in the main body of this document or elsewhere, but rather is intended as an information resource for the exploration industry on “best practices” for minimizing and controlling the effects of erosion and sedimentation.

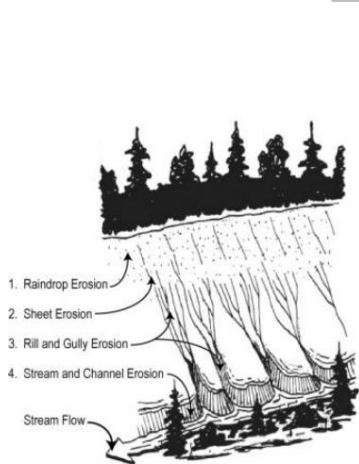
The priority locations to employ erosion and sediment control practices are near open waterbodies and watercourses, as required by Section 45(1)(b) of the *Mineral Regulations* under the *Mineral Act* and Section 9(3) of the *Water Resources Act*.

BACKGROUND:

Erosion is defined as the mechanical detachment of sediment (clay, silt, sand, or gravel) from its place or origin and subsequent transportation by moving water or wind. Since erosion by water is more typically the concern with respect to disturbed exploration sites, erosion by wind will not be addressed in this Appendix. Eroded material is carried either in suspension or bounced along the bottom by saltation. Where the moving water is forced to slow down, for example, by entering a pool or pond, energy is dissipated from the system and deposition of sediment occurs. Deposition rates vary greatly based on flow velocity, topography, and the size of the particles. For example, in a low-energy environment, coarse sand settles in a matter of seconds whereas clay-sized particles settle out over many days.

While erosion is a natural occurrence, disruption or removal of the protective ground cover consisting of topsoil and vegetation can produce an increase in erosion rates on the order of 10 to 20 times. The intensification of erosion caused by disruption or removal of the ground cover can result in a number of undesirable environmental impacts. Increases in turbidity of aquatic habitats decreases oxygen and light availability and causes decreased feeding rates and increased stress and respiration rates in fish, which can cause mortality in local populations. Deposition of sediment can partially or completely bury spawning beds and smother incubating eggs. Harmful substances such as oils and heavy metals can be attached to transported sediment and introduced into aquatic habitats.

Types of water erosion, increasing in intensity and effect, are described in Figure A1.



Types of Water Erosion	
Raindrop Splash Erosion	The impact of falling droplets of rain mechanically dislodges soil particles causing them to be carried away by runoff.
Sheet Erosion	Before concentrating into small channels. Raindrop splash and runoff moves as broad sheets over the land and removes layers of exposed soil.
Rill and Gully Erosion	As runoff concentrates in rivulets, it cuts grooves called rills. If the flow of water is sufficient, rills will develop into gullies.
Stream and Channel Erosion	Large volumes of fast-flowing water in unprotected channels will cause stream bank and stream bottom instability, scouring and removal of significant portions of the stream or channel banks and stream bottoms.

Figure A1. Types of water erosion. (source: Handbook for Mineral and Coal Exploration in British Columbia, 2008/9 edition).

In the context of exploration, disruption of the ground cover occurs inadvertently due to ATV and heavy equipment traffic and removal of the ground cover occurs deliberately by grubbing, stripping, and excavating to variously prepare access roads, drill sites, trench sites, laydown areas, or campsites.

EROSION CONTROL:

Exposed sediment is vulnerable to erosion. Erosion control aims to prevent erosion at the source by reducing the amount of sediment exposed. By contrast, sediment control is an “after-the-fact” approach which attempts to intercept sediment already having been eroded and now in transport. This section reviews methods of erosion control.

Preserving the natural ground vegetation cover is the primary means to prevent erosion as ground vegetation cover protects the soil from rain and wind, binds the soil with roots, and absorbs water. The most fundamental erosion control practice is to limit disturbance of ground vegetation to the minimum necessary to carry out the work. In order to accomplish this, careful planning and focused field supervision are necessary.

Where exploration activities require the removal of ground vegetation and topsoil – in this document referred to together as “**organic cover**” – the organic cover should be stockpiled so that once exploration work has been completed the organic cover can be re-spread back over the site without delay. If deeper excavations are taking place, it is important that the organic cover be stockpiled separately from deeper materials so that the organic cover remains accessible and does not get lost when backfilling deeper materials.

If the original organic cover is removed or rutted through, then the ground should be re-covered at the first opportunity. The following materials and methods are recommended, depending on the situation:

- **Corduroy or brush matting** (*recommended for areas or trails still in use*).
- **Scattered timbers, brush, roots, stumps** (*recommended for areas that do not need to be travelled over again*). For slopes, consideration should be given to orienting timbers parallel to contour so as to intercept and disperse flowing water rather than channeling it. Timbers may also be partially embedded in the ground to provide structure.
- **Scattered organic mulch such as hay, straw, woodchips, wood fiber, recycled paper fiber, or compost** (*recommended for areas that do not need to be travelled over again and where timbers and brush are unavailable or insufficient or to be applied beneath them*). Organic mulches will mould to the ground surface, are biodegradable, and generally promote vegetation growth. As with any ground covering used for erosion control, organic mulches should be inspected regularly to ensure continued effectiveness, especially after heavy rainfall events. Important considerations when selecting an organic mulch include the following:
 - Straw is preferred over hay as it does not attract animals and there is significantly less potential to introduce an invasive plants species. One bale (92 cm x 46 cm x 36 cm) covers an area of approximately 20 m².
 - Wood chips are highly resistant to wind and water however do not readily allow plants beneath them to grow up through. Applications of nitrogen fertilizer will assist decomposition and re-vegetation.
 - Wood fibers and recycled paper fibers may be applied hydraulically.

For ruts just starting to form, the ground should be covered without delay with corduroy and brush matting to prevent deepening of the ruts.

Before the end of the exploration season, deeply rutted or pock-marked ground should be physically restored to its approximate original position and then covered with organic materials. If an excavator is available, physical restoration should be carried out by the excavator “retreating” from the exploration area while restoring the ground in its wake.

Options for erosion control over large areas in particularly sensitive locations include rolled erosion control products and organic fiber rolls, described below.

Rolled erosion control products are temporary degradable or permanent non-degradable “blankets” of material held together with netting and functioning similarly to an organic mulch. These products are supplied in a roll and are applicable to both flat and sloping profiles, including stockpiles. Erosion control benefits from these products are immediate and can last for several months to several years, depending on the specific product and site conditions. Rolled erosion control products fall into two categories: temporary degradable, consisting of straw, natural fibers, or coir (shredded coconut husks), and long-term non-degradable, consisting of synthetic fibers, nets, or wire mesh.

In order to be effective, rolled erosion control products must be well fastened to the target surface by fasteners which vary in configuration depending on the proposed use and include U-shaped metal staples, circle top pins, biodegradable stakes, and wooden stakes. Below is a generalized set of instructions for installing a rolled erosion control product (RECP) on a slope:

Instructions for installing a rolled erosion control product (RECP) on a slope

- Select RECP, fasteners and plan a layout based on expected overland flow volumes, slope gradient, estimated timeframe of usage, local vegetation cover, and climate. Product should be installed perpendicular to contour, rolled downslope, parallel to flow. Assume that manufacturers installation instructions are minimum requirements under perfect conditions.
- Target surface should have soil and seeding methods applied and should be smooth for full contact with RECP.
- Excavate a 20 x 30 cm or greater trench along the length of the top of the slope, at a minimum of 1 metre back from the edge of slope (or at the crest of a double sided stockpile). Trench should be dug as parallel to contour as possible.
- With the roll resting on the upslope side of the trench, place the leading edge of RECP into the trench, fasten to the inside every 30 cm then backfill. Roll the product slowly over the trench, fastening into the backfilled trench every 30 cm along contour.
- Slowly walk the product down the slope making sure it conforms as best as possible to the surface (this will require two or more people). Do not let product roll out under its own weight; this would cause it to stretch and would result in minimal contact. Install fasteners every 30 cm along contour at every revolution of the roll.
- Never walk on the RECP during installation and never install perpendicular to slope.
- The product must terminate on a flat surface, no less than 1 metre past the end of the slope. At the slope bottom and the terminal end of the roll apply fasteners every 15 cm.
- If one roll of product cannot cover the entire target area, extra rolls can be similarly installed and over lapped a minimum of 10 cm along their lengths and fasteners installed in the seams at 15 cm spacing.
- Inspection of the RECP is required immediately to insure proper installation given expected water flow levels, slope gradient, timeframe of use, growth of vegetation, and climate, and regularly thereafter (suggest once a week as well as after high rain or wind events). Any damage or displacement of product must be repaired.
- Product is not intended to be removed.

Organic fiber rolls are tubular rolls of organic fibers enclosed in a biodegradable netting. The rolls are installed parallel to contour on large slopes to control erosion by creating grade-breaks for natural runoff. When new, organic fiber rolls can act as a “filter” for coarse sediment and also as an effective method of sediment control by collecting waterborne sediment along the upslope edge of the roll. The rolls are designed for short-term erosion control with a functional life of about one to two years in low runoff flow conditions. In high water flow conditions, the height of the roll can be compromised by water overflowing the roll or erosion undermining the roll. Below is a generalized set of instructions for installing an organic fiber roll:

Instructions for installing an organic fiber roll

- Select the appropriate fiber roll based on expected overland flow volumes, slope gradient, estimated timeframe of usage, local vegetation cover, and climate. Product should be installed parallel to contour, perpendicular to flow. Assume that manufacturers installation instructions are minimum requirements under perfect conditions. Diameters for fiber rolls should follow these general guidelines:

Diameter of Roll	Slope of Surface	Site Conditions		
		Low Erodibility and Runoff	Moderate Erodibility and Runoff	Intense Erodibility and Runoff
15 cm	< 4:1	✓	✓	
23 cm	4:1 - 2:1	✓	✓	
30 cm	> 2:1		✓	✓

- Spacing between fiber rolls is determined chiefly by the slope of the target surface with the following guidelines suggested: 3 m spacing for 1:1 slope, 6 m for 2:1 slope, 9 m for 3:1 slope. Rolls should be spaced closer again if substrate is highly erodible or if high runoff is expected.
- Smooth out topographic irregularities in the disturbed surface where rolls will be installed and remove any large debris.
- Starting at the bottom of the slope, excavate rounded trenches where the rolls will be installed. The width of the trench will be the same as the diameter of the roll, while the depth should be approximately 40% the diameter.
- Lay the fiber rolls into the trenches, avoiding overlaps. If additional lengths are needed, they should be adjoined end-to-end.
- Use wooden stakes to anchor the fiber roll into place. Stakes should be positioned at each terminal end of the roll and approximately every meter in between. Create a pilot hole first by driving a sharp metal bar through the center of the roll and into the ground underneath. Pilot holes and stakes should be driven down approximately 30 cm, perpendicular to slope rather than vertical.
- Backfill and compact the soil at the upslope edge of the roll, re-establishing the original topography (do not backfill to the height of the roll).
- Inspection of the organic fiber rolls is required immediately by the designer/implementer to insure proper installation given expected water flow levels, slope gradient, timeframe of use, growth of vegetation, and climate, and regularly there-after (suggest once a week as well as after large water flow events). Where erosion has undermined the rolls, the areas must be backfilled and the roll re-anchored.
- Product is not intended to be removed.

Erosion control on sections of access trail where the organic cover has been removed or rutted through, or on prepared access roads, can be assisted by the installation of **water bars**. Water bars, in the form timbers or scrap lumber, should be placed across access trails located on sloped ground (Figures A2, A3). Water bars may even be constructed by embedding a line of cobbles or elongate stones across the path. The bars should be placed oblique to the trail with the downslope end of the bar extending beyond the edge of the trail to divert water out of the trail. The bars should be partially embedded in the ground along their length. Water bars provide a measure of erosion control by reducing the quantity of water flowing down the surface by periodically diverting it and also by reducing the flow velocity of the water thereby reducing its erosive ability. The ability of water bars to function depends on the depth of ruts and the overall depth of the access trail: if the trail has become too rutted, it will be difficult to place water bars to check the flow of water through the ruts; if the trail surface has become significantly lower than the adjacent ground surfaces, it will be difficult to embed the bars in such a way to divert water out of the trail.

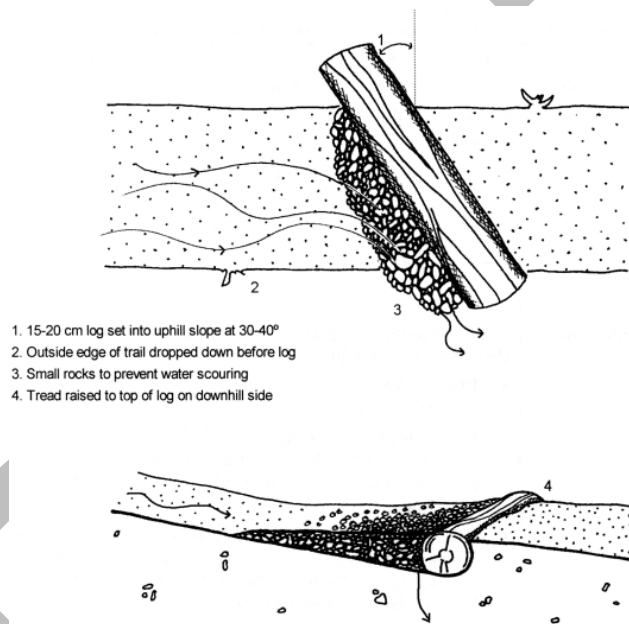


Figure A2. *Proper installation of water bars.* (source: British Columbia Ministry of Forests: Recreation Manual)

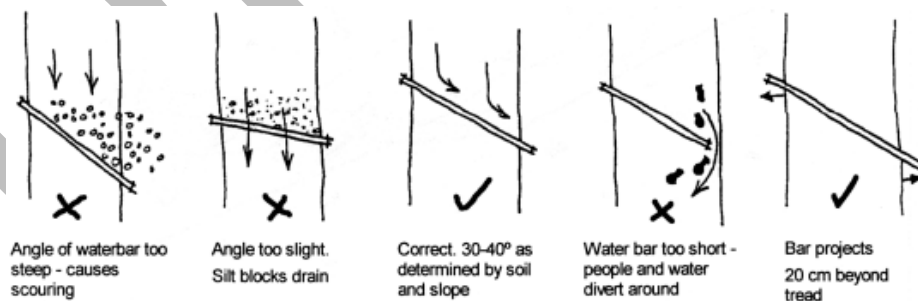


Figure A3. *Proper installation of water bars [upslope to top].* (source: British Columbia Ministry of Forests: Recreation Manual)

Re-vegetation is required for permanent erosion control. While re-vegetation will eventually occur naturally, the Department has documented many instances where mineral soil and till in the province, having become exposed in the course of mineral exploration, have remained largely barren of vegetation for periods of twenty years or more. For this reason, and for prompt erosion control, re-vegetation of exploration sites should be facilitated by one or more of the following practices: re-spreading the original organic cover (i.e., stockpiled topsoil and ground vegetation); scattering timbers, roots, stumps, and brush; applying an organic mulch (except for those such as wood chips that, unless applied thinly, may inhibit plant growth); and seeding, whether mechanically or hydraulically. Seeding is addressed below; the other practices are addressed above.

Note that replacing the original organic cover (i.e., topsoil and vegetation including remaining woody material) is more effective in re-vegetating disturbed ground than other methods.

Seeding functions as erosion control by binding the soil with roots and by slowing incoming rain and overland flow. Seeding is most effective when paired with the distribution of organic materials, whether organic cover, woody debris, or organic mulch. The distribution of organic materials will stabilize the soil before plants become established, provide shelter and microhabitats for sprouting seeds and young plants, and provide an organic base from which to grow and obtain nutrients.

The following seed mixture has been found effective for seeding alongside new highways in the province: annual rye grass, Canada blue grass, creeping red fescue (boreal), hard fescue, tall fescue, timothy grass, white clover, and birdsfoot trefoil. This mixture works well for slope stabilization. Annual rye grows very quickly, sending out fibrous roots to bind the soil, preventing rill erosion. Annual rye grass is short-lived, lasting only one growing season, and doesn't self-seed in the province's climate. Slower growing, self-seeding fescue, bluegrass, clover, and trefoil can then become established within the protection of the rye grass, becoming further established over the next few years in the stable soil left by the rye. Once vegetation is in place, the ground has been stabilized and native colonizers rapidly move in. Initial native colonizers include goldenrod, pearly everlasting, fireweed, raspberry, northeastern wild rose, and alder.

The development of plant cover by seeding is not guaranteed and is limited by many factors, including soil compaction, nutrient levels, acidity, drainage, climate, weather events, and time of year. Soils should be uncompacted and with an irregular surface to better hold seeds, promote run off infiltration, and provide microhabitats for growth. Fertilizer should be applied to provide nutrients where soils are lacking.

Perhaps the simplest seeding method is to harvest alder seeds by hand during late fall and let the wind blow the seeds across the surface to be covered. The seeds do not need fertilizing and are adapted to nutrient-deficient soils. Other seeds can also be spread by hand, however for systematic, even application seeds should be applied mechanically or hydraulically.

Mechanical seeding includes using a personal rotary seeder and ATV cyclone seeding. For most mineral exploration applications, hand-operated rotary seeders are recommended. They are cost effective and can seed areas at about a rate of one hectare an hour. Seed density and spreading rates can be easily calculated and controlled based on manufacturer's recommendations and fertilizer can be spread as well, although not at the same time due to density differences and mixing inconsistencies. ATV mounted cyclone spreaders distribute seeds in a very similar fashion, with the same advantages, but can cover much larger areas in shorter time, if required.

Hydraulic seeding uses water to deliver seed and fertilizers and when mulch is also delivered is referred to as **hydroseeding**. Hydraulic seeding is the most effective seeding method but still does not guarantee that the seeds will germinate and grow. Hydroseeding is the most expensive seeding technique and requires specialized equipment and good site access.

SEDIMENT CONTROL:

Sediment control measures are necessary where there is a risk that sediment, or waterborne drill cuttings, may enter an open waterbody or watercourse. In determining whether sediment control measures are necessary, consider that waterborne sediment or drill cuttings can travel long distances should they intercept topography that forms a channel (even if it is dry), and thereby potentially be carried into an open waterbody or watercourse located some distance away. Sediment control measures should be located at the base of slopes and as close to the source as possible. Common sources of sediment-laden water in the mineral exploration industry are: drill discharge waters (high flow), bedrock (e.g., trench bottom) cleaning discharge waters (high flow), as well as excavation, drill site, and stockpile runoff (low flow). Sediment control is intended to supplement effective erosion control and does not provide an effective replacement for erosion control. Sediment control methods include sediment fences, sediment retention ponds, and berms.

Sediment fences consist of permeable geotextile fabric anchored by posts into the ground for the purpose of collecting sediment (Figure A4), and are also known as silt screens, silt fences, and filter fences. Note, however, that filtration is only a secondary function of sediment fences and decreases rapidly with time as filtered particles clog the medium. Sediment fences function primarily by causing pooling of sediment-laden water thereby producing a low energy environment that allows waterborne sediment to settle out of the water column. If configured and installed correctly, sediment fencing is an effective method of sediment control. However, sediment fencing should only be used as a temporary measure and does not provide effective erosion control. If installed incorrectly sediment fencing may actually contribute to additional erosion, for instance, by water undercutting the fence. To ensure the effectiveness of sediment fencing, installed fencing must be regularly inspected and accumulated sediment removed. The life cycle of a sediment fence is estimated to be one year, and maintenance should include annual removal and replacement if the need for sediment control remains.

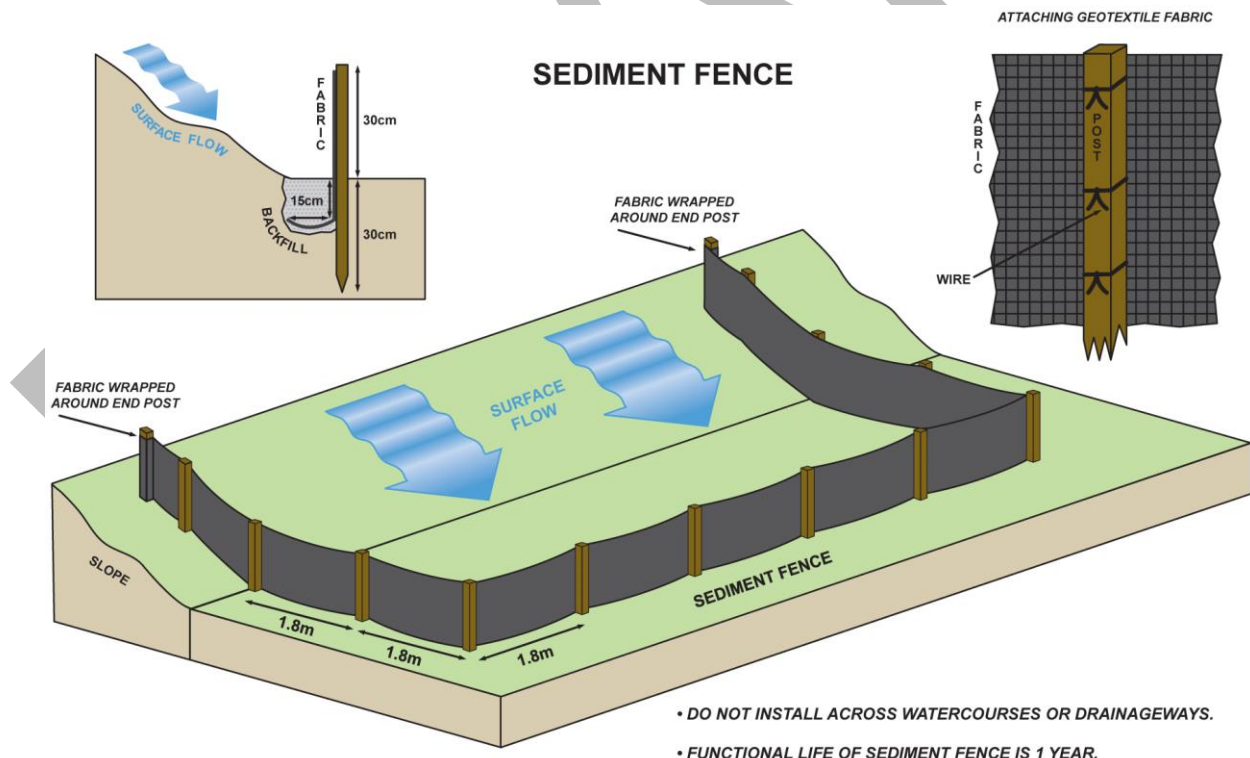


Figure A4. Sediment fence installation.

Below is a generalized set of instructions for installing and maintaining a sediment fence:

Instructions for installing and maintaining a sediment fence

Please refer to Figure A4 which illustrates key installation features of sediment fences.

- Plan the layout for the sediment fence based on expected overland flow volumes, slope gradient, estimated timeframe of usage, and vegetation cover. Assume that manufacturers installation instructions are minimum requirements under perfect conditions.
- Fabric should be pre-attached or attached on site to the posts before installation using wire fasteners that are twisted to tightness. Staples are inadequate fasteners.
- Fencing should be installed perpendicular to flow, along a consistent contour, and turned upslope or “winged” at each end in a direction parallel to flow. Turning the ends of the fence upslope is required to prevent water from flowing around it.
- Excavate a 15 x 15 cm or greater trench along the length of planned sediment fence. Do not use a V or U shaped trench, rather it should be dug with as square a profile as possible.
- Starting at one end, wrap the pre-attached fabric three times over the first post. Cut loose 15 cm of the fabric from the bottom where it is wrapped to create the “flap” of material that will lie across the bottom of the trench.
- Install fence posts starting with the post that will be at one of the terminal upslope ends. Posts should be positioned tight against the downslope wall of the trench, with the fabric side facing upslope. Sink posts in succession and pull fabric tight between them to avoiding sagging. Ensure posts are spaced closely enough and sunk deep enough to support the weight of water that might come to bear against them. Posts should be sunk to a minimum of 30 cm depth or half the length of the post – whichever is greater – and spaced a maximum of 1.8 m apart, with posts sunk deeper and spaced closer if higher water volumes are expected.
- Do not remove defective or damaged posts during install as this will create holes in the fabric and reduce effectiveness. Instead, cut off damaged posts at the level of the bottom of the fabric and install a replacement post immediately adjacent with wire fasteners.
- Wrap fabric three times around the final post and cut loose 15 cm of fabric from the bottom where it is wrapped to created the “flap” that will lie across the bottom of the trench.
- Backfill trench on the fabric side of the posts (i.e., from the upslope or upflow side) with all excavated material and compact as much as possible.
- The supervisor responsible for environmental compliance should inspect the fence immediately to insure proper installation given expected water flow levels, slope gradient, timeframe of use, and vegetation cover, and regularly thereafter (recommend every two weeks as well as after large water flow events). If sediment fence is functioning properly accumulation of sediment will take place inside the upslope side of the fence.
- To remain effective, sediment buildup must be removed once it reaches 20 cm thickness or half the height of the fence – whichever comes first – and disposed of at a location where it will not be significantly re-mobilized, for example, a well-vegetated area on flat, level ground.
- When removing sediment fence, cut fabric at base of fencing along the entire length and remove posts from one terminal end to the other. This will leave 30 cm of fabric buried but prevent further disturbance of soil where vegetation may have begun to take root.

Sediment retention ponds consist of earthen basins excavated to collect runoff waters (e.g., drilling discharge waters) and allow the settling and deposition of waterborne sediment. Sediment retention ponds function similarly to sediment fences in that they provide a low energy environment for sediment to settle out of the water column. Sediment retention ponds can hold water indefinitely and sediment will naturally filter out of the runoff as the water drains into the ground. Typically in the exploration industry a sediment retention pond is only required for a relatively short period of time and consists of a small, temporary hole dug with an excavator. Sediment retention ponds must be constructed large enough that they do not overflow during use, and depending on sediment load and duration of use, accumulated sediment may need to be removed on occasion. When a retention pond overflows it is no longer able to capture clays and finer silts and in such a scenario a flocculent product or filtration may be required. Sediment retention ponds must be inspected and maintained regularly (suggest weekly and after large water flow events).

For high runoff volumes, whether due to large drainage areas (e.g., a large trench) or high precipitation or discharge rates (e.g., drill discharge waters), excavated sediment retention ponds are most appropriate. Such ponds are commonly referred to in the exploration industry as **sump pits**. Sediment retention ponds may even take the form of a tapered ditch, for example, excavated at the downslope end a trench.

For low runoff volumes, sediment retention ponds may consist of a shallow basin created by earthen berms. Without the support of the surrounding ground as in the case of dug ponds, ponds constructed of berms could be prone to sudden failure accompanied by the release of captured sediment, which is why they not be used for high flow applications.

Sediment retention ponds are an easy, inexpensive, and effective way to control waterborne sediment.

When a sediment retention pond created by excavation (whether to dig a hole or obtain material for a berm) is no longer required, it must be rehabilitated as per the requirements for trenches and other excavations.

SPECIAL CASE - CHANNELIZED RUNOFF:

As illustrated in Figure A1, ongoing sheet erosion will eventually transition into rill and gully erosion which will eventually transition into stream and channel erosion. Channelized runoff can also occur as flow of water through rutted ground, particularly in boggy areas. Channelized runoff presents a unique challenge for erosion and sediment control and as such is considered a special case that is to be avoided if possible. Channelized runoff of significant volume or velocity cannot be contained by placing sediment fences or earthen berms across the channel because the water will inevitably (and possibly very quickly) flow around, over, or under the barrier. Where channelized erosive runoff occurs, the flow velocity should “checked” by some kind of permeable obstacle and the runoff diverted by channeling the water into a well vegetated or rocky dispersion / filtration zone.

Flow velocity may be decreased by check dams, which typically consist of gravel dams placed in ditches, however ditches and sources of clean gravel are not typical features of mineral exploration projects.

Bundles of timbers and brush placed longitudinally in a channel should have a similar effect as gravel check dams, especially when placed end to end. Bundles of timbers and brush have the added advantage that, where placed in access trail ruts, they can be driven over without inhibiting their function.

Channelized flow may be diverted by digging drainage channels to divert flow into well vegetated or rocky ground. Waterbars constructed with parallel lengths of lumber, or even timber, would similarly assist in diverting flow. Waterbars are embedded obliquely across the trail and extend into the surrounding, undisturbed ground (Figures A2 and A3).