6. GEOLOGY, TERRAIN AND SOILS

Physiography is the science of physical geography that encompasses the processes and features that make up the earth (Gabler et al. 2008). This section provides information on physiography existing in the geology, terrain and soils Local Study Area (LSA) including geology (bedrock geology [i.e., earth’s physical structure and substance]), terrain (surficial geology [i.e., the study of landforms and the unconsolidated sediments that lie beneath them], topography [i.e., arrangement of natural physical features] and hazardous slopes), and soils (pedology [i.e., the branch of science concerned with the formation, nature, ecology, and classification of soils]). Refer to Section 6.4.2 for the definition of the geology, terrain, and soils LSA.

This section describes and summarizes an assessment of the effects of the East-West Tie Transmission Project (the Project) on geology, terrain, and soils. The assessment follows the general approach and concepts described in Section 5. The main steps in the assessment include:

- considering input from Indigenous communities, government representatives and agencies, other communities, property owners, and people or groups interested in the Project during the ongoing consultation and engagement process refer to (Section 6.1);
- identifying information and data sources used in the assessment (refer to Section 6.2);
- identifying and rationale for selection of criteria for geology, terrain, and soils and the associated indicators (refer to Section 6.3);
- establishing temporal boundaries (i.e., construction and operation phases) and study areas (i.e., Project footprint and local study area) for the assessment of effects on these criteria (refer to Section 6.4);
- describing the existing environment (i.e., baseline characterization) and identifying environmentally sensitive features specific to each criterion (refer to Section 6.5);
- identifying potential Project-environment interactions (refer to Section 6.6);
- undertaking the net effects assessment (refer to Section 6.7):
  - identifying potential environmental effects;
  - identifying mitigation measures;
  - predicting the net effects; and
  - characterizing the net effects (i.e., after mitigation) of the Project on environmental criteria (Section 6.8);
- assessing the significance of the net effects (refer to Section 6.9);
- conducting a cumulative effects assessment of the net effects in combination with other past, present, or reasonably foreseeable developments (RFDs) and activities, and assessing significance, if applicable (refer to Section 6.10);
- determining the degree of certainty in the net effects prediction and associated assessment of significance (refer to Section 6.11); and
- identifying follow-up, inspection, and monitoring programs that will be completed during and after construction (refer to Section 6.12).
6.1 Input from Consultation and Engagement

Consultation and engagement for the Project considered Indigenous communities, regulatory agencies, property owners, interest holders, Crown interests and the general public. Consultation activities are described in Section 2 of the amended Environmental Assessment (EA) Report. The draft and final EA Reports were each subject to a public review and comment period. Comments received on the draft EA Report, responses and change log are provided in Appendix 1-III. Comments received on the final EA Report and responses are provided in Appendix 1-IV. The following concerns related to geology, terrain and soils were raised during consultation and engagement and from comments received on the draft and final EA Reports:

- Ministry of Environment and Climate Change (MOECC), Ministry of Natural Resources and Forestry (MNRF), and Métis Nation of Ontario (MNO) expressed concern that many responses to comments on the draft EA Report were provided in Appendix 1-III of the final EA Report and not integrated into the body of the final EA Report. Suggested changes acknowledged in responses to comments on the draft EA Report but not incorporated into the final EA Report have been incorporated into the amended EA Report where appropriate.

- MOECC, MNRF and Indigenous communities expressed concern with the pathway screening methodology employed in the draft and final EA Reports. The EA methods have been revised and feedback has been incorporated. The terms “effect pathway” and “assessment endpoint” were removed from the amended EA Report. This revision is reflected throughout this section of the amended EA Report.

- MOECC, MNRF and Indigenous communities expressed concerns about the use of the pathway screening method excluding some potential Project effects from being carried forward to the net effects assessment. All potential Project effects are considered in the net effects assessment and a net effects assessment table was added as Table 6-8 to this section.

- Pays Plat First Nation expressed concerns regarding the potential for erosion as a result of the Project. Concerns regarding soil erosion and soil loss as a result of Project construction were also raised during public consultation and engagement for the Project. The erosion concerns included sedimentation into water bodies and site and soil storage stabilization during and following construction. Soil textures and potential for erosion are discussed in the Geology, Terrain and Soils baseline report (refer to Appendix 6-I). The potential effects from, mitigation for and net effects of soil erosion are outlined in this section (refer to Section 6.7.3 and 6.7.4).

- MNRF expressed concerns regarding the instability of talus slopes. The baseline conditions of hazardous slopes are outlined in this section (refer to Section 6.5.2.2.3).

Specific responses to concerns expressed by Indigenous communities are also included in Section 2.2.5 of the amended EA Report and a detailed public and Indigenous consultation and engagement record is provided in Appendices 2-III and 2-IX, respectively.
6.2 Information Sources

Information for the characterization of geology, terrain, and soils baseline conditions and the assessment of Project effects was collected from a review of the following sources:

- baseline existing conditions reports for the Project (Dillon 2015, 2016);
- Geological Survey of Canada physiographic regions map (Bostock 2014);
- Digital Northern Ontario Engineering Geology Terrain Study (NOEGTS 2005);
- surficial geology, bedrock geology, topographic mapping, and available existing geological and hydrogeological reports (Ontario Geological Survey 2011; MNRF 2016);
- The Canadian System of Soil Classification (SCWG 1998);
- The Ecosystems of Ontario, Part 1: Ecozones and Ecoregions (Crins et al. 2009); and
- geotechnical investigations carried out for the Project.

For the purposes of the amended EA Report, sufficient information was available from the references listed above to assess the potential effects of the Project on geology, terrain, and soils.

6.3 Criteria and Indicators

Criteria are components of the environment that are considered to have economic, social, biological, conservation, aesthetic, or ethical value (refer to Section 5.1). Terrain and soils influence local and regional biodiversity, contributing to the abundance and distribution of plants and animals on the landscape and supporting forestry, agriculture, and other vegetation communities. Subsequently, these components of the physical environment are considered to be criteria because, if changed by Project activities, they could affect terrestrial and aquatic ecosystem structure and function (refer to Table 6-1). Changes to bedrock geology from Project activities are not expected to affect terrestrial or aquatic ecosystem structure, and therefore, geology has not been identified as a criterion and will not be considered in the effects assessment. The following criteria have been identified for terrain and soils:

- Terrain and soils: Terrain, or topographical relief, is the elevation, slope, and orientation of the land surface. Soil is a mixture of minerals and organic matter that is a medium for plant growth, water storage, and habitat for organisms. Soils are inherently heterogeneous across the landscape, and are therefore referred to in the plural.
Indicators represent attributes of the environment that can be used to characterize changes to criteria in a meaningful way. The indicators for terrain and soils criteria are defined as follows:

- **Terrain distribution:** refers to the amount or abundance and spatial configuration (distribution) of terrain units. This is measured qualitatively as a change in overall representation (abundance and distribution) of the terrain and soils criteria in the assessment area, and analyzed through visual examination of indicator mapping. Data on terrain (including surficial geology, topography and hazardous slopes) were collected from existing published literature and provincial mapping data and incorporated into a Geographic Information System (GIS) platform to be analyzed.

- **Soil quality:** refers to the physical, chemical, and biological characteristics of soil. This is measured qualitatively in terms of changes to soil quality. Soil quality is defined qualitatively by determining its potential for compaction, rutting, admixing as well as chemical influences from Project activities such as hazardous material spills and deposition of blasting residues.

- **Soil distribution:** refers to the amount or abundance and spatial configuration of soil. This is measured qualitatively as a change in overall representation (abundance and distribution) of the criterion in the assessment area, and analyzed through visual examination of indicator mapping. Soil distribution data were collected from existing published literature and provincial mapping data and incorporated into a GIS platform.

The criterion and indicators selected for the assessment of Project effects on terrain and soils, the measurement of potential effects for the indicators, data sources used, and the rationale for their selection, are provided in Table 6-1.
### Table 6-1: Terrain and Soils Criteria and Indicators

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Indicators</th>
<th>Measurement of Potential Effects</th>
<th>Data Source(s)</th>
<th>Rationale</th>
</tr>
</thead>
</table>
| Terrain and soils | Terrain distribution| Potential effects are measured qualitatively as a change in overall representation (abundance and distribution) of terrain units in the study areas. | Geological Survey of Canada physiographic regions map (Bostock 2014)  
Digital Northern Ontario Engineering Geology Terrain Study (NOEGTS 2005)  
Surficial geology, bedrock geology, topographic mapping, and available existing geological and hydrogeological reports (Ontario Geological Survey 2011; MNRF 2016)  
Proterozoic Geology of the Lake Superior Area (Sutcliffe 1991) | Related to ecosystem conservation, importance to ecosystem diversity, and interrelation with other criteria (e.g., ground and surface water) and identification of hazardous slopes |
| Soil quality       |                     | Potential effects are measured qualitatively in terms of changes to soil quality in the study areas. | The Canadian System of Soil Classification (SCWG 1998)  
Digital Northern Ontario Engineering Geology Terrain Study (NOEGTS 2005)  
The Ecosystems of Ontario, Part 1: Ecozones and Ecoregions (Crins et al. 2009) | Importance of soil productivity in maintaining agricultural and forest capability, and interrelation with other criteria (e.g., vegetation, fish, wildlife) |
| Soil distribution |                     | Potential effects are measured qualitatively as a change in overall representation (abundance and distribution) of soil in the study areas. | surficial geology, bedrock geology, topographic mapping, and available existing geological and hydrogeological reports (Ontario Geological Survey 2011; MNRF 2016)  
Digital Northern Ontario Engineering Geology Terrain Study (NOEGTS 2005) | Importance of soil abundance to maintain agricultural and forest capability, and interrelation with other criteria (e.g., vegetation, fish, wildlife) |
6.4 Assessment Boundaries

6.4.1 Temporal Boundaries
The Project is planned to occur during two phases (refer to Section 5.2.1):

- **construction phase:** the period from the start of construction to the start of operation (approximately two years); and
- **operation phase:** encompasses operation and maintenance activities throughout the life of the Project, which is anticipated to be indefinite.

The assessment of Project effects on terrain and soils considers changes that occur during the construction and operation phases. These periods are sufficient to capture the effects of the Project.

6.4.2 Study Areas
Study areas for the assessment are provided in Table 6-2 and shown in Figure 6-1.

**Table 6-2: Geology, Terrain and Soils Study Areas**

<table>
<thead>
<tr>
<th>Study Area</th>
<th>Area (ha)</th>
<th>Description</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project footprint</td>
<td>3,490</td>
<td>The Project footprint is the preferred route right-of-way (ROW), laydown yards, storage yards, construction camps, construction easements, and new access roads</td>
<td>Designed to capture the potential direct effects of the footprint of the Project</td>
</tr>
<tr>
<td>Geology, terrain, and soils LSA</td>
<td>100,069</td>
<td>Includes the Project footprint and extends approximately 1 km from the preferred route ROW boundary and approximately 500 m from the boundaries for laydown yards, storage yards, construction camps, construction easements, and new access roads</td>
<td>Designed to capture the potential direct effects of the footprint of the Project and immediate indirect effects (e.g., air emissions and fugitive dust that can change soil quality) on geology, terrain, and soils. The geology, terrain, and soils LSA intersects four ecoregions defined by the MNRF (i.e., Pigeon River [4W], Lake Nipigon [3W], Lake Abitibi [3E], and Lake Temagami [4E]) that include land uses such as mining, forestry, outdoor recreation, agricultural, and rural and urban developments (Crins et al. 2009) The geology, terrain, and soils LSA is considered large enough to encompass potential predicted changes in geology, terrain and soils, and no geology, terrain, and soils RSA is required.</td>
</tr>
</tbody>
</table>

ha = hectare; km = kilometre; LSA = Local Study Area; m = metre; MNRF = Ministry of Natural Resources and Forestry; RSA = Regional Study Area; ROW = right-of-way.
6.5 Description of the Existing Environment

This section provides a summary of the existing environment for geology, terrain, and soils based on review of desktop information.

6.5.1 Baseline Data Collection Methods

A desktop study was completed to identify the baseline conditions in the geology, terrain, and soils LSA. Available data sources were reviewed and relevant information assembled to provide overview descriptions of geology (bedrock geology), terrain (surficial geology, topography and hazardous slopes), and soil (pedology) attributes in the geology, terrain, and soils LSA. Information was collected from existing published literature and provincial mapping data and incorporated into a GIS platform. Baseline conditions are detailed in Appendix 6-I and summarized below.

6.5.2 Baseline Conditions

The geology, terrain, and soils LSA intersects seven ecodistricts located in the Lake Abitibi, Nipigon, Temagami, and Pigeon River ecoregions of the Ontario Shield Ecozone. Ecodistricts are subdivisions of the region that are based on patterns of relief, geology, geomorphology, and substrate parent material (Crins et al. 2009), and were used to divide the Project into distinct areas. Ecodistricts and their relative proportions in the geology, terrain, and soils LSA include Tip Top Mountain (27%), Schreiber (28%), Black Sturgeon (18%), Foleyet (15%), Savanne (6%), Kakabeka (6%), and Michipicoten (1%) (refer to Figure 6-II-3 in Appendix 6-II).

6.5.2.1 Geology

The Project is located in the Southern Craton and Superior Province (spatial entity with common geologic attributes) of Ontario (Ontario Geologic Survey 1991). The western portion of the Project crosses the Animikie Basin and the Nipigon Embayment of the Southern Craton. The Animikie Group of formations within the Animikie Basin is composed of Proterozoic metasedimentary and metavolcanic rocks and mafic intrusive rocks. The Nipigon Embayment group of formations is composed of volcanic and sedimentary rocks (refer to Figure 6-II-1 in Appendix 6-II). The central and eastern portions of the Project are located in the Wawa Sub-province. These geological units are represented by Archean tonalites to granite rocks, overlain by metavolcanic and metasedimentary rocks (Ontario Geological Survey 2000).

The geology, terrain, and soils LSA is largely underlain by granitic or gneissic bedrock, with intrusive areas of less acidic metavolcanic and metasedimentary rock and formations of basalt and other volcanic rocks (refer to Table 6-3). Greenstone, siltstone, and shale are also present in the geology, terrain, and soils LSA (Sutcliffe 1991).
Table 6-3: Dominant Bedrock Types in Each Ecodistrict in the Geology, Terrain and Soils Local Study Area

<table>
<thead>
<tr>
<th>Ecodistrict</th>
<th>Dominant Bedrock Types(a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tip Top Mountain</td>
<td>Gneissic, granite, and metavolcanic</td>
</tr>
<tr>
<td>Foleyet</td>
<td>Granite, metavolcanic</td>
</tr>
<tr>
<td>Savanne</td>
<td>Intrusive and granite</td>
</tr>
<tr>
<td>Black Sturgeon</td>
<td>Intrusive and metasedimentary</td>
</tr>
<tr>
<td>Schreiber</td>
<td>Alkaline intrusive, granite, and metavolcanic</td>
</tr>
<tr>
<td>Michipicoten</td>
<td>Granite</td>
</tr>
<tr>
<td>Kakabeka</td>
<td>Granite, metasedimentary, and intrusive</td>
</tr>
</tbody>
</table>

(a) Intrusive bedrock is typically made up of dikes and sills within other bedrock types. Metavolcanic bedrock typically basaltic and andesitic flows. Metasedimentary bedrock is typically, wacke, siltstone, arkose, argillite, slate, and mudstone. Gneissic and granite bedrock are massive to foliate.

6.5.2.2 Terrain

6.5.2.2.1 Surficial Geology

The surficial geology in the geology, terrain, and soils LSA is diverse. The dominant surficial material types include undifferentiated igneous and metamorphic bedrock, exposed at surface or covered by a discontinuous, thin layer of drift. Glaciolacustrine deposits are present on the west part of the geology, terrain, and soils LSA near Black Sturgeon River and fluvial deposits are scattered throughout the geology, terrain, and soils LSA where abandoned flood plains, terrace remnants or modern flood plains exist. Till is mostly present north from Pukaskwa National Park on the east side of the geology, terrain, and soils LSA where it is intermixed with glaciofluvial ice-contact deposits and gravel and sand beach glaciolacustrine deposits (Figure 6-II-2). More recent deposits such as organic deposits composed of peat, muck and marl, and fluvial deposits composed of gravel, sand, silt, and clay are also located along the proposed alignment (Barnett et al. 1991a,b). Overburden thickness across the alignment ranges from approximately 0 to 30.6 m. In summary, the surficial materials in the geology, terrain, and soils LSA are composed of 66% bedrock, 12% glaciofluvial, 11% glaciolacustrine, and an 11% mix of open water, till, organic, and fluvial (refer to Appendix 6-I for dominant surficial material composition of each ecodistrict).

6.5.2.2.2 Topography

The majority of the geology, terrain, and soils LSA is in the Port Arthur Hills and Abitibi Upland physiographic divisions of the James Region of the Precambrian Canadian Shield (Bostock 2014). The Abitibi Uplands form a rocky landscape scattered with lakes and large areas covered by deposits from glaciation, whereas the Port Arthur Hills around the City of Thunder Bay consist of ridges produced by folded sequences of diabase sills and sedimentary rocks (Thurston 1991).

The topography in the geology, terrain, and soils LSA has a variable relief with some areas (i.e., immediately west of the Municipality of Wawa) characterized by rough, broken topography with hills rising steeply from Lake Superior and along river valleys leading to the shore. These extremes in landforms and topography gradually become moderated inland from Lake Superior and east and northeast of the Municipality of Wawa. In these areas, rock outcrops become less prevalent and there is gently rolling to flat relief. The topography near the Township of Nipigon is most variable, typified by terrace-type formations extending north from Lake Superior to mountainous, steep-cliffed rock formations, bisected by river valleys and outwash plains (Thomson Environmental no date).

The topography ranges in elevation from approximately 190 to 560 metres above sea level and slopes typically vary between very gentle and strong (from 2% to 30%) in the geology, terrain, and soils LSA. The extent of steep slopes that can potentially be unstable (i.e., greater than 30%) varies between physiographic divisions. Slopes greater than 30% occur on approximately 3% (2,952 ha) of the geology, terrain, and soils LSA. Regional drainage patterns are complex and depend on local topography and landforms (Crins et al. 2009).
6.5.2.2.3 Hazardous Slopes

Bobrowsky and Dominguez (2012) suggest that for the most part, the area within the geology, terrain, and soils LSA traversed by the Project footprint has a low landslide susceptibility. However, the areas along or close to Lake Superior and the area between Lake Nipigon and Lake Superior have been mapped as having low, moderate and high susceptibility to landsliding. Bobrowsky and Dominguez (2012) state that more diligent studies and interpretation on a case by case basis is advised for detailed needs. No mapping or field investigations have been completed to support this assessment for the Project at this time.

Overlaying the Project footprint over the NOEGTS (2005) 1:100,000 scale mapping suggests that there is approximately 2.8 km of terrain crossed, occurring in six areas, that may exhibit evidence of slope instability (Appendix 6-I). These six areas occur in the preferred route ROW from approximately KP 74+865 to KP 120+745. This area is dominated mainly by undifferentiated igneous and metamorphic bedrock, exposed at the surface or covered by a discontinuous, thin layer of drift (Barnett et al. 1991a, 1991b). Glaciolacustrine deposits have been identified in the area near Helen Lake and Cameron Falls and on the west side of Black Sturgeon River; these latter three areas may be susceptible to landsliding should these materials occur on sloping topography.

Mapping by the Ontario Geological Survey (1991) suggests that the Project footprint will cross or run parallel to a number of faults. Most of these faults are found at and east of Black Sturgeon River north of Black Bay.

6.5.2.3 Soils

Substrates are generally poorly developed and varied in the geology, terrain, and soils LSA. Steep terrain yields rock outcrops with poor or no substrate development. Where rock is covered by a discontinuous layer of drift (fluvial and glaciofluvial), soils are usually dominated by podzols (humo-ferric podzols) and brunisols (dystric brunisols). In neutral to calcareous areas, fine-textured materials (glaciolacustrine) and luvisols (gray luvisols) dominate. Organic peats and gleysols are found in poorly drained sites and bedrock depressions (Crins et al. 2009). The dominant soil orders in the geology, terrain, and soils LSA are exposed bedrock, podzolic/brunisolic, and luvisols (refer to Table 6-4; Figure 6-II-4 in Appendix 6-II).

<table>
<thead>
<tr>
<th>Dominant Soil Order</th>
<th>Area (ha)</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Podzolic/Brunisolic</td>
<td>15,316</td>
<td>15</td>
</tr>
<tr>
<td>Luvisols</td>
<td>17,437</td>
<td>17</td>
</tr>
<tr>
<td>Organic/Gleysolic</td>
<td>555</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Exposed bedrock</td>
<td>66,181</td>
<td>66</td>
</tr>
<tr>
<td>Open water</td>
<td>580</td>
<td>&lt;1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100,069</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>


Note: Numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values. ha= hectare; % = percent.
Drainage ranges from rapidly drained bedrock through well-drained, coarse-textured soils to poorly and very poorly drained organic soils in lower slope positions. Coarse-textured fluvial and glaciofluvial soils commonly found in the geology, terrain, and soils LSA, with higher initial total porosity, are relatively resistant to compaction compared to finer textured soils found in other geographies (Carr et al. 1991). These soils are, however, prone to wind erosion. Sandy textured soils typically do not have a well-developed soil structure. The lack of soil structure is due to limited soil aggregation or adhesion of the soil particles and, therefore, does not form larger and more stable soil aggregates. Aggregated soil particles are less likely to be moved by wind. Soil erosion risk is a concern for disturbed soils because the sparse vegetation cover exposes soil materials to the elements (e.g., wind and water).

There is limited land with soil characteristics suitable for agriculture in the geology, terrain, and soils LSA (Hills and Morwick 1944). Agricultural practices are generally confined to areas with till or glaciolacustrine substrates and terraced or outwash plain topography. These areas include the Little Clay Belt in the Michipicoten Ecodistrict and areas with fine-grained deposits in the Kakabeka Ecodistrict. Soils and terrain with characteristics suitable for agriculture constitute less than 1% of the geology, terrain, and soils LSA (Crins et al. 2009). A substantial proportion of the substrates in the geology, terrain, and soils LSA exhibit a high to moderate ability to buffer the effects of acidic inputs (Crins et al. 2009).

6.5.2.4 Summary of Baseline Conditions

The following section summarizes the key findings of the baseline characterization of geology, terrain, and soils.

The geology, terrain, and soils LSA is largely underlain by granitic or gneissic bedrock, with intrusive areas of less acidic metavolcanic and metasedimentary rock and formations of basalt and other volcanic rocks. Glaciolacustrine deposits are present on the west part of the geology, terrain, and soils LSA near Black Sturgeon River and fluvial deposits are scattered throughout where abandoned flood plains, terrace remnants, or modern flood plains exist. Till is mostly present north from Pukaskwa National Park on the east side of the geology, terrain, and soils LSA, where it is intermixed with glaciofluvial ice-contact deposits and gravel and sand beach glaciolacustrine deposits. The topography has a variable relief with some areas characterized by rough, broken topography with hills rising steeply from Lake Superior and along river valleys leading to the shore. There is approximately 2.8 km of terrain crossed by the Project footprint that may exhibit evidence of slope instability.

Substrates are generally poorly developed and varied in the geology, terrain, and soils LSA. Steep terrain yields rock outcrops with poor or no substrate development. Where rock is covered by a discontinuous layer of drift, soils are usually dominated by podzols and brunisols. In neutral to calcareous areas, fine-textured materials dominate, and organic peats and gleysols are found in poorly drained sites and bedrock depressions.

6.6 Potential Project-Environment Interactions

Potential Project-environment interactions were identified through a review of the Project Description and existing environmental conditions. The linkages between Project components and activities and potential effects to terrain and soils are identified in Table 6-5.
Table 6-5: Project-Environment Interactions for Terrain and Soils

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Indicator</th>
<th>Project Phase</th>
<th>Description of Potential Project-Environment Interaction (Potential Effect)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Construction (includes access road and ROW preparation, installation, and reclamation activities)</td>
<td>Operation (includes operation and maintenance activities)</td>
</tr>
<tr>
<td>Terrain and soils</td>
<td>Terrain distribution</td>
<td>✓</td>
<td>Alteration to terrain from site clearing and preparation during Project construction can alter surface and ground water flows, increase slope instability and ecosystem diversity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓</td>
<td>Change to terrain (topography and surficial geology) from blasting can alter surface and ground water flows, increase slope instability, and change ecosystem diversity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Reduction in soil quality from compaction, rutting, and admixing can change the productivity of soil to maintain agricultural and forest capability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ ✓</td>
<td>Reduction in soil quality from chemical or hazardous material spills (e.g., petroleum products [i.e., materials derived from crude oil (petroleum) as it is processed in oil refineries], pesticides) on the Project footprint can change the productivity of soil to maintain agricultural and forest capability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓</td>
<td>Change to soil quality from blasting (e.g., ammonium nitrate) can change the productivity of soil to maintain agricultural and forest capability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓</td>
<td>Change to soil quality from chemical changes to the environment resulting from dust and air emissions and subsequent deposition can change the productivity of soil to maintain agricultural and forest capability</td>
</tr>
<tr>
<td>Soil quality</td>
<td></td>
<td></td>
<td>Change to soil distribution from erosion can reduce soil abundance and the ability to maintain agricultural and forest capability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓</td>
<td>Change to soil distribution from changes to hydrology (e.g., altered drainage patterns, drainage flows and surface water levels) can reduce soil abundance and ability to maintain agricultural and forest capability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓</td>
<td>Change to soil distribution from blasting can reduce soil abundance and the ability to maintain agricultural and forest capability</td>
</tr>
<tr>
<td>Soil distribution</td>
<td></td>
<td></td>
<td>Change to soil distribution from erosion can reduce soil abundance and the ability to maintain agricultural and forest capability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓</td>
<td>Change to soil distribution from changes to hydrology (e.g., altered drainage patterns, drainage flows and surface water levels) can reduce soil abundance and ability to maintain agricultural and forest capability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓</td>
<td>Change to soil distribution from blasting can reduce soil abundance and the ability to maintain agricultural and forest capability</td>
</tr>
</tbody>
</table>

ROW = right-of-way; ✓ = A potential Project-environment interaction could result in an environmental or socio-economic effect; _ = No plausible interaction was identified.
6.7 Potential Effects, Mitigation and Net Effects

This section presents the potential effects, appropriate mitigation measures, and predicted net Project effects for terrain, and soils.

6.7.1 Measurement of Potential Effects

6.7.1.1 Terrain Distribution

Potential effects to terrain distribution are measured qualitatively as a change in overall representation (abundance and distribution) of terrain units in the study areas. Changes to terrain distribution can affect ecosystem diversity by altering ground and surface water flows. The assessment takes into consideration the area of disturbance from Project activities, and the associated potential changes to slopes, topography and surficial geology in the study areas. The changes are measured by comparing baseline conditions with anticipated or predicted post-construction disturbance conditions of the environment in the Project study areas, through visual examinations of indicator mapping using a GIS. The potential effects include alteration to terrain from site clearing and preparation and blasting during project construction.

6.7.1.2 Soil Quality

Potential effects to soil quality are measured qualitatively in terms of changes to soil quality in the study areas. Changes to soil quality can alter the productivity of maintaining agricultural and forest capabilities. Potential changes to soil quality are measured by determining its potential for compaction, rutting, admixing (refer to Appendix 6-I) as well as chemical influences from Project activities such as hazardous material spills and deposition of blasting residues and air and dust emissions.

6.7.1.3 Soil Distribution

Potential effects to soil distribution are measured qualitatively as a change in overall representation (abundance and distribution) of soil in the study areas. Changes to soil distribution can alter the maintenance of soil to support agricultural and forest capabilities. The assessment takes into consideration the area of disturbance from Project activities, and the associated potential changes to soil erosion potential, changes to hydrology and increased sedimentation and soil loss from blasting in the study areas. The changes are measured by comparing baseline conditions with anticipated or predicted post-construction disturbance conditions of the environment in the Project study areas, through visual examinations of indicator mapping using a GIS.
6.7.2 Terrain Distribution

6.7.2.1 Change to Terrain (Topography and Surficial Geology) from Site Clearing and Preparation during Construction

6.7.2.1.1 Potential Effects

Grading during site clearing and preparation during Project construction involves removal of overburden and re-contouring of topography which will alter the local distribution of terrain (topography and surficial geology) from baseline conditions. Construction of the Project will involve establishing temporary laydown yards, storage yards, construction easements and construction camps, and the development of new, and upgrading of existing, permanent and temporary access roads and associated water crossings. Laydown yards are anticipated to be approximately 300 m by 300 m in size, and construction camps are anticipated to be approximately 400 m by 400 m in size. Access roads are expected to be approximately 8-m-wide with a 20-m-wide right-of-way (ROW), which allows for a 12-m-wide road easement. Water body banks will be re-contoured to allow for road crossings and maintained flow regimes. Storage yards (approximately 400 m by 400 m) are planned to be located at previously cleared or disturbed sites near the City of Thunder Bay, the Town of Marathon, and the Municipality Wawa, where possible. Approximately 3,490 ha (4% of the LSA) will be disturbed during construction, of which 95 ha will permanently change terrain distribution relative to baseline. This change in distribution was calculated from a comparison of baseline mapping to proposed post-construction mapping using a GIS.

Change to terrain is not anticipated during operation because grading, site clearing and preparation are not required following construction, and existing permanent access roads will be used during operation.

6.7.2.1.2 Mitigation

The potential for change in terrain is limited by using existing roads and trails, wherever feasible, to limit the amount of new roads and associated soil stripping and grading required. Grading will also be limited on areas prone to erosion or steep slopes. Temporary infrastructure not required during the operation phase, such as laydown yards, will be re-contoured after construction to return the site to the approximate preconstruction profile. For temporary Project components (e.g., ROW, temporary access roads), areas with changes in terrain will be regraded to conform to the local topography. Rollback or other bank stabilization methods will be installed at water body crossings when reconstructing water body banks to improve stability and reduce the potential and magnitude of effects on terrain. Terrain conditions will be assessed to monitor reclamation success and physical disturbances, which may cause slope instability. Mitigation measures are summarized in Table 6-6. The effectiveness of mitigation and reclamation will be evaluated during construction and post-construction, and measures will be modified or enhanced as necessary through adaptive management.

6.7.2.1.3 Net Effects

There is a predicted net effect of alteration to terrain distribution from permanent Project features (i.e., structure, permanent access roads and water body crossings) that persists into the operation phase even with the implementation of the mitigation measures described above (refer to Section 6.7.2.1.2) and in Table 6-6 relative to baseline conditions. This effect (decrease in terrain distribution (topography and surficial geology) from site clearing and preparation) is carried forward to the net effects characterization (refer to Section 6.8).
6.7.2.2 Change to Terrain (Topography and Surficial Geology) from Blasting During Construction

6.7.2.2.1 Potential Effects

Blasting in bedrock may be required to create level areas for concrete foundations and for new permanent access roads. Use of explosives during the Project construction has potential to change the distribution of terrain. Blasting can alter topography and slopes which can change surface and groundwater flows and increase slope instability. Approximately 2,810 ha (81% of the Project footprint) is characterized as having bedrock materials where blasting for Project infrastructure may occur but blasting may only be required at structure locations and permanent access roads where these bedrock materials occur.

Change to terrain is not anticipated during operation because blasting is not required following construction.

6.7.2.2.2 Mitigation

The use of explosives for foundation excavations and permanent access roads will be limited to the Project footprint. The limited use of blasting will reduce the potential and magnitude of the effects to terrain. The preferred method for foundation excavations and access roads will be 'ripping' where rock is encountered during construction. Additional or replacement backfill, if warranted, will be imported from approved locations to return blasting sites to the approximate preconstruction profile, to the extent practical. Some fractures created from blasting adjacent to Project infrastructure may be filled with grout. Blasting activities will be limited to areas where conditions that do not allow for typical or standard drilling methods. Blasting activities shall be carried out in accordance with Ontario Provincial Standard Specification 120 General Specification for the Use of Explosives and adhere to the mitigation outlined in the Blasting Management Plan (refer to Appendix 4-II, Section 8.3) to limit alteration of local terrain. Mitigation measures are summarized in Table 6-6. The effectiveness of mitigation and reclamation will be evaluated during construction and post-construction, and measures will be modified or enhanced as necessary through adaptive management.

6.7.2.2.3 Net Effects

There is a predicted net effect of alteration to terrain distribution from blasting at permanent Project features (i.e., structures and permanent access roads) that persists into the operation phase of the Project even with the implementation of the mitigation measures described above (refer to Section 6.7.2.2.2) and in Table 6-6 relative to baseline conditions. This effect (decrease in terrain distribution [topography and surficial geology] from blasting) is carried forward to the net effects characterization (refer to Section 6.8).

6.7.3 Soil Quality

6.7.3.1 Change to Soil Quality from Compaction, Rutting and Admixing

6.7.3.1.1 Potential Effects

Soil compaction, rutting, and admixing from construction activities can result in changes to soil quality. The definition of soil quality encompasses physical, chemical, and biological characteristics that are used to determine overall soil health (Ewing and Singer 2012). Stripping, admixing, and stockpiling upper soil materials can cause physical changes to soil such as disturbing soil structure. Loss of soil structure may result in a reduction in the amount of organic matter present in the soil and influence the bulk density, pore size distribution, and microbial community structure (Wick et al. 2009). However, by salvaging the upper soil horizons where possible, soil organic materials can be maintained, which is important for ecosystem resilience (Baldock and Broos 2012).
Soil compaction decreases soil quality and occurs primarily from heavy equipment or repeated passes of equipment across the soil surface. Soil compaction increases soil density and reduces soil porosity, influences drainage and structure, and alters soil strength, water content, and temperature (Corns 1988; Tuttle et al. 1988; Busse et al. 2006; Blouin et al. 2008). Areas most prone to compaction are low-lying, poorly drained areas with fine-textured soils.

Change to soil quality from compaction, rutting, and admixing is not anticipated during operation because soil stripping and stockpiling are not required and existing permanent access roads will be used during operation.

6.7.3.1.2 Mitigation

The risk of soil compaction, rutting and admixing is mitigated by choosing construction methods for the temporary access roads and temporary workspaces that avoid or minimize negative environmental effects. The risk of soil compaction, rutting and admixing is also reduced by using clearing equipment that minimizes surface disturbance, soil compaction and topsoil loss (e.g., equipment with low ground pressure tracks or tires, blade shoes and brush). If soils are excessively saturated, construction alternatives or suspending construction will be considered. Subsoils, temporary access trails and soils damaged during wet weather will be decompacted prior to reclamation. Soil quality issues such as compaction, rutting and admixing will be visually assessed throughout the Project footprint during construction. Mitigation measures are summarized in Table 6-6. The effectiveness of mitigation and reclamation will be evaluated during construction and post-construction, and measures will be modified or enhanced as necessary through adaptive management.

6.7.3.1.3 Net Effects

There is a predicted net effect to soil quality from the construction of permanent Project features (i.e., structures, permanent access roads and water body crossings) even with the implementation of the mitigation measures described above (refer to Section 6.7.3.1.2) and in Table 6-6 relative to baseline conditions. This effect (Decrease in soil quality from compaction, rutting and admixing) is carried forward to the net effects characterization (refer to Section 6.8).

6.7.3.2 Change to Soil Quality from Chemical or Hazardous Material Spills

6.7.3.2.1 Potential Effects

Spills from chemical or hazardous material (e.g., petroleum products, ammonium nitrate, pesticides) that occur in high enough concentrations could contaminate soils and cause adverse effects on aquatic organisms, soil organisms, and vegetation. Change to soil quality from chemical or hazardous material spills is possible during the construction and operation (maintenance) phases of the Project.

6.7.3.2.2 Mitigation

Adverse effects to soil quality from spills will be avoided or minimized by appropriate handling and transportation of chemicals, fuel, and hazardous materials, secondary containment of fuel tanks, inspection of equipment for leaks in accordance with the Clean Equipment Protocol for Industry (Halloran et al. 2013). In the unlikely event that a spill occurs, the severity of the spill will be minimized by having an adequate supply of spill prevention and emergency response equipment on site at all times, and implementation the Spill Prevention and Response Plan (refer to Appendix 4-II, Section 6.1; Appendix 4-III, Appendix C) will be adhered to if any spills occur. The Contractor will develop an Environmental Emergency Response Plan for review and approval by the Owner that describes response procedures to potential environmental incidents or emergencies (e.g., spills, fire, erosion, or sedimentation), clearly indicates responsibilities for communication and reporting, and provides contact names and details for individuals to be contacted in case of emergency. Mitigation measures are summarized in Table 6-6. The effectiveness of mitigation and reclamation will be evaluated during construction and post-construction, and measures will be modified or enhanced as necessary through adaptive management.
6.7.3.2.3 Net Effects
Transport and handling of hazardous materials will be carefully managed by NextBridge (refer to Section 4.2.9 for details about fueling areas). The implementation of the Construction Environmental Protection Plan (CEPP; refer to Appendix 4-II), Operation Environmental Management Plan (OEMP; refer to Appendix 4-III) and training of personnel in safe handling of chemicals and hazardous materials, are anticipated to minimize the frequency, spatial extent, and severity of spills. Spills in the Project footprint are anticipated to be unlikely and are not expected to result in measurable environmental changes, and were determined to have no net effect on soil quality with effective implementation of the mitigation described in Section 6.7.4.2, Table 6-6 and the CEPP (refer to Appendix 4-II) and OEMP (refer to Appendix 4-III). This potential effect (decrease in soil quality from chemical or hazardous material spills) is not carried forward to the net effects characterization.

6.7.3.3 Change to Soil Quality from Blasting

6.7.3.3.1 Potential Effects
Blasting of holes in bedrock may be required to create level areas for concrete foundations and for new permanent access roads. Use of explosives during the Project construction has potential to change the quality of soils. Ammonium nitrate explosives may be used and this type of explosive has the potential to leave nitrogen residual substances (e.g., ammonia nitrate) on the blasted material and fugitive dust on soils. Ammonia nitrate can change soil quality and reduce its productivity to maintain agricultural and forest capability. Change to soil quality from blasting is not anticipated during operation because blasting is not required and existing permanent access roads will be used during operation.

6.7.3.3.2 Mitigation
The use of explosives for foundation excavations will be limited in the Project footprint and used in situations where typical or standard drilling methods are not possible. Where rock is encountered, ripping will be the preferred method over blasting. The limited use of blasting will reduce the potential and magnitude of the effects to soil quality. Additional or replacement backfill, if warranted, will be imported from approved locations to return blasting sites to the approximate preconstruction profile, to the extent practical. Blasting activities will follow the Blasting Management Plan, which will also reduce potential and magnitude of the effects to soil quality. Mitigation measures are summarized in Table 6-6. The effectiveness of mitigation and reclamation will be evaluated during construction and post-construction, and measures will be modified or enhanced as necessary through adaptive management.

6.7.3.3.3 Net Effects
There is a predicted net effect from blasting residues expected to result in changes to soil quality relative to baseline conditions, even with effective implementation of the mitigation described in Section 6.7.3.4.2, Table 6-6. This effect (decrease in soil quality from blasting) is carried forward to the net effects characterization (refer to Section 6.8).

6.7.3.4 Change to Soil Quality from Dust and Air Emissions

6.7.3.4.1 Potential Effects
Change to soil quality from dust and air emissions is expected to occur primarily during the construction phase of the Project, and limited to vehicular emission sources during operation and maintenance activities. Therefore, effects were only assessed for the construction phase of the Project.

Construction would generate air emissions including sulphur dioxide (SO₂), nitrogen dioxide (NO₂), and other particulate matter such as fugitive dust. The use of fossil fuels in vehicles, construction equipment, generators, blasting, and travel along access roads would be the main sources of emissions (Farmer 1993; Harrison et al. 2003; Peachey et al. 2009; Liu et al. 2011).
The deposition of air and dust emissions can lead to changes in soil quality by altering soil pH and nutrient content and soil fauna composition, which can lead to alterations in rates of organic matter decomposition and nutrient cycling (Rusek and Marshall 2000; Jung et al. 2011). The related changes to soil from atmospheric inputs are determined by several complex geochemical factors, which include decomposition of vegetation, cation and anion exchange in soil, soil sensitivity to acidification, and duration and quantity of atmospheric inputs (Holowaychuk and Fessenden 1987; Turchenek et al. 1998; Jung et al. 2011). Ultimately, the concentration and duration of air and dust emissions and the sensitivity of the ecosystems determine the overall influence that emission deposition will have on soil quality (Bobbink et al. 1998).

The alteration of soil pH from deposition of SO\textsubscript{2} and NO\textsubscript{2} can cause acidification. However, the potential for acidification depends on the buffering capacity of the soil and the vegetation cover present in the receiving environment (Bobbink et al. 1998; Barton et al. 2002; Jung et al. 2011; Jung et al. 2013). Soils in the geology, terrain, and soils LSA are anticipated to have low to moderate sensitivity to acid deposition, based on their inferred characteristics and distribution (Holowaychuk and Fessenden 1987; Turchenek et al. 1998). In addition, the acidification potential of SO\textsubscript{2} and NO\textsubscript{2} can be counteracted by other cations and anions in dusts present in the emissions.

When SO\textsubscript{2} is oxidized, it can produce sulphate, which can be retained in soil solution, taken up by vegetation, adsorbed onto soil particles, or lost from soils through leaching (Jung et al. 2011). Sulphur transformations are affected by redox and pH interactions and are biologically mediated. Sulphate adsorption can counter the acidifying effects of sulphur deposition by delaying the loss of base cations through leaching (Jung et al. 2011). The ability of soils to adsorb sulphate depends on soil characteristics, including concentrations of aluminum and iron, mineralogical composition, pH, and the content and nature of organic matter (Alves and Lavorenti 2004; Jung et al. 2011). Soil pH is negatively correlated with sulphate adsorption because as pH decreases the number of positively charged soil particles increase (Jung et al. 2011).

Changes in the amount of nitrogen in an ecosystem can affect soil nutrient balance in a number of ways, including the amount of litter produced and the rates of ammonification (i.e., release of ammonia from the soil surface) and nitrification (i.e., conversion of ammonia to nitrate) (Grantz et al. 2003). When NO\textsubscript{2} is oxidized, it can produce nitrate, which typically is limited in nutrient-poor environments and can be taken up by vegetation. Biological uptake can reduce the effects of nitrogen deposition because nitrogen is retained in the plant biomass.

In addition to changes from the deposition of SO\textsubscript{2} and NO\textsubscript{2}, chemical changes can occur from the deposition of dust. Rates of dust deposition and accumulation are dependent on the rate of supply from the source, wind speed, precipitation events, topography, and vegetation cover (Rusek and Marshall 2000; Liu et al. 2011). Changes in soil quality depend on the chemical compositions of dust and its source (Grantz et al. 2003, Peachey et al. 2009). For example, cations such as calcium in dust emissions can reduce the acid-generating potential of the SO\textsubscript{2} and oxides of nitrogen (NO\textsubscript{x}) because they tend to react with bases (e.g., carbonates) found in dust (McNaughton et al. 2009).

Ambient air quality data were obtained from the City of Thunder Bay air quality monitoring station to determine baseline conditions. Concentrations of NO\textsubscript{x}, total suspended particulates (TSP, which includes fugitive dust) and particulate matter (e.g., PM\textsubscript{2.5}) were observed to be below the relevant ambient air quality criteria for all compounds and averaging periods assessed (refer to Section 9.5.2.5). For example, annual ambient concentrations of NO\textsubscript{x} and TSP were 14.8 µg/m\textsuperscript{3} (ECCC 2016) and 18.4 µg/m\textsuperscript{3}, respectively. Air quality criteria for annual NO\textsubscript{x} and TSP emissions are 60 µg/m\textsuperscript{3}, and 30 µg/m\textsuperscript{3} for SO\textsubscript{2} (CCME 1999). However, SO\textsubscript{2} is not measured at the City of Thunder Bay or at monitoring stations within 100 km of the Project. Given that the ambient concentrations of all other measured compounds are small, the background air quality concentration of SO\textsubscript{2} is also predicted to be small as there are no large industrial sources of SO\textsubscript{2} in the immediate vicinity of the Project (refer to Section 9.5).
Air and fugitive dust emissions will be highest during Project construction, and limited to vehicular emission sources during operation and maintenance activities. Therefore, the air quality assessment was restricted to emissions from construction activities, which included vehicles, equipment, and land clearing. A screening level assessment was completed for a 5 km segment of the preferred route (refer to Section 9). Maximum predicted concentrations of compounds assessed were highest closest to the Project footprint, decreased markedly with distance from the Project, and were below air quality criteria. For example, within 100 m of the Project footprint, the maximum annual SO\(_2\) concentration is predicted to be 0.07 µg/m\(^3\) but this decreased to 0.04 µg/m\(^3\) at 200 m from the preferred route centreline. Similarly, the annual concentration of NO\(_x\) is predicted to be 30.6 µg/m\(^3\) and 20.0 µg/m\(^3\) at 100 m and 200 m from the Project footprint, respectively. Annual TSP concentrations are predicted to be 18.3 µg/m\(^3\) at 100 m and 12.0 µg/m\(^3\) at 200 m from the Project. Importantly, these modelled annual concentrations represent conservative values (i.e., overestimate effects) as the construction period for a 5-km segment of the preferred route is much less than one year (refer to Section 9.6).

6.7.3.4.2 Mitigation
The risk of air and dust emissions and subsequent deposition causing chemical changes to the environment and affecting plant health will be minimized by implementation measures to control dust and other air emissions (e.g., wind erosion control, maintenance of vehicles and equipment, coordination of worker transportation, spray dust control solution that holds moisture for a long period of time minimizing the generation of fugitive dust and compliance with regulatory approvals and permits). Mitigation measures are summarized in Table 6-6. The effectiveness of mitigation and reclamation will be evaluated during construction and post-construction, and measures will be modified or enhanced as necessary through adaptive management.

6.7.3.4.3 Net Effects
There is a predicted net effect from air and dust emissions and subsequent deposition expected to result in changes to soil quality relative to baseline conditions, even with effective implementation of the mitigation described in Section 6.7.3.4.2, Table 6-6 and the CEPP (refer to Appendix 4-II). This effect (decrease in soil quality from dust and air emissions) is carried forward to the net effects characterization (refer to Section 6.8).

6.7.4 Soil Distribution

6.7.4.1 Change to Soil Distribution from Erosion
Soil erosion from construction activities can result in changes to soil distribution. Stripping and stockpiling upper soil materials can cause physical changes to soil such as disturbing soil structure. Loss of soil structure may result in a reduction in the amount of organic matter present in the soil and influence the bulk density, pore size distribution, microbial community structure, and resistance of soil to erosion (Wick et al. 2009). However, by salvaging the upper soil horizons where possible, soil organic materials can be maintained, which is important for ecosystem resilience (Baldock and Broos 2012).

Change to soil distribution from erosion is not anticipated during operation because soil stripping and stockpiling are not required and existing permanent access roads will be use during operation.

6.7.4.1.1 Mitigation
The potential risk of soil erosion is reduced by tackifying, covering, seeding, applying water or packing the topsoil stockpiles and windrows with approved equipment, for soils prone to wind erosion. Vegetation will be selectively cut, and clearing and grubbing restricted within areas with steep slopes or soils prone to risk of erosion. Erosion and sediment control devices such as sediment filters and fencing will be used in areas with soils that are prone to erosion, or near water bodies. Selective vegetation clearing and grading will be minimized in areas with steep slopes. A Soil Handling Contingency Plan and Erosion and Sedimentation Control Management Plan will be implemented during all construction activities involving soil handling. Soil issues such as erosion, will be visually
assessed throughout the Project footprint during construction and post-construction. Mitigation measures are summarized in Table 6-6. The effectiveness of mitigation and reclamation will be evaluated during construction and post-construction, and measures will be modified or enhanced as necessary through adaptive management.

6.7.4.1.2 Net Effects
The implementation of the CEPP (refer to Appendix 4-II), is anticipated to minimize loss and re-distribution of soil through erosion. Erosion in the LSA is not expected to result in measurable environmental changes, and was determined to have no net effect on soil distribution with the effective implementation described in Section 6.7.4.2, Table 6-6 and the CEPP (refer to Appendix 4-II). This effect (decrease in soil distribution from erosion) is not carried forward to the net effects characterization.

6.7.4.2 Change to Soil Distribution from Changes to Hydrology
6.7.4.2.1 Potential Effects
Change to drainage patterns and increases and decreases in drainage flows and surface water levels beyond the natural range of variation could lead to a change in the distribution of soils through increased erosion. Project activities are expected to not influence broad-scale drainage patterns. Some changes to localized soil moisture regimes (and erosion) adjacent to smaller drainages may occur during construction until vegetation cover is restored in the surrounding area (refer to Section 7). Approximately 3,490 ha (4% of the LSA) will be disturbed during construction, which may alter hydrology and lead to a change in soil distribution.

Change to soil distribution from change to hydrology is not anticipated during operation because erosion and sediment controls will be in place at water body crossings and disturbed areas will be regraded and re-contoured to approximate pre-construction conditions and restore drainage patterns.

6.7.4.2.2 Mitigation
Change in soil distribution through increased erosion from change to drainage patterns and increases and decreases in drainage flows and surface water levels will be reduced by implementation of mitigation related to water bodies and surface hydrology. Specifically, re-contouring disturbed areas to restore drainage patterns and regrading disturbed areas to maintain drainage patterns will reduce the potential for increases and/or decreases in drainage flows to result in soil erosion. Installation of culverts and construction of water body crossing structures in accordance with environmental approval conditions and best management practices will also reduce the potential for soil erosion as a result of change to drainage flows. A Soil Handling Contingency Plan (refer to Appendix 4-II, Section 7.2) and Erosion and Sedimentation Control Management Plan (refer to Appendix 4-II, Section 8.1) will be implemented during all construction activities involving soil handling. Soil issues such as erosion, will be visually assessed throughout the Project footprint during construction and post-construction. Mitigation measures are summarized in Table 6-6. The effectiveness of mitigation and reclamation will be evaluated during construction and post-construction, and measures will be modified or enhanced as necessary through adaptive management.

6.7.4.2.3 Net Effects
There is a predicted net effect on soil distribution from changes to hydrology when compared to baseline conditions, even after the implementation of the mitigation described above (refer to Section 6.7.4.2.2) and in Table 6-6. This effect (decrease in soil distribution from changes to hydrology) is carried forward to the net effects characterization (refer to Section 6.8).
6.7.4.3  Change to Soil Distribution from Blasting

6.7.4.3.1  Potential Effects

Blasting of holes in bedrock may be required to create level areas for concrete foundations and for new permanent access roads. Use of explosives during the Project construction has potential to change the distribution of soil. Blasting can alter soil distribution which can reduce soil abundance to maintain agricultural and forest capability.

Change to soil distribution from blasting is not anticipated during operation because blasting will not be required post-construction.

6.7.4.3.2  Mitigation

The use of explosives for foundation excavations will be limited in the Project footprint and used in situations where typical or standard drilling methods are not possible. Where rock is encountered, ripping will be the preferred method over blasting. The limited use of blasting will reduce the potential and magnitude of the effects to soil distribution. Additional or replacement backfill, if warranted, will be imported from approved locations to return blasting sites to the approximate preconstruction profile, to the extent practical. Blasting activities will follow the Blasting Management Plan, which will also reduce potential and magnitude of the effects to soil distribution. Mitigation measures are summarized in Table 6-6. The effectiveness of mitigation and reclamation will be evaluated during construction and post-construction, and measures will be modified or enhanced as necessary through adaptive management.

6.7.4.3.3  Net Effects

There is a predicted net effect from blasting expected to result in changes to soil distribution relative to baseline conditions, even with effective implementation of the mitigation described in Section 6.7.3.4.2 and Table 6-6. This effect (change to soil distribution from blasting) is carried forward to the net effects characterization (refer to Section 6.8).

6.7.5  Summary of Potential Effects, Mitigation and Net Effects

A summary of the potential effects assessment is provided in Table 6-6, which is based on assessment discussion and the implementation of mitigation measures identified above and further supplemented in the table below.
### Potential Effects, Mitigation, and Predicted Net Effects for Terrain and Soils

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Indicators</th>
<th>Project Component or Activity</th>
<th>Potential Effect</th>
<th>Mitigation</th>
<th>Inspection and Monitoring Details</th>
<th>Net Effect</th>
</tr>
</thead>
</table>
| Terrain and soils | Terrain distribution | Project activities during the construction phase, including: | Alteration to terrain from site clearing and preparation during Project construction can change surface and ground water flows, increase slope instability and ecosystem diversity | Construction Phase: **Terrain and Soil Mitigation:**  
- Use existing roads and trails as identified on the Access and Construction Environmental Maps and comply with conditions outlined in road use agreements.  
- Meet all applicable regulatory agencies prior to blasting and implosion operations.  
- Blasting will only be conducted after obtaining the required regulatory approvals and in accordance with the Blasting Management Plan.  
- Blasting operations will adhere to applicable regulations and guidelines for transportation, handling, storage and use of explosives:  
  - Natural Resources Canada’s permit under the Explosives Act (Government of Canada 1985) for the use, storage, or transportation of explosives;  
  - Ontario Ministry of Labour’s safety regulations per the Occupational Health and Safety Act (Government of Ontario 1999), including the filing of a notice of Project at least 30 days prior to the start of construction;  
  - NAV Canada’s Land Use Assessment Form per the Land Use Program for blasting operations;  
  - Local Municipalities’ Noise Bylaws;  
  - DFO’s Measures to Avoid Causing Harm to Fish and Fish Habitat Including Aquatic Species at Risk (DFO 2016); and.  
- Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (refer to Appendix H5; OPSS 182); and.  
- Use of explosives for foundation excavations and access roads will be limited to conditions that do not allow for typical or standard drilling methods.  
- The Contractor will develop a detailed Blasting Management Plan for review and approval by the Owner prior to blasting and implosion operation that describes specific measures that would be implemented if blasting is required. The plan will also include safety and exclusion zones, emergency and response procedures and contact information.  
- Blasting will not be conducted within 50 m of identified water wells.  
- To the extent practicable, blasting will not be conducted in areas of artisanal groundwater conditions.  
- Fractures created from blasting adjacent to the transmission foundation may be filled with grout.  
- Import additional or replacement backfill, if warranted, from approved locations. | **Construction Phase:**  
- The Owner will appoint qualified Environmental Inspector(s) to guide implementation, monitor and report on the effectiveness of the construction procedures and mitigation measures for minimizing potential impacts.  
- Post-construction environmental monitoring will be conducted after the completion of the construction activities and continue into the operation phase, and will include such activities as examining and documenting the success of mitigation measures. | Net effect – Decrease in terrain distribution (topography and surficial geology) from site clearing and preparation |

---

**Notes**:  
1. **CAUTION**: The above information should not be used to plan or implement blasting operations.  
2. **Environmental Inspector(s)** must ensure that blasting takes place in accordance with the project’s Blasting Management Plan.  
3. **Blasting** is only to be conducted by a licensed water well technician in accordance with the Wells Regulation (O Reg. 903). Where landowner permission is granted, the pre-blast survey will include completion of a well questionnaire to obtain details about the well and measurement of water levels.  
4. **The Environmental Inspector(s)** will monitor blasting operations.  
5. **The Owner** will appoint qualified Environmental Inspector(s) to guide implementation, monitor and report on the effectiveness of the construction procedures and mitigation measures for minimizing potential impacts.
### Table 6-6: Potential Effects, Mitigation, and Predicted Net Effects for Terrain and Soils

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Indicators</th>
<th>Project Component or Activity</th>
<th>Potential Effect</th>
<th>Mitigation</th>
<th>Inspection and Monitoring Details</th>
<th>Net Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrain and soils</td>
<td>Soil quality during the construction phase</td>
<td>Project activities including: site access development, temporary workspaces; deconstruction of temporary workspaces; decommissioning of temporary access roads and workspaces; and clean-up and reclamation.</td>
<td>Reduction in soil quality from compaction, rutting, and admixing can change the productivity of soil to maintain agricultural and forest capability.</td>
<td>Use appropriate equipment that minimizes surface disturbance, soil compaction and topsoil loss (e.g., equipment with low ground pressure tires, or wide pad tracks), when working in wet areas, under wet conditions, or during spring break-up.</td>
<td>Monitor the condition of the soils throughout construction and further assess whether topsoil is being subject to degradation that will eventually impact soil capability.</td>
<td>Net effect – Decrease in soil quality from compaction, rutting, and admixing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Construction Phase: Terrain and Soil Mitigation</td>
<td></td>
<td>Implement Terrain and Soil Mitigation listed in the potential effect for “Alteration to terrain from site clearing and preparation during Project construction can change surface and ground water flows, increase slope instability and ecosystem diversity” above. In addition, implement the following mitigation measures:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>When construction schedule allows, plan construction activities in wet areas during frozen conditions.</td>
<td></td>
<td>When working under frozen conditions, use probes or other techniques to assess that the frost is deep enough (i.e., below the depth of topsoil) to proceed without causing excessive soil rutting and compaction.</td>
<td>Complete clean-up and interim reclamation of the Project footprint under non-frozen conditions as soon as possible after decommissioning, when the project schedule allows.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Implement the Soil Handling Contingency Plan (refer to Appendix 4-II, Section 7.2) during topsoil stripping if one of the following are encountered:</td>
<td></td>
<td>Implement the Soil Handling Contingency Plan (refer to Appendix 4-II, Section 7.2) during topsoil stripping if one of the following are encountered:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>little or no topsoil; uneven boundary between topsoils and subsoils; poor colour separation between topsoils and subsoils;</td>
<td></td>
<td>little or no topsoil; uneven boundary between topsoils and subsoils; poor colour separation between topsoils and subsoils;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>rainy soils; wet conditions; and high winds; or</td>
<td></td>
<td>rainy soils; wet conditions; and high winds; or</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>requisites for alternate topsoil handling methods that the Owner has received from landowners.</td>
<td></td>
<td>requisites for alternate topsoil handling methods that the Owner has received from landowners.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use of Equipment Mitigation:</td>
<td></td>
<td>Use of Equipment Mitigation:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use low ground pressure equipment and prevent ground disturbance by using a protective layer such as frost packing, snow, ice or matting (refer to Appendix 4-II, Figure B-13) or biodegradable geotextile and clay ramps between wetland roadside bed and construction equipment.</td>
<td></td>
<td>Use low ground pressure equipment and prevent ground disturbance by using a protective layer such as frost packing, snow, ice or matting (refer to Appendix 4-II, Figure B-13) or biodegradable geotextile and clay ramps between wetland roadside bed and construction equipment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use equipment that minimizes surface disturbance, soil compaction and topsoil loss (e.g., equipment with low ground pressure tires, or wide pad tracks), when working in wet areas, under wet conditions, or during spring break-up.</td>
<td></td>
<td>Use equipment that minimizes surface disturbance, soil compaction and topsoil loss (e.g., equipment with low ground pressure tires, or wide pad tracks), when working in wet areas, under wet conditions, or during spring break-up.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use equipment that minimizes surface disturbance when brushing non-merchantable timber in areas where grading is not warranted.</td>
<td></td>
<td>Use equipment that minimizes surface disturbance when brushing non-merchantable timber in areas where grading is not warranted.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use appropriate equipment on decompacted subsoils to break up lumps and to smooth the surface.</td>
<td></td>
<td>Use appropriate equipment on decompacted subsoils to break up lumps and to smooth the surface.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Project personnel will avoid unnecessary wheel spin.</td>
<td></td>
<td>Project personnel will avoid unnecessary wheel spin.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Soil Salvage Mitigation:</td>
<td></td>
<td>Soil Salvage Mitigation:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Do not strip topsoil within wetlands.</td>
<td></td>
<td>Do not strip topsoil within wetlands.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>When the wetland organic layer is salvaged to accommodate for geotechnical investigations and transmission foundation construction, store the layer separately from upland soils for restoration.</td>
<td></td>
<td>When the wetland organic layer is salvaged to accommodate for geotechnical investigations and transmission foundation construction, store the layer separately from upland soils for restoration.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Apply geotextile, matting (refer to Appendix 4-II, Appendix B, Figure B-13) or fill material (e.g., gravel) as appropriate. Place a membrane (filter fabric) between fill material and soil to minimize admixing.</td>
<td></td>
<td>Apply geotextile, matting (refer to Appendix 4-II, Appendix B, Figure B-13) or fill material (e.g., gravel) as appropriate. Place a membrane (filter fabric) between fill material and soil to minimize admixing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strip topsoil within the Project footprint.</td>
<td></td>
<td>Strip topsoil within the Project footprint.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remove soil in lifts and strip available topsoil in one lift.</td>
<td></td>
<td>Remove soil in lifts and strip available topsoil in one lift.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>For construction scheduled to occur under frozen conditions, and where topsoil stripping is required, attempt to pre-strip topsoil prior to freeze-up, where conditions permit.</td>
<td></td>
<td>For construction scheduled to occur under frozen conditions, and where topsoil stripping is required, attempt to pre-strip topsoil prior to freeze-up, where conditions permit.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rip frozen topsoil to the same depth as the stripping requirements. Do not over rip and avoid overstripping.</td>
<td></td>
<td>Rip frozen topsoil to the same depth as the stripping requirements. Do not over rip and avoid overstripping.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strip the topsoil at burn locations to prevent sterilization of the soil.</td>
<td></td>
<td>Strip the topsoil at burn locations to prevent sterilization of the soil.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sufficient space (approximately 1 m) will be left between the topsoil and subsoil piles. If space is limited, separate stripped topsoil and excavated subsoil using a visible separation barrier (e.g., biodegradable filter cloth, geotextile fabric, snow).</td>
<td></td>
<td>Sufficient space (approximately 1 m) will be left between the topsoil and subsoil piles. If space is limited, separate stripped topsoil and excavated subsoil using a visible separation barrier (e.g., biodegradable filter cloth, geotextile fabric, snow).</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>If topsoil is being degraded, consider stripping topsoil as outlined below or implement the measures outlined in the Soil Handling Contingency Plan (refer to Appendix 4-II, Section 7.2).</td>
<td></td>
<td>If topsoil is being degraded, consider stripping topsoil as outlined below or implement the measures outlined in the Soil Handling Contingency Plan (refer to Appendix 4-II, Section 7.2).</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post-construction environmental monitoring will be conducted after the completion of the construction activities and continue into the operation phase, and will include such activities as examining and documenting the success of reclamation measures.</td>
<td></td>
<td>Post-construction environmental monitoring will be conducted after the completion of the construction activities and continue into the operation phase, and will include such activities as examining and documenting the success of reclamation measures.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 6-6: Potential Effects, Mitigation, and Predicted Net Effects for Terrain and Soils

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Indicators</th>
<th>Potential Component or Activity</th>
<th>Project activities during the construction phase, including:</th>
<th>Construction Phase: Spill Prevention Mitigation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrain and soils</td>
<td>Soil quality</td>
<td></td>
<td>site access development, site preparation and soil salvage (e.g., surveying and flagging, cleaning and grubbing, and transport (striping and grading);</td>
<td>Maintain equipment in good operating condition and inspect regularly for cleanliness, leaks, excess oil or grease. Identified problems or deficiencies shall be corrected in a timely manner.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>hauling of materials; domestic waste (solid and liquid) management; construction of temporary workspaces; and geotechnical investigations; foundation installation; conductor installation, including cable splicing; decommissioning of temporary access roads and workspaces; and clean-up and reclamation.</td>
<td>Employ the following measures to reduce the risk of fuel spills:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Project activities during the operation phase, including: maintenance of access roads, transmission line, and preferred ROW.</td>
<td>The Contractors will adhere to the Spill Prevention and Response Contingency Plan (refer to Appendix 4-II, Section 7.1) to prevent spills and/or release.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Maintain an adequate supply of spill prevention and emergency response equipment onsite at all times and train Project personnel on the use of this equipment. The risk for site-specific spills will be used to determine the appropriate type of response equipment and suitable location for storage. The Contractor will also provide a list of required stand-by equipment and required spill response container supplies to respond to large volume spills.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The Contractor will adhere to the Spill Prevention and Response Contingency Plan (refer to Appendix 4-II, Section 7.1) to prevent spills and/or release.</td>
</tr>
</tbody>
</table>

---

### Contaminated Soils Mitigation

- The Contractor will adhere to the Spill Prevention and Response Contingency Plan (refer to Appendix 4-II, Section 7.1) to prevent spills and/or release.

- Maintain an adequate supply of spill prevention and emergency response equipment onsite at all times and train Project personnel on the use of this equipment. The risk for site-specific spills will be used to determine the appropriate type of response equipment and suitable location for storage.

- The Contractor will also provide a list of required stand-by equipment and required spill response container supplies to respond to large volume spills.

### Operation Phase:

- NextBridge will oversee implementation of the environmental management measures described in the OEMP during operation and maintenance.

- NextBridge may inspect equipment and vehicles arriving on Project footprint prior to arriving at the job.

---

### Inspection and Monitoring Details

- The Owner or Environmental Inspector will visually assess the suspected material and surrounding area and determine the extent of potential contamination, if any.

- The Owner or the Environmental Inspector may inspect equipment and vehicle arriving on Project footprint prior to entry.

- The Owner will appoint qualified Environmental Inspector(s) to guide implementation, monitor and report on the effectiveness of the construction procedures and mitigation measures for minimizing potential impacts.

---

### Net Effect

- No net effect
Table 6-6: Potential Effects, Mitigation, and Predicted Net Effects for Terrain and Soils

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Indicators</th>
<th>Project Component or Activity</th>
<th>Potential Effect</th>
<th>Mitigation</th>
<th>Inspection and Monitoring Details</th>
<th>Net Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>The Owner will notify relevant federal and provincial regulatory authorities as required.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The Owner will develop a suitable course of action (e.g., excavate, stockpile, sample, remediate and/or contain and dispose) in consultation with the appropriate regulatory agencies, if necessary.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The Owner will identify local licensed landfill that would be able to receive soils if confirmed to be contaminated.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The Owner will prepare a contaminated soil and associated water notification report (refer to Appendix 4-II, Appendix E) and support from the Contractor may be required.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Segregate or separately store contaminated soils on a high-density polyethylene liner or equivalent (within a bermed area), at minimum 100 m away from permanent water features and on relatively flat surface. Label and/or install signs at the contaminated soils piles.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Protect contaminated soil piles from erosion by installing silt fence or using plastic tarps to cover the pile as necessary.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Spill Prevention Mitigation: Prior to construction of the Project, the Contractor will develop an Environmental Emergency Response Plan for review and approval by the Owner that describes response procedures to potential environmental incidents or emergencies (e.g., spills, fire, erosion or sedimentation), clearly indicates responsibilities for communication and reporting, and provides contact names and details for individuals to be contacted in case of emergency.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>In the event that any spills occur, implement the reporting measures provided in the Spill Prevention and Response Contingency Plan (refer to Appendix 4-II, Section 7.1).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Operation Phase: Spill Prevention Mitigation:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Implement the Spill Prevention Mitigation listed in the Construction Phase for the above.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Spills Mitigation:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>In the event that any spills occur, implement the reporting measures provided in the Spill Prevention and Response Contingency Plan (refer to Appendix 4-III, Appendix C).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Criteria</td>
<td>Project Component or Activity</td>
<td>Potential Effect</td>
<td>Mitigation</td>
<td>Inspection and Monitoring Details</td>
<td>Net Effect</td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>--------------------------------</td>
<td>------------------</td>
<td>------------</td>
<td>-----------------------------------</td>
<td>------------</td>
<td></td>
</tr>
<tr>
<td>Terrain and soils</td>
<td>Soil quality Change to soil quality from blasting (e.g. ammonium nitrate) can change the productivity of soil and the ability to maintain agricultural and forest capability</td>
<td>Construction Phase: Blasting Mitigation: Implement Blasting Mitigation listed in the potential effect for “Change to terrain (topography and surficial geology) from blasting can alter surface and ground water flows, increase slope instability and alter ecosystem diversity” above.</td>
<td>Construction Phase: Implement Inspection and Monitoring Details listed in the potential effect for “Change to terrain (topography and surficial geology) from blasting can alter surface and ground water flows, increase slope instability and alter ecosystem diversity” above.</td>
<td>Net effect - Decrease in soil quality from blasting residues</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Project activities during the construction phase, including: - site access development; - foundation installation; and - use of explosives.</td>
<td>Change to soil quality from chemical changes to the environment resulting from air and dust emissions and subsequent deposition can change the productivity of soil and the ability to maintain agricultural and forest capability</td>
<td>Construction Phase: Air Quality/Emission Mitigation: - Turn off vehicles and equipment when not in use and minimize idling, unless weather and/or safety conditions dictate the need for them to remain turned on and in a safe operating condition. - Noise abatement, emission and pollution control equipment on machinery should be in place, properly maintained and in good working order. - Keep equipment well-maintained. - Burning of slash will be in accordance with regulatory approvals and permits and subject to agreements with landowners, SFL holders (e.g., overlapping agreements). - Implement dust control measures (e.g., spray dust control solution that holds moisture for a long period of time causing dust to settle) as advised by the Environmental Inspector. - To minimize drifting soils and loss of topsoil in areas prone to wind or water erosion stabilize the disturbed area as soon as practicable by: spreading wood chips or straw crimping (weed-free straw); sowing a fast growing ground cover (e.g., cereal crop); - Installing erosion control blankets; or - walking down tree and shrub debris over exposed soils (rollback). - Suspend or postpone topsoil handling during high wind or wet conditions, where practicable. If it is not possible to suspend or postpone the construction activities, a site-specific Erosion and Sedimentation Control Plan will be implemented in consultation with the Owner. - Retain compatible vegetation (e.g., below 2 m in height) where practicable on areas prone to wind erosion, steep slopes, drainage ways or next to a water body. - Tackify, cover, seed, apply water or pack the topsoil stockpiles and windrows with approved equipment, if soils prone to wind erosion. - Use multi passenger vehicles to transport workers to site when practicable.</td>
<td>Net effect – Decrease in soil quality from dust and air emissions</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 6-6: Potential Effects, Mitigation, and Predicted Net Effects for Terrain and Soils

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Indicators</th>
<th>Project Component or Activity</th>
<th>Mitigation</th>
<th>Inspection and Monitoring Details</th>
<th>Net Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrain and soils</td>
<td>Soil distribution</td>
<td>Project activities during the construction phase, including:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- site access development; site preparation and soil salvage (e.g., surveying and flagging, cleaning and grubbing, and topsoil stripping and grading);</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- construction of temporary workspaces;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- surface water management and erosion control;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- decommissioning of temporary access roads and workspaces; and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- clean-up and reclamation.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Change to soil distribution from erosion can reduce soil</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Chocolate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- topsoil stripping and grubbing, and flagging, clearing (e.g., excessive rain, wet weather, or flood-like conditions), saturated soils, or during spring break-up, or where soils prone to erosion are present.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Maintain an adequate supply of erosion and sedimentation control materials on site prior to commencement of construction at site specific locations and or on the use of this equipment. Standard erosion and sedimentation control materials that may be kept on site include:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Erosion Control Mitigation:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Follow applicable measures from Ontario’s Provincial Standards for Temporary Erosion and Sediment Control Measures (refer to Appendix 4-II, Appendix H4: OPSS 805).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Implement Terrain and Soil Mitigation listed in the potential effect for “Alteration to terrain from site clearing and preparation during Project construction can change surface and ground water flows, increase slope instability and ecosystem diversity” above.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Implement Reclamation Mitigation listed in the potential effect for “Alteration to terrain from site clearing and preparation during Project construction can change surface and ground water flows, increase slope instability and ecosystem diversity” above. In addition, implement the following measures:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- On private lands, reclaim as per landowner specifications and base on the availability of seed at the time of reclamation.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- On federal land, provincial Crown land or municipal land, allow for natural regeneration or use certified native seed in consultation with appropriate Land Administrator. Natural recovery is the preferred method of reclamation on level terrain where erosion is not expected.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Seed areas prone to erosion with a native cover crop (e.g., cereal crop) and certified seed mix approved by the applicable regulatory agency as soon as feasible after construction.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Natural recovery is the preferred method of reclamation in wetlands.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Natural recovery is the preferred method of reclamation in wetlands.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Plant conifers when reclaiming laydown yards, construction camps, and storage yards located off of the transmission line ROW and in consultation with the landowner or communities and applicable regulatory authority.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 6-6: Potential Effects, Mitigation, and Predicted Net Effects for Terrain and Soils

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Indicators</th>
<th>Project Component or Activity</th>
<th>Potential Effect</th>
<th>Mitigation</th>
<th>Inspection and Monitoring Details</th>
<th>Net Effect</th>
</tr>
</thead>
</table>
| **Terrain and soils** | Soil distribution | Project activities during the construction phase, including:  
- site access development, site preparation and soil salvage (e.g., surveying and flagging, clearing and grubbing, and topsoil stripping and grading);  
- construction of temporary workspaces;  
- surface water management and erosion control;  
- decommissioning of temporary access roads and workspaces; and  
- clean up and reclamation. | Change to soil distribution from changes to hydrology (e.g., altered drainage patterns, drainage flows and surface water levels) can reduce soil abundance and the ability to maintain agricultural and forest capability | Construction Phase:  
Erosion Control Mitigation:  
- Implement Erosion and Sedimentation Control Mitigation listed in the potential effect for “Change to soil distribution from erosion can reduce soil abundance and the ability to maintain agricultural and forest capability” above.  
Water Body Crossing Mitigation:  
- Reduce grading near water bodies. Limit the width of grading to reduce the potential for erosion and subsoil compaction,  
- Limit disturbance to natural drainages during grading; avoid blocking drainages with graded material; install culverts if necessary;  
- Design new bridges to extend beyond the channel width to avoid erosion and damage to banks. Do not place fill within primary banks for bridge abutment construction, unless approved by the appropriate regulatory agencies (refer to Appendix 4-II, Figures B-7 and B-8). Bridge abutments with wings may require hauling in of fill material and placing geotextile fabric between the fill material and the surface layer.  
- Pump grey water (i.e., water that cannot be returned into a water body) onto stable, well vegetated areas, sheeting, rocks, sand bags, or into settling ponds, or other appropriate sediment filtering devices. Complete dewatering in a manner that does not cause erosion or allow sediment to re-enter a water body (at least 50 m away). Grey water should not flow directly into a water body.  
- Implement Reclamation Mitigation listed in the potential effect for “Change to soil distribution from erosion can reduce soil abundance and the ability to maintain agricultural and forest capability” above.  
Reclamation Mitigation:  
- Implement Reclamation Mitigation listed in the potential effect for “Change to soil distribution from erosion can reduce soil abundance and the ability to maintain agricultural and forest capability” above. In addition, implement the following measures:  
- Install rollback or other bank stabilization methods (e.g., live willow cuttings) at water crossings when reconstructing water body banks, as required or request by landowner, to improve stability and to re-establish cover and habitat for fish-bearing water bodies.  
- If replacement rock reinforcement/arming is required to stabilize eroding or exposed areas of the bank, appropriated sized clean rock will be used and installed at a similar slope, maintaining a uniform bank/shoreline and natural stream/shoreline alignment.  
- Revegetation of the riparian zone if necessary will consider DFO’s Measures to Avoid Causing Harm to Fish and Fish Habitat Including Aquatic Species at Risk (DFO 2016) and MNRF’s Environmental Guidelines for Access Roads and Water Crossings (refer to Appendix 4-II, Appendix H2; MNR 1990), and Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales (refer to Appendix 4-II, Appendix H3; MNR 2010a) and its associated Background Rationale document (MNRF 2010b).  
- If mulch (e.g., wood chips and slash debris) is available (i.e., leftover from Project construction), reseeded sites maybe covered with mulch to hold seeds in place until germination can occur.  
- Design new bridges to extend beyond the channel width to avoid erosion and damage to banks. Do not place fill within primary banks for bridge abutment construction, unless approved by the appropriate regulatory agencies (refer to Appendix 4-II, Figures B-7 and B-8). Bridge abutments with wings may require hauling in of fill material and placing geotextile fabric between the fill material and the surface layer.  
- If replacement rock reinforcement/arming is required to stabilize eroding or exposed areas of the bank, appropriated sized clean rock will be used and installed at a similar slope, maintaining a uniform bank/shoreline and natural stream/shoreline alignment.  
- Revegetation of the riparian zone if necessary will consider DFO’s Measures to Avoid Causing Harm to Fish and Fish Habitat Including Aquatic Species at Risk (DFO 2016) and MNRF’s Environmental Guidelines for Access Roads and Water Crossings (refer to Appendix 4-II, Appendix H2; MNR 1990), and Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales (refer to Appendix 4-II, Appendix H3; MNR 2010a) and its associated Background Rationale document (MNRF 2010b).  
- If mulch (e.g., wood chips and slash debris) is available (i.e., leftover from Project construction), reseeded sites maybe covered with mulch to hold seeds in place until germination can occur. | Construction Phase:  
Blasting Mitigation:  
- Implement Blasting Mitigation listed in the potential effect for “Change to terrain (topography and surficial geology) from blasting can alter surface and ground water flows, increase slope instability and alter ecosystem diversity” above.  
Construction Mitigation:  
- Implement Reclamation Mitigation listed in the potential effect for “Change to soil distribution from erosion can reduce soil abundance and the ability to maintain agricultural and forest capability” above.  
Reclamation Mitigation:  
- Implement Reclamation Mitigation listed in the potential effect for “Change to soil distribution from erosion can reduce soil abundance and the ability to maintain agricultural and forest capability” above. In addition, implement the following measures:  
- If mulch (e.g., wood chips and slash debris) is available (i.e., leftover from Project construction), reseeded sites maybe covered with mulch to hold seeds in place until germination can occur. | Construction Phase:  
- The Owner will appoint qualified Environmental Inspector(s) to guide implementation, monitor and report on the effectiveness of the construction procedures and mitigation measures for minimizing potential impacts.  
- Monitor the condition of the soils throughout construction and further assess whether topsoil is being subject to degradation that will eventually impact soil capability.  
- Post-construction environmental monitoring will be conducted after the completion of the construction activities and continue into the operation phase, and will include such activities as examining and documenting the success of reclamation measures. | **Net effect** - Decrease in soil distribution from changes to hydrology |

| Terrain and soils | Soil distribution | Project activities during the construction phase, including:  
- site access development;  
- foundation installation; and  
- use of explosives. | Change to soil distribution from blasting can reduce soil abundance to maintain agricultural and forest capability | Construction Phase:  
Blasting Mitigation:  
- Implement Blasting Mitigation listed in the potential effect for “Change to terrain (topography and surficial geology) from blasting can alter surface and ground water flows, increase slope instability and alter ecosystem diversity” above.  
Construction Mitigation:  
- Implement Reclamation Mitigation listed in the potential effect for “Change to soil distribution from erosion can reduce soil abundance and the ability to maintain agricultural and forest capability” above.  
Reclamation Mitigation:  
- Implement Reclamation Mitigation listed in the potential effect for “Change to soil distribution from erosion can reduce soil abundance and the ability to maintain agricultural and forest capability” above. In addition, implement the following measures:  
- If mulch (e.g., wood chips and slash debris) is available (i.e., leftover from Project construction), reseeded sites maybe covered with mulch to hold seeds in place until germination can occur. | Construction Phase:  
- Implement inspection and Monitoring Details listed in the potential effect for “Change to terrain (topography and surficial geology) from blasting can alter surface and ground water flows, increase slope instability and alter ecosystem diversity” above. | **Net effect** – Decrease in soil distribution from blasting |

DFO = Fisheries and Oceans Canada; m = metres; OEMP = Operation Environmental Management Plan.
6.8 Net Effects Characterization

6.8.1 Approach

The effects assessment approach followed the general process described in Section 5.5 (methods section). Potential effects with no predicted net effect after implementation of mitigation identified in Table 6-6 are not carried forward to the net effects characterization. Net effects are described using the factors of significance identified in Section 5.5.4 (refer to Table 5-5). Effects levels are defined for the magnitude of the factors of significance for terrain, and soils in Table 6-7.

Table 6-7: Magnitude Effect Levels for Terrain, and Soils

<table>
<thead>
<tr>
<th>Indicator / Net Effect</th>
<th>Magnitude Level Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>A small change that is expected to be within the range of baseline or guideline values</td>
<td></td>
</tr>
<tr>
<td>A change (discernable) that is expected to be at or slightly exceed the limits of baseline or guideline values</td>
<td></td>
</tr>
<tr>
<td>A discernable effect that is potentially detrimental but manageable – does not represent a management concern(a)</td>
<td></td>
</tr>
<tr>
<td>A discernable effect that is substantially detrimental – the effect can pose a serious risk and represents a management concern(a)</td>
<td></td>
</tr>
</tbody>
</table>

(a) An effect that poses a management concern may require actions such as research, monitoring or recovery initiatives.

6.8.2 Results

Net effects are described after the implementation of effective mitigation, and summarized according to direction, magnitude, geographic extent, duration/irreversibility, frequency/timing, and likelihood of the effect occurring following the methods described in Section 5.5.4. Effective implementation of mitigation summarized in Table 6-6, Section 6.7, the CEPP (refer to Appendix 4-II), and OEMP (refer to Appendix 4-III) is expected to reduce the magnitude and duration of net effects on terrain, and soils.

6.8.2.1 Terrain Distribution

6.8.2.1.1 Decrease in Terrain Distribution (Topography and Surficial Geology) from Site Clearing and Preparation

Post-construction monitoring will be used to determine the success of reclamation activities, and provide feedback for additional mitigation, if necessary. As a result, much of the disturbance to terrain is anticipated to be reversible within three to five years following the end of construction.

In contrast, changes to terrain from permanent Project features (i.e., structures, permanent access roads and water body crossings) are irreversible during operation of the Project. However, the mitigation measures implemented during the construction of these features are anticipated to result in negligible and localized changes to these physical criteria relative to baseline conditions. Therefore, this net effect was determined to be a direct effect (i.e., as a result of a Project component or activity affecting terrain rather than affecting another criterion that indirectly affects terrain). Approximately 95 ha (<1% of the LSA) will have permanent Project infrastructure.

The magnitude of the effect was determined to be negligible, a small change within the range of baseline values because reclamation activities, re-contouring and regrading affected sites will return the ROW and temporary access roads, laydown yards to the approximate preconstruction profile. Permanent changes at structures and permanent access roads are small in comparison to the areas in temporary Project components (e.g., ROW, temporary access roads) reclaimed after construction. The net effect is confined to the Project footprint and was considered to be long-term but reversible for the ROW and temporary Project components and permanent and...
irreversible for the structures and permanent access roads (including water body crossings). The net effect was predicted to be frequent and probable (refer to Table 6-8).

### 6.8.2.1.2 Decrease in Terrain Distribution (Topography and Surficial Geology) from Blasting

Post-construction monitoring will be used to determine the success of reclamation activities, and provide feedback for additional mitigation, if necessary. As a result, much of the disturbance to terrain is anticipated to be reversible within three to five years following the end of construction.

In contrast, changes to terrain from permanent Project features (i.e., structures, permanent access roads and water body crossings) are irreversible during operation. However, the mitigation measures implemented during the construction of these features are anticipated to result in negligible and localized changes to these physical criteria relative to baseline conditions. Therefore, this net effect was determined to be a direct effect (i.e., as a result of a Project component or activity affecting terrain rather than affecting another criterion that indirectly affects terrain). Approximately 95 ha (<1% of the LSA) will have permanent Project features, and of this area, only 73 ha is located on areas which may require blasting activities. Implementing mitigation will reduce this area even further.

The magnitude of the effect was determined to be negligible, a small change within the range of baseline values because reclamation activities, recontouring and regrading affected sites are expected to return the ROW and temporary workspaces to the approximate preconstruction profile. Permanent changes at structures and permanent access roads are small in comparison to the areas in temporary Project components (e.g., ROW, temporary access roads) reclaimed after construction. The net effect was considered to be confined to the Project footprint. The net effect was considered to be long-term but reversible for the ROW and temporary Project components and permanent and irreversible for the structures and permanent access roads. The net effect was predicted to be frequent and probable (refer to Table 6-8).

### 6.8.2.2 Soil Quality

#### 6.8.2.2.1 Decrease in Soil Quality from Compaction, Rutting, and Admixing

Post-construction monitoring will be used to determine the success of mitigation and reclamation activities, and provide feedback for additional mitigation, if necessary. As a result, much of the disturbance to soil quality from compaction, rutting, and admixing is anticipated to be reversible within three to five years following the end of construction. In contrast, changes from permanent Project features (i.e., structures, permanent access roads and water body crossings) are irreversible during operation of the Project. However, the mitigation measures implemented during the construction of these features are anticipated to result in negligible and localized changes to these physical criteria relative to baseline conditions. Therefore, this net effect was determined to be a direct effect.

The magnitude of the effect was assessed as negligible because the implementation of mitigation measures described in Section 6.6.3.2 will reduce the risk of soil compaction, rutting, admixing and erosion and the overall extent of affected areas. The net effect was considered to be confined to the Project footprint and to be long-term and reversible. The net effect was predicted to be infrequent and possible (refer to Table 6-8).
6.8.2.2 Decrease in Soil Quality from Blasting

The use of explosives will be limited to Project construction and to specific geological conditions that do not allow for an alternative method of removing material for the anchoring of structures or construction of new permanent access roads. Overall, blasting effects were characterized as negligible, infrequent, and confined to the Project footprint. The net effect was considered to be direct and was assessed as negligible in magnitude and permanent and irreversible where material removed from blasting cannot be returned to approximate the preconstruction profile (e.g., blasting sites along permanent roads and structures). The net effect was predicted to be infrequent and possible (refer to Table 6-8).

6.8.2.3 Decrease in Soil Quality from Dust and Air Emissions

Overall, air and dust emissions and subsequent deposition are expected to result in small and local changes to soil quality relative to baseline conditions with effective implementation of the mitigation described in Section 6.6.3, Table 6-6 and the CEPP (refer to Appendix 4-II). Therefore, this net effect was assessed as negligible in magnitude. The net effect was considered to be indirect and to primarily occur in the Project footprint but may extend into the LSA. The net effect was predicted to be short-term but reversible, frequent and possible (refer to Table 6-8).

6.8.2.3 Soil Distribution

6.8.2.3.1 Decrease in Soil Distribution from Changes to Hydrology

Overall, small and local changes to soil distribution from changes to hydrology are predicted relative to the baseline conditions with effective implementation of the mitigation described in Section 6.6.3, Table 6-6 and the CEPP (refer to Appendix 4-II). This net effect was characterized as indirect (i.e., as a result of a change to one criterion affecting soil quantity and distribution).

The magnitude of the effect was assessed as negligible, a small change within baseline values, and to occur primarily in the Project footprint but may extend into the LSA. The net effect was assessed as long-term, infrequent and possible (refer to Table 6-8).

6.8.2.3.2 Decrease in Soil Distribution from Blasting

The use of explosives will be limited to Project construction and to specific geological conditions that do not allow for an alternative method of removing material for the anchoring of structures or construction of new permanent access roads. Overall, blasting effects were characterized as negligible, infrequent, and localized to the Project footprint. The net effect was characterized as direct and was assessed as negligible in magnitude and permanent and irreversible where material removed from blasting cannot be returned to approximate the preconstruction profile (e.g., blasting sites along permanent roads and structures). The net effect was predicted to be infrequent and possible (refer to Table 6-8).

6.8.3 Summary of Net Effects Characterization

A summary of the characterization of net effects of the Project on terrain, and soil is provided in Table 6-8.
Table 6-8: Characterization of Predicted Net Effects for Terrain and Soils

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Indicators</th>
<th>Net Effect</th>
<th>Direct/Indirect</th>
<th>Direction</th>
<th>Magnitude</th>
<th>Geographic Extent</th>
<th>Duration/Irreversibility</th>
<th>Frequency</th>
<th>Likelihood of Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrain and soils</td>
<td>Terrain distribution</td>
<td>Decrease in terrain distribution (surficial geology and topography) from site clearing and preparation</td>
<td>Direct</td>
<td>Negative</td>
<td>Negligible</td>
<td>Project footprint</td>
<td>Long-term – reversible for ROW and temporary access roads and workspaces. Permanent – Irreversible for structures and permanent access roads.</td>
<td>Frequent</td>
<td>Probable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Decrease in terrain distribution (topography and surficial geology) from blasting</td>
<td>Direct</td>
<td>Negative</td>
<td>Negligible</td>
<td>Project footprint</td>
<td>Long-term – reversible for ROW and temporary access roads and workspaces. Permanent – Irreversible for structures and permanent access roads.</td>
<td>Frequent</td>
<td>Probable</td>
</tr>
<tr>
<td>Soil quality</td>
<td>Decrease in soil quality from compaction, rutting, and admixing</td>
<td>Direct</td>
<td>Negative</td>
<td>Negligible</td>
<td>Project footprint</td>
<td>Long-term - reversible</td>
<td>Infrequent</td>
<td>Possible</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Decrease in soil quality from blasting residues</td>
<td>Direct</td>
<td>Negative</td>
<td>Negligible</td>
<td>Project footprint</td>
<td>Long-term - reversible</td>
<td>Infrequent</td>
<td>Possible</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Decrease in soil quality from dust and air emissions</td>
<td>Indirect</td>
<td>Negative</td>
<td>Negligible</td>
<td>Local - LSA</td>
<td>Short-term - reversible</td>
<td>Frequent</td>
<td>Possible</td>
<td></td>
</tr>
<tr>
<td>Soil distribution</td>
<td>Decrease in soil distribution from changes to hydrology</td>
<td>Indirect</td>
<td>Negative</td>
<td>Negligible</td>
<td>Local - LSA</td>
<td>Long-term - reversible</td>
<td>Infrequent</td>
<td>Possible</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Decrease in soil distribution from blasting</td>
<td>Direct</td>
<td>Negative</td>
<td>Negligible</td>
<td>Local - LSA</td>
<td>Long-term – reversible for ROW and temporary access roads and workspaces. Permanent – Irreversible for structures and permanent access roads.</td>
<td>Infrequent</td>
<td>Possible</td>
<td></td>
</tr>
</tbody>
</table>

LSA = Local Study Area; ROW = right-of-way.
6.9 Assessing Significance

The assessment of significance of net effects from the Project on terrain and soils followed the general process described in Section 5.6 and is informed by the interaction between the factors of significance, with magnitude, duration and geographic extent being the most important factors. Consideration is also given to concerns of interested agencies, groups and individuals raised during consultation and engagement and through review comments on the draft and final EA reports.

The factors considered in the assessment of significance of net effects on terrain and soils, are summarized in Table 6-9. Net effects to a terrain and soils would be considered to be significant if the majority of the net effects are assessed as high magnitude, long-term or permanent duration, at any geographic extent and any likelihood. The effects, if significant, would be measurable and predicted to result in changes to terrain and soils that represent permanent changes to ecosystem diversity, and productivity for agriculture and forest capability. Effects would be considered not significant if the effects are determined to be negligible, low or moderate in magnitude, any duration, any extent and any likelihood that would not cause permanent changes to ecosystem diversity, and/or productivity for agriculture and forest capability.

Implementation of proven mitigation in Table 6-6, discussed in Section 6.7, and in the CEPP (refer to Appendix 4-II) is expected to avoid or reduce the duration, magnitude, and extent of net effects on terrain and soils. The magnitude of the predicted net effects on geology, terrain and soils are negligible (a small change that is expected to be within the range of baseline or guideline values), direct and indirect, and local (confined to the Project footprint or extending into the LSA). Changes to geology, terrain and soils occurring at permanent Project components (structures, permanent access roads) are predicted to be permanent; however, most of the predicted net effects are anticipated to be reversible over the short and long-term, for temporary Project components.

The predicted net effects on terrain and soils are not anticipated to result in a change to ecosystem diversity, and the soil productivity and abundance to maintain agriculture and forest capability that will alter the sustainability of the criteria beyond a manageable level. The permanent loss of terrain and soil resources is less than 1% of the LSA, therefore, the predicted net effects on terrain and soil are assessed as not significant.
### Table 6-9: Factors Considered in the Assessment of Significance of Net Effects on Terrain and Soils

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Indicators</th>
<th>Significance</th>
<th>Magnitude</th>
<th>Duration</th>
<th>Extent</th>
<th>Frequency</th>
<th>Likelihood</th>
<th>Context / Sustainability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrain and soils</td>
<td>- Terrain distribution</td>
<td>Significant</td>
<td>High</td>
<td>Any duration</td>
<td>Any extent</td>
<td>Any frequency</td>
<td>Any likelihood</td>
<td>Effects to the terrain and soils would cause permanent changes to ecosystem diversity, and productivity for agriculture and forest capability.</td>
</tr>
<tr>
<td></td>
<td>- Soil quality</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Soil distribution</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not significant</td>
<td>- Negligible</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Effects to the terrain and soils would not cause permanent changes to ecosystem diversity, and productivity for agriculture and forest capability.</td>
</tr>
<tr>
<td></td>
<td>- Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Moderate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6.10 Cumulative Effects Assessment

In addition to assessing the net environmental effects of the Project itself, the assessment also evaluates the significance of the net and cumulative effects from the Project that overlap temporally and spatially with effects from all other past, present, and RFDs and activities (refer to Section 5.7).

Importantly, not all net effects from the Project on terrain and soil may require an assessment of cumulative effects. The factors used to determine if a net effect should be carried forward for further analysis in the cumulative effects assessment are outlined in Section 5.7.

The level of change from the Project compared to baseline conditions for a net effect is characterized by the magnitude of the effect (refer to Table 6-7). By definition, negligible net effects can result in changes to indicators, but do not necessarily cause measurable effects to a criterion. For example, a small decrease in soil quality within a soil order unit from blasting residues is not predicted to affect the structure and function of the associated soil order unit in the study area. Therefore, net effects that are assessed as a negligible magnitude are not likely to additively or synergistically contribute to measurable effects from other past, present, or RFDs to terrain and soils criteria, and are not carried forward for cumulative effects assessment. Alternately, net effects with predicted stronger magnitude or intensity of changes in indicators from the Project relative to baseline conditions may likely contribute additively or synergistically to other past, present and RFDs and were carried forward to the cumulative effects assessment. All of the predicted net effects for the terrain and soils criteria were assessed as negligible magnitude.

Based on the discussion above, there are no net effects from the Project that are carried forward to the analysis and characterization in the cumulative effects assessment for terrain and soils. Therefore, a cumulative effects assessment was not completed for terrain and soils.

6.11 Prediction Confidence in the Assessment

The confidence in the effects assessment for terrain and soils is moderate to high. The mitigation described in the CEPP (refer to Appendix 4-II) and OEMP (refer to Appendix 4-III) is based on accepted and proven best management practices that are well understood and have been applied to transmission line projects throughout North America. There is a high degree of certainty that Project construction activities will result in minor and localized changes to the distribution of terrain (topography and surficial geology). Construction activities are expected to also result in minor changes to soil quantity and distribution, and quality within and immediately adjacent to the Project footprint. Decommissioning and reclamation of temporary Project components is anticipated to occur during construction and into operations.

Uncertainty in the assessment has been further reduced by including information from the scientific literature and by applying conservatism to air emission models. The implementation of monitoring programs will be used to provide feedback on the effectiveness of mitigation and success of reclamation activities. Using monitoring and adaptive management, mitigation may be modified and/or additional mitigation may be implemented to reduce predicted or unexpected effects.
6.12 Follow-Up, Inspection, and Monitoring Programs

The objectives of follow-up, inspection, and monitoring programs include:

- Evaluating the effectiveness of mitigation and reclamation, and modifying or enhancing measures as necessary through adaptive management;
- Identifying unanticipated potentially adverse effects, including possible accidents and malfunctions; and
- Contributing to continual improvement.

Monitoring and post-construction monitoring activities are described in Section 23 and the CEPP (refer to Appendix 4-II). A summary of the monitoring activities relevant to the protection of terrain and soils are described below:

- The Owner will appoint qualified Environmental Inspector(s) to guide implementation, monitor and report on the effectiveness of the construction procedures and mitigation measures for minimizing potential impacts.
- Monitor the condition of the soils throughout construction and further assess whether topsoil is being subject to degradation that will eventually impact soil capability.
- Soil quality issues such as compaction, rutting and admixing will be visually assessed throughout the Project footprint during construction.
- NextBridge may inspect equipment and vehicles arriving on the Project footprint prior to arriving at the job.
- Conduct a pre-blast survey of identified wells within 250 m of all blast locations by a licenced water well technician in accordance with the Wells Regulation (O.Reg. 903). Where landowner permission is granted, the pre-blast survey will include completion of a well questionnaire to obtain details about the well and measurement of water levels.
- The Environmental Inspector will monitor blasting operations.
- Post-construction environmental monitoring will be conducted after the completion of the construction activities and continue into the operation phase, and will include such activities as examining and documenting the success of reclamation measures.
- NextBridge will oversee implementation of the environmental management measures described in the OEMP during operation and maintenance.
- Terrain distribution on the Project footprint will be monitored for changes to surface and ground water flows and slope instability during the construction and reclamation phases of the Project.
- Soil quality issues such as compaction, rutting and admixing will be visually assessed throughout the Project footprint during construction.
- Soil distribution and erosion and sedimentation control measures will be monitored to avoid and minimize sediment mobilization from disturbed areas to drainages or water bodies. The Erosion and Sedimentation Control Plan will be utilized during the monitoring programs.
- Soil quality and distribution will be monitored during blasting activities using the Blasting Management Plan.
- Examination and documentation during construction activities and reclamation, will be completed by qualified environmental inspectors.
6.13 Information Passed on to Other Components

Results of the geology, terrain, and soils assessment were reviewed and incorporated into the following components of the amended EA Report:

- Vegetation and Wetlands (refer to Section 12); and
- Fish and Fish Habitat (refer to Section 13).