Table 6-2: Residual Environmental Effects Summary Matrix: Air Quality			
Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
Site Preparation Activities	NS		
Removal and Transport of Hazardous Material and Fuel			

KEY:

Residual Environmental Effects Rating:

S = Significant Adverse Environmental Effect
NS = Not Significant Adverse Environmental Effect
P = Positive Environmental Effect

Probability of Occurrence: based on professional judgement:

1 = Low
2 = Medium
3 = High
n/a = effect not predicted to be significant

Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:

1 = low level of confidence
2 = medium level of confidence
3 = high level of confidence
n/a = effect not predicted to be significant

6.3.2.5 Summary of Environmental Effects on Air Quality

The Sarcpa Lake remediation will have a positive impact on air quality in terms of removing contaminated soil from the environment, thereby reducing the risk of dust from this soil affecting air quality. The extraction of granular material and grading activities will have the potential to create dust and have a negative effect on air quality, however, this will be infrequent in nature, localized, and affect a limited number of sensitive receptors.

6.4 Soil Quality

6.4.1 Existing Environment

Soils in the CAM-F DEW Line Site area are typically Turbic and Static Cryosols with some Organic Cryosols in poorly drained areas. These soils are developed on stony, sandy till, fluvial and marine deposits. Information on soil quality is lacking.

6.4.2 Soil Quality Impact Assessment

6.4.2.1 Study Area Boundaries

The spatial boundary for the assessment of project effects on soil quality is the CAM-F DEW Line Site and the extent beyond the site in which soil contaminates may be expected to migrate. The temporal boundary is the remediation field-work period as well as the additional monitoring period following completion of the Project.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA and NIRB for review by other federal and territorial departments following the CEAA process with additions

to meet the NIRB requirements. Technical boundaries of the soil quality assessment are the lack of site-specific soil data and the limited time frame associated with the environmental screening.

6.4.2.2 Identification of Issues, Interactions and Potential Effects

The remediation phase of the Project has the potential to interact with soil quality through the exposure of hazardous materials and contaminated soil to leaching during investigations and through accidental events such as spills. There is also the potential for migration of contaminants from the new landfills constructed. The operation of the work camp will include treatment and disposal of waste, and could negatively affect soil quality if not carried out properly. Table 6-3 is an environmental assessment matrix for the Soil Quality VEC.

Table 6-3: Environmental Effects Assessment Matrix: Soil Quality

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Residual Environmental Effects				
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
General Clean-up Activities	Hazardous materials or contaminated soils may be exposed to leaching during investigations (A).	• Investigators will have reviewed previous site assessments and activities near known areas of contamination will be carried out in a manner to minimize disturbance to the contaminated materials.	1	2	2/1	R	2
	Accidental spills may result in soil degradation (A).	• Proper handling, storage and transportation procedures for hazardous materials will be implemented. • All workers will be trained in proper handling procedures for all hazardous materials on-site. • Hazardous materials or fuel will not be stored in the beach area. • Spill contingency plans have been developed and will be implemented as necessary. • Contingency plans related to all materials and equipment will be available on-site. • All fuel will be handled in accordance with the Contingency Plan.	1	1	2/1	R	2

Table 6-3: Environmental Effects Assessment Matrix: Soil Quality

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Residual Environmental Effects				
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
	The operation of the construction camp will include treatment and disposal of waste, which could degrade soil quality (A).	• Hazardous materials will not be disposed of in the camp waste system. • All hazardous materials will be removed from the site for disposal. • All sewage will be disposed of in accordance with applicable regulations and guidelines.	1	2	2/1	R	2
Contaminated Soil Disposal/ Hazardous Materials Removal	The removal of the contaminated soil and hazardous materials from contact with the environment will improve soil quality (P).	• N/A					
Removal and Transport of Hazardous Material, Fuel and Contaminated Soil	The potential exists for accidental release of hazardous materials, contaminated soil and/or fuels that could degrade soil quality (A).	• Proper handling, storage and transportation procedures for hazardous materials will be implemented. • All workers will be trained in proper handling procedures for all hazardous materials on-site. • Hazardous materials or fuel will not be stored in the beach area. • Spill contingency plans have been developed and will be implemented as necessary. • Contingency plans related to all materials and equipment will be available on-site. • All fuel will be handled in accordance with the Contingency Plan.	1	1	3/1	R	2

KEY

Magnitude

1 = Low: Soil chemical composition is not altered to the extent that vegetation currently present is affected.
2 = Moderate: Soil chemical composition is altered such that a moderate percentage of the vegetation is affected.
3 = High: Soil chemical composition is altered such that all vegetation is degraded and/or contaminants leach to groundwater.

Geographic Extent:

1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = >10,000 km²

Duration:

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

Frequency:

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

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse effects.
N/A = Not Applicable

6.4.2.3 Mitigation

The new landfills will be sited away from natural drainages. The secure soil storage facility will incorporate leachate containment, which includes a synthetic liner and freezeback of permafrost. The existing landfills are being remediated to eliminate the risk of leachate production and migration, and they will be graded to promote surface runoff. Spill prevention and spill contingency plans will be in effect during all activities.

Proper handling procedures will be implemented for the storage and transportation of hazardous materials. All workers will be trained to properly handle all hazardous materials on-site, and no hazardous materials or fuel will be stored on the beach area. Contingency plans for spills will be followed, and will be available on-site, and all fuel will be handled in accordance with the contingency plan.

Hazardous materials will not be disposed of in the camp waste system. The disposal of all sewage will be in accordance with applicable regulations and guidelines

6.4.2.4 Residual Environmental Effects

Definition of Significance

Significant Impacts are defined as those altering soil such that one or both of the following occurs:

- soil chemical composition is altered such that it will not support vegetation in areas where vegetation previously grew and the extent is greater than 1 km from the facility; and
- soil chemical composition is altered such that it is a threat to groundwater and surface water.

Residual Environmental Effects Summary

Table 6-4 summarizes the residual environmental effects of the project activities on soil quality. Activities during the remediation phase are not expected to affect soil quality significantly.

Table 6-4: Residual Environmental Effects Summary Matrix: Soil Quality

Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
General Clean Up Activities	NS		
Contaminated Soil Disposal / Hazardous Materials Removal	P		
Removal and Transport of Hazardous Material, Fuel and Contaminated Soil	NS		

KEY

Residual Environmental Effects Rating:

S = Significant Adverse Environmental Effect
NS = Not Significant Adverse Environmental Effect
P = Positive Environmental Effect

Probability of Occurrence: based on professional judgement:

1 = Low
2 = Medium
3 = High
n/a = effect not predicted to be significant

Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:

1 = low level of confidence
2 = medium level of confidence
3 = high level of confidence
n/a = effect not predicted to be significant

6.4.2.5 Summary of Environmental Effects on Soil Quality

Activities associated with the remediation program at CAM-F DEW Line Site are assessed as having an overall positive effect on soil quality in terms of removing contaminated soils and hazardous materials from the environment. Migration of contaminants from the new landfills has the potential to degrade soil quality if not constructed properly. However, the new landfill will be constructed away from natural drainages. The secure soil storage facility will incorporate leachate containment, including synthetic liners and freezeback of permafrost. The existing landfills are being remediated to eliminate the risk of leachate production and migration, and they will be graded to promote surface runoff.

The potential exists for an accidental release of hazardous materials, contaminated soil and/or fuels that could impact soil quality. However, proper handling procedures for hazardous materials will be implemented for their storage and transportation. Also, all workers will be trained to properly handle hazardous materials on-site and no hazardous materials or fuel will be stored on the beach areas. Spill contingency plans will be followed, and will be available on-site. All fuel will be handled in accordance with the contingency plan.

The operation of the work camp will include the treatment and disposal of waste, and has the potential to degrade soil quality. However, hazardous materials will not be disposed of in the camp waste system, and the disposal of all sewage will be in accordance with applicable regulations and guidelines.

6.5 Water Quality

6.5.1 Existing Environment

Waterbodies in the vicinity of the CAM-F DEW Line Site include Sarcpa Lake, the Kingora River, Hall Lake, and numerous smaller lakes and rivers.

6.5.2 Water Quality Impact Assessment

6.5.2.1 Study Area Boundaries

The spatial boundary for the assessment of the effects of project activities on the water quality of the area is the local watershed for Sarcpa Lake and the watersheds crossed by the winter access route from Hall Beach to the site. The temporal boundary is the remediation field-work period, as well as the additional monitoring period following completion of the project.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA and NIRB for review by other federal and territorial departments following the CEAA process with additions to meet the NIRB requirements. Technical boundaries of the water quality assessment are the lack of site-specific water quality data and the limited time frame associated with the environmental screening.

6.5.2.2 Identification of Issues, Interactions and Potential Effects

Interactions between the remediation phase and the water quality environment will be similar to those for the soil quality environment, i.e., the potential for leachates from exposed hazardous materials and contaminated soil, and the potential for spills of fuel and hazardous materials.

Table 6-5 is an environmental assessment matrix for the Water Quality VEC.

Table 6-5: Environmental Effects Assessment Matrix: Water Quality

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
General Clean Up Activities	Hazardous materials or contaminated soils may be exposed to leaching; the leachate may degrade water quality (A).	• Investigators will have reviewed previous site assessments and activities near known areas of contamination will be carried out in a manner to minimize disturbance to the contaminated materials.	1	2	2/1	R	1
	Accidental spills may result in water quality degradation (A).	• Proper handling, storage and transportation procedures for hazardous materials will be implemented. • All workers will be trained in proper handling procedures for all hazardous materials on-site. • Hazardous materials or fuel will not be stored in the beach area. • Spill contingency plans have been developed and will be implemented as necessary. • Contingency plans related to all materials and equipment will be available on-site. • All fuel will be handled in accordance with the Contingency Plan.	1	2	2/1	R	1

Table 6-5: Environmental Effects Assessment Matrix: Water Quality								
Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects					
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context	
Landfill Development / Landfill Closure	Closure and remediation of landfills and the removal of the contaminated soil and hazardous materials from the environment will reduce the risk of contamination of surface and active layer water (P)	• N/A						
	The development of new landfills and closure of existing dumps has the potential to disrupt drainage at the site (A)	• New landfills will be sited away from natural drainages • Upon closure, existing landfills will be graded to promote surface runoff	1	2	5/1	R	1	
Contaminated Soil Disposal / Hazardous Materials Removal	The removal of the contaminated soil and hazardous material from the environment will reduce the risk of contamination of surface and active layer water (P)	• N/A						
Removal and Transport of Hazardous Material, Fuel and Contaminated Soil	The potential exists for accidental release of hazardous materials, contaminated soil, and/or fuels that could degrade water quality (A)	• Proper handling, storage and transportation procedures for hazardous materials will be implemented. • All workers will be trained in proper handling procedures for all hazardous materials on-site. • Hazardous materials or fuel will not be stored in the beach area. • Spill contingency plans have been developed and will be implemented as necessary • Contingency plans related to all materials and equipment will be available on-site. • All fuel will be handled in accordance with the Contingency Plan.	1	2	3/1	R	1	

Table 6-5: Environmental Effects Assessment Matrix: Water Quality

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
Site Grading / Borrow Source Development	The erosion of soil and sedimentation of water bodies during grading and gravel extraction activities has the potential to degrade water quality (A)	• Siltation will be prevented by use of berms and/or silt fences. • Equipment will not be operated within the wetted perimeter. • Disturbed areas adjacent to water will be stabilized, if required.	1	2	3/1	R	1
	Grading and gravel extraction activities will also alter the terrain, and has the potential to disturb drainage (A)	• Grading and gravel extraction activities will be sited away from natural drainages • Upon completion of gravel extraction activities, the areas will be graded to blend with the natural terrain, and where appropriate, to promote surface runoff.	1	2	3/1	R	1
	Some improvements to drainage may be expected as a result of properly grading existing disturbed sites (P)	• N/A					
Contractor Support	The operation of the work camp will include treatment and disposal of waste, which has the potential to impact water quality (A).	• Hazardous materials will not be disposed f in the camp waste system. • Disposal of all sewage will be in accordance with applicable regulations and guidelines.	1	2	3/1	R	1

KEY:

Magnitude:

1 = Low: *e.g.*, Minor changes to water quality but not to the extent that aquatic life is affected or water that was previously potable is now non-potable.

2 = Medium: *e.g.*, Moderate changes to water quality, affecting aquatic life at a local level or decreasing the quality of potable water (*e.g.*, odour problem).

3 = High: *e.g.*, Major changes to water quality, affecting aquatic life at a regional level or rendering previously potable water non-potable.

Geographic Extent:

1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = >10,000 km²

Duration:

1 = <1 month
2 = 1-7 months
3 = 8-36 months
4 = 37-72 months
5 = >72 months

Frequency:

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

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 = Relatively pristine area or area not adversely affected by human activity.

2 = Evidence of adverse effects.

N/A = Not Applicable

6.5.2.3 Mitigation

The new landfills will be sited away from natural drainages. The Tier II facility will incorporate leachate containment, which includes a synthetic liner and freezeback of permafrost. The existing landfills are being remediated to eliminate the risk of leachate production and migration, and they will be graded to promote surface runoff. Material handling and spill contingency plans will be in place and the disposal of camp wastes will meet all regulatory standards.

Proper handling procedures will be implemented for the storage and transportation of hazardous materials. All workers will be trained to properly handle all hazardous materials on-site and no hazardous materials or fuel will be stored on the beach area. Contingency plans for spills will be followed, and will be available on-site, and all fuel will be handled in accordance with the contingency plan.

During grading and gravel extraction activities, Siltation will be prevented by the use of berms and/or silt fences, and equipment will not be operated within the wetted perimeter. Additionally, disturbed areas adjacent to water will be stabilized, if required. Grading and gravel extraction activities will be sited away from natural drainages, and upon completion, the areas will be graded to blend with the natural terrain, and where appropriate, to promote surface runoff.

Hazardous materials will not be disposed of in the camp waste system. The disposal of all sewage will be in accordance with applicable regulations and guidelines.

6.5.2.4 Residual Environmental Effects

Definition of Significance

A significant impact to water quality is defined as one of sufficient magnitude so as to alter the quantity or quality of water to a degree that will result in a significant impact on aquatic life as defined in the impact significance definitions for other related VECs.

Residual Environmental Effects Summary

Table 6-6 summarizes the residual environmental effects of the project activities on water quality. Activities during the remediation phase are not expected to affect water quality significantly, while the closure of an existing landfill and removal of hazardous waste is assessed as having a positive effect on water quality.

Table 6-6: Residual Environmental Effects Summary Matrix: Water Quality

Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
Landfill Development	NS		
Landfill Closure	P		
Contaminated Soil Disposal / Hazardous Materials Removal	P		

Table 6-6: Residual Environmental Effects Summary Matrix: Water Quality			
		Likelihood (of significant adverse environmental effects)	
Removal and Transport of Hazardous Material, Fuel and Contaminated Soil	NS		
Borrow Source Development	NS		
Site Grading	P		
Contractor Support	NS		

KEY

Residual Environmental Effects Rating:	Probability of Occurrence: based on professional judgement:	Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:
S = Significant Adverse Environmental Effect	1 = Low	1 = low level of confidence
NS = Not Significant Adverse Environmental Effect	2 = Medium	2 = medium level of confidence
P = Positive Environmental Effect	3 = High	3 = high level of confidence
	n/a = effect not predicted to be significant	n/a = effect not predicted to be significant

6.5.2.5 Summary of Environmental Effects on Water Quality

The CAM-F DEW Line Site remediation program will have an overall positive impact on water quality in terms of closing the existing landfills and removing contaminated soils and hazardous materials form the environment.

6.6 Terrain

The terrain VEC includes surficial geology, soils and vegetation. The soils component refers to the physical characteristics of the surficial material; soil quality is addressed as a separate VEC in Section 6.3.

6.6.1 Existing Environment

6.6.1.1 Geology and Soils

Surficial Geology

The geology in the CAM-F DEW Line Site area is comprised largely of a plateau of Proterozoic granites rising from 50 to 450 m above sea level (asl). It is characterized by a rolling topography with elevational changes of 200 m or more within a few kilometres. The land is well drained, with numerous large lakes and rivers. CAM-F DEW Line Site is bordered by large hills (approximately 80 m) rising to the north and west. The hills are mainly rugged granite fell fields with large boulders and glacial eratics. The area is dotted with many tundra ponds, marshy areas, vegetated meadows and drier upland ridges (Montgomerie *et al.*, 1982).

Soils

The Melville Peninsula is composed of the flat-lying, Palaeozoic strata that form a very shallow basinlike area on the old surface of the Precambrian Shield. Turbic and Static Cryosols with some Organic Cryosols developed on marine, discontinuous glacial drift and organic deposits are the dominant soils. Permafrost is continuous with medium ice content (Ecological Stratification Working Group 1995). The surface active layer varies from 8-10 cm in depth to over 90 cm, depending on slope, aspect, parent material type and texture and the type of vegetation cover (Jacques 1982).

6.6.1.2 Vegetation

The mid-arctic climate limits the vegetation to herbaceous species only. The region is characterized by discontinuous tundra vegetation such as purple saxifrage, *Dryas spp.*, and arctic willow, along with alpine foxtail, wood rush, and saxifrage. Wet areas have a continuous cover of sedge, cottongrass, saxifrage, and moss (Ecological Stratification Working Group 1995). No trees are found in the area.

Extensive well-vegetated areas are not common in this region but can be found around Sarcpa Lake (Montgomerie *et al.* 1982). Scattered drier upland ridges and tundra ponds are present are present. Montgomerie *et al.* (1982) classified the habitats around Sarcpa Lake as ponds and small lakes (<5%), wet sedge meadows (10%), solifluction zones (30%), *Dryas*-lichen ridges (20%), boulder fields and exposed rock (25%), and disturbed area (10%). These classifications were for their 13 km^2 study around the CAM-F site.

Jacques (1982) further classified the vegetation communities in the nearby Roche Bay area. These classifications were based on bedrock and surficial materials. West of Roche Bay, where Sarcpa Lake is located, is comprised of Precambrian granites and gneisses. There are five major plant associations in this upland region: 1) Dwarf shrub-lichen; 2) Dwarf shrub; 3) Dwarf shrub-heath-moss; 4) Sedge meadows; and 5) Snow beds.

The dwarf shrub-lichen association is found where snow cover is light to non-existent. Total vegetation cover is low ranging from 15 to 30 percent. Bare rock and bedrock fragments form most of the ground cover. Dominant vascular plant species include Mountain Avens (*Dryas integrifolia*). Alpine Sweetgrass (*Hierochloe alpina*) is abundant on the most exposed sites. Dwarf shrub associations occur where the snow is somewhat deeper. Total vegetation cover is 50 to 80 percent. The dwarf shrub-heath-moss association develops where snow cover is light to moderate but persistent until June in most years. Total vegetation cover ranges from 50 to 75 percent. Mountain Avens, Arctic Heather (*Cassiope tetragona*) and the mosses *Rhacomitrium lanuginosum* and *Tomenthypnum nitens* dominate this association. The sedge meadow association develops on nearly level or gentle slops where drainage is imperfect. Total vegetation cover ranges from 80 to 100 percent. Dominant plant species are water sedge *(Carex aquatilis)* and *Bryum* spp. The snow bed association develops in topographic depressions or lee slopes where snow accumulations are heavy and snow cover remains until late in the growing season. Vegetation species vary depending on the longevity of the snow cover (Jaques 1982).

There are over 1000 species of vascular plants in Nunavut. Of these only 18 species have been reviewed as to their general status in the territory. To date no rare or endangered vegetation species have been identified (Department of Sustainable Development 2001).

6.6.2 Terrain Impact Assessment

6.6.2.1 Study Area Boundaries

The spatial boundary for the assessment of the effects of project activities on the terrain of the area include the area immediately surrounding the CAM-F DEW Line Site facilities. The temporal boundary is the remediation field-work period as well as the additional monitoring period following completion of the project.

The administrative boundaries for the assessment refer to the jurisdictions within which and for which the assessment is being prepared. In this case, the assessment is being prepared under CEAA and NIRB for review by other federal and territorial departments following the CEAA process with additions to meet the NIRB requirements. Technical boundaries of the terrain assessment are the lack of site-specific terrain data and the limited time frame associated with the environmental screening.

6.6.2.2 Identification of Issues, Interactions and Potential Effects

An alteration in the ability of the local terrain to support native plants may result from the remediation activities. The majority of the terrain in the immediate vicinity of the site facilities is already heavily disturbed. Efforts have been made to locate borrow sources and new landfills within or close to the footprint of the facility site. Clean up and remediation of the site will allow for revegetation to occur. The dwarf shrub-lichen association would likely recolonize in the area, however given the harsh growing conditions of the area this may not be noticed for a number of years. The majority of the terrain in the immediate vicinity of the site facilities is already heavily disturbed.

Most of the waste appears to have been deposited directly on the ground and only minor quantities have been buried. The excavation required for the development and subsequent closure of the new landfills and the closure of existing landfills has the potential to degrade permafrost. Efforts will be made to minimize re-grading of the site. The removal of site debris has the potential to further disturb the existing terrain. However, terrain and drainage will be improved as a result of grading disturbed areas to blend into the natural environment.

Local vegetation may be affected by fugitive dust during the clean up and remediation activities. Mitigation measures used to reduce the levels of fugitive dust should reduce impacts to local vegetation.

The extraction of granular material will alter the terrain of borrow areas, and the movement of contractor's equipment and personnel around the site has the potential to disturb the tundra. Additionally, the excavation and removal of contaminated soil has the potential to degrade the permafrost.

Table 6-7 is an environmental assessment matrix for the Terrain VEC.

Table 6-7: Environmental Effects Assessment Matrix: Terrain

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context
Landfill Development / Landfill Closure	Excavation required for the development and subsequent closure of the new landfills and closure of existing landfills has the potential to degrade permafrost (A)	• The duration of permafrost exposure will be minimized. • The surface area of exposed permafrost or active zone will be minimized. • Unless required for drainage purposes (i.e., landfill cap), smoothing and contouring of the surface will be minimized in order to create microsites that will encourage vegetation growth.	1	2	3/1	R	2
Site Debris Disposal	The removal of site debris has the potential to further disturb the existing terrain (A)	• Disturbed area will be regraded and reshaped to match existing terrain and drainage paths. • Existing tracks will be used for movement around the site.	1	2	3/1	R	2
Site regrading	Drainage will be improved as a result of grading disturbed areas. Previously disturbed areas will blend into the natural environment (P).	• N/A					
Borrow Source Development	The extraction of granular material will alter the terrain of the borrow area (A).	• Disturbed area will be re-graded and reshaped to match existing terrain and drainage paths.	1	2	2/1	R	1
Contaminated Soil Excavation	The excavation and removal of contaminated soil has the potential to degrade permafrost (A).	• The duration of permafrost exposure will be minimized. • The surface area of exposed permafrost or active zone will be minimized.	1	2	3/1	R	2
Contractor Support	The establishment of the work camp may disturb or destroy landforms.	• The camp will be located on previously disturbed lands.	1	1	3/6	R	2
	Movement of contractor's equipment and personnel around the site has the potential to disturb the tundra (A).	• Existing roads will be used for movement around the site.	1	3	1/1	R	2

Table 6-7: Environmental Effects Assessment Matrix: Terrain

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility	Ecological/Socio-Cultural and Economic Context

KEY

Magnitude:

1 = Low: Erosion, permafrost degradation and destruction of vegetation is minor and limited in extent.

2 = Medium: Erosion, permafrost degradation and destruction of vegetation is more intense and widespread.

3 = High: Extensive erosion, permafrost degradation and destruction of vegetation.

Geographic Extent:

1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = >10,000 km²

Duration:

1 = <1 month
2 = 1-7 months
3 = 8-36 months
4 = 37-72 months
5 = >72 months

Frequency:

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

Reversibility:

R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:

1 Relatively pristine area or area not adversely affected by human activity.

2 Evidence of adverse effects.

N/A = Not Applicable

6.6.2.3 Mitigation

Excavation required for the development and subsequent closure of the new landfills and closure of existing landfills has the potential to degrade permafrost, however, project activities will be conducted to ensure that the time that the permafrost is exposed is minimized. Additionally, the surface area of exposed permafrost or active zone will be minimized.

The removal of site debris has the potential to further disturb the existing terrain however, the disturbed areas will be re-graded and reshaped to match existing terrain and drainage paths. Unless required for drainage purposes (i.e., landfill cap), smoothing and contouring of the surface will be minimized in order to create microsites that will encourage vegetation growth. During the remediation activities, vehicles and workers will use existing tracks for travel, whenever possible. Terrain and drainage will be improved on previously disturbed areas as a result of grading to blend into the natural environment.

The extraction of granular material will alter the terrain or borrow areas, however these will be re-graded and reshaped to match existing terrain and drainage paths. The excavation and removal of contaminated soil has the potential to degrade the permafrost, however project activities will be carried out to ensure that the time the permafrost is exposed is minimized, and to minimize the exposed surface are of permafrost or the active zone.

Mitigation measures to reduce to levels of fugitive dust will also benefit local terrestrial vegetation.

6.6.2.4 Residual Environmental Effects

Definition of Significance

A significant environmental effect on the terrain VEC is one that results in permafrost degradation, surface erosion, sliding or slumping such that a significant effect results upon one of the water quality, biological, heritage resource, or socio-economic VECs or when the population of a vegetation species is sufficiently affected to cause a decline in abundance and/or change in distribution beyond which natural recruitment would not return the population to its former level within several growing seasons.

Residual Environmental Effects Summary

Table 6-8 summarizes the residual environmental effects of the project activities on terrain. Activities during the remediation phase are not expected to have a significant effect on soil quality, and are expected to benefit vegetation through the creation of microsites, during grading, which will assist the establishment of vegetation.

Table 6-8: Residual Environmental Effects Summary Matrix: Terrain

Phase	Residual Adverse Environmental Effect Rating	Likelihood (of significant adverse environmental effects)	
		Probability of Occurrence	Scientific Uncertainty
Landfill Development/ Closure	NS		
Site Debris Disposal	NS		
Site Regrading	P		
Borrow Source Development	NS		
Contractor Support	NS		
Contaminated Soil Excavation	NS		

KEY

Residual Environmental Effects Rating:

S = Significant Adverse Environmental Effect
NS = Not Significant Adverse Environmental Effect
P = Positive Environmental Effect

Probability of Occurrence: based on professional judgement:

1 = Low
2 = Medium
3 = High
n/a = effect not predicted to be significant

Scientific Uncertainty: based on scientific information, and statistical analysis or professional judgement:

1 = low level of confidence
2 = medium level of confidence
3 = high level of confidence
n/a = effect not predicted to be significant

6.6.2.5 Summary of Environmental Effects on Terrain

Excavation required for the development and subsequent closure of the new landfills and closure of existing landfills has the potential to degrade permafrost, however, project activities will be conducted to ensure that the time that permafrost is exposed is minimized. Additionally, the surface area of exposed permafrost or active zone will be minimized.

The removal of site debris has the potential to further disturb the existing terrain; however the disturbed areas will be re-graded and reshaped to match existing terrain and drainage paths. Grading will create microsites that will encourage vegetation growth. Vehicles and workers will use existing tracks for movement around the site to minimize disturbance to the tundra. Terrain and drainage will be improved on previously disturbed area as a result of grading to blend in to the natural environment.

The extraction of granular material will alter the terrain of borrow areas, however, these will be re-graded and reshaped to match existing terrain and drainage paths. The excavation and removal of contaminated soil has the potential to degrade permafrost, however project activities will be carried out to minimize the extent and duration of permafrost exposure

Remediation activities are assessed as not having significant effects on the terrain of the CAM-F Intermediate DEW Line Site area.

6.7 Terrestrial Animals and Habitat

6.7.1 Existing Environment

Wildlife in the region is dependent on suitable habitat for survival and given the sparse presence of vegetation in the region low densities and diversity of wildlife in the area are expected. There are however several species that may utilize the area for certain life stages such as breeding or migrating. Based on existing information the keystone wildlife species expected in the area are highlighted below. It should be noted that all existing information for the area has been collected after the CAM-F facilities were already in place.

6.7.1.1 Mammals

Terrestrial mammals include polar bear, common in coastal areas, as well as arctic hare, arctic fox, lemming, and caribou (Ecological Stratification Working Group 1995).

Polar Bear

The polar bear is considered a sensitive species in Nunavut (Department of Sustainable Development, 2001) and in 2002 it was listed as a species of Special Concern (COSEWIC 2003). Movements of polar bears are normally dictated by sea ice characteristics, climate and the presence of prey species, especially ringed seals (Taylor *et al.* 2001). In Nunavut, polar bears are common in the coastal areas, especially in the summer. They move inland to find denning sites, where females will spend the winter with their new-born young.

CAM-F DEW Line Site is within the Foxe Basin polar bear population that is estimated to be 2300 animals (IUCN 2004). Within this population, polar bears exhibit site fidelity to these regions because of discontinuities in movement influenced by land-mass and open-water impediments and poor habitat. During the ice-free season, polar bears tend to concentrate on Southampton Island, where denning has occurred (Borealis Exploration Limited 1981), and along the Wager Bay coast. However, some bears may be encountered on the islands and coastal regions throughout the Foxe Basin area (IUCN 2004). The number of polar bears occurring on or near Melville Peninsula is believed to be small. Local wind and drift ice conditions likely make the area unsuitable for polar bears (Borealis Exploration Limited 1981). While occurrences of polar bears in the CAM-F DEW Line Site region are likely to be low, they could be met there occasionally at any time throughout the year. Preferred hunting areas for polar bears are north of Melville Peninsula than along its eastern coast. Polar bears have been observed in the Garry Bay (Ferguson and Vincent 1992).