6. DESCRIPTION OF PHYSICAL ENVIRONMENT

6.1 CLIMATE

The climate of central Ungava has been classified as humid micro-thermal under the Koppen-Gieger system (Pollard 2005).

The region is characterized by cool, four- to five-month-long summers and cold, snowy winters (Acterre August 2006).

Long-term records indicate a mean annual air temperature of -4.9°C (for the Schefferville town site at 520 m asl), but tundra ridge areas have been documented to have mean annual air temperatures as low as - 7°C (Pollard 2005). Detailed analysis of data from a meteorological station operated for five years on the Timmins 4 site at an altitude of 782 m demonstrated a mean annual temperature there of -6.2°C (Nicholson and Lewis 1976).

The seasonal pattern in air temperature is typically continental and characterized by dramatic extremes, with extreme minima as low as -50°C and extreme maxima above 30°C (Pollard 2005).

Based on long-term data, the annual precipitation is approximately 732 mm and is roughly skewed with a peak in late summer (Pollard 2005).

6.2 GEOLOGY, GEOMORPHOLOGY AND HYDROGEOLOGY

Sectors 2 and 3 are located within the Labrador Trough formed in the Churchill Province of the Canadian Shield where it meets the Superior Province. It is a northwest-southeast trending syncline that extends more than 800 km from western Labrador to the tip of the Ungava peninsula. It separates the Archaean rocks of the Superior Province to the west from the rocks comprising the North Atlantic Craton to the east (Gartner Lee Limited and Groupe Hemisphères December 2007).

The rocks of the Labrador Trough are distributed in three belts representing at least three cycles of tectonic activity and sedimentation, which are reflected in its ridge-and-valley topography (Gartner Lee Limited and Groupe Hemisphères December 2007).

The Schefferville area was not ice-free until 5,000 to 6,000 years ago (Nicholson and Moore 1977).

The drainage divide bordering the Howells River catchment was formed at the end of the Wisconsin glaciation at the time of the melting of the ice cap that covered the Québec-Labrador region. Glacial masses and melt waters flowed towards the north-west and the south-east along the axis of the Labrador Trough and, in the process, scoured depressions within pre-existing valleys to form the present basins of such systems as the Howells (Derbyshire 1962, cited in Curtis February 2004).

The landscape around Schefferville displays widespread evidence of erosion by glacial meltwater: there are numerous subglacial meltwater channels perched and nested high on the upland surfaces and vast areas of boulder-filled channels that are more characteristic of proglacial meltwater (Gartner Lee Limited and Groupe Hemisphères December 2007).

6.3 SOIL

Due to the recent deglaciation, soils in the Schefferville region are relatively young. They generally developed on thin layers of drift which "although variable in composition often shows similarities with the underlying bedrock" (Nicholson and Moore 1977). In those areas where bedrock outcrops, soil development has not occurred at all (Nicholson and Thom 1973).

The soils can be classified as Alpine Dystric Brunisol, Rego Humic Gleysol and Lithic Regosol (Nicholson and Thom 1973). With the exception of soils underlain by dolomite, which are rich in calcium and magnesium, soils are acid and contain few nutrients (Waterway *et al*. 1984).

6.4 PERMAFROST

The first casual observations of frozen ground conditions in Labrador-Ungava, which covers Northern Québec and Labrador and parts of the Côte-Nord and of Abitibi-Témiscamingue, were reported by Jenness (1949), who mapped what is now Schefferville as the "tentative southern limit of continuous permafrost". Thomas (1953) later described the same boundary as the "approximate southern limit of permafrost", noting that permafrost-free areas of limited extent occurred north of the boundary. Based on the same field data, Black (1951) concluded that there was no continuous permafrost in Labrador-Ungava and indicated boundaries of discontinuous and sporadic zones. The southern limit of discontinuous permafrost was put at some 160 km north of Schefferville, while the sporadic zone extended to within 80 km of the Gulf of St Lawrence (Pryer no date).

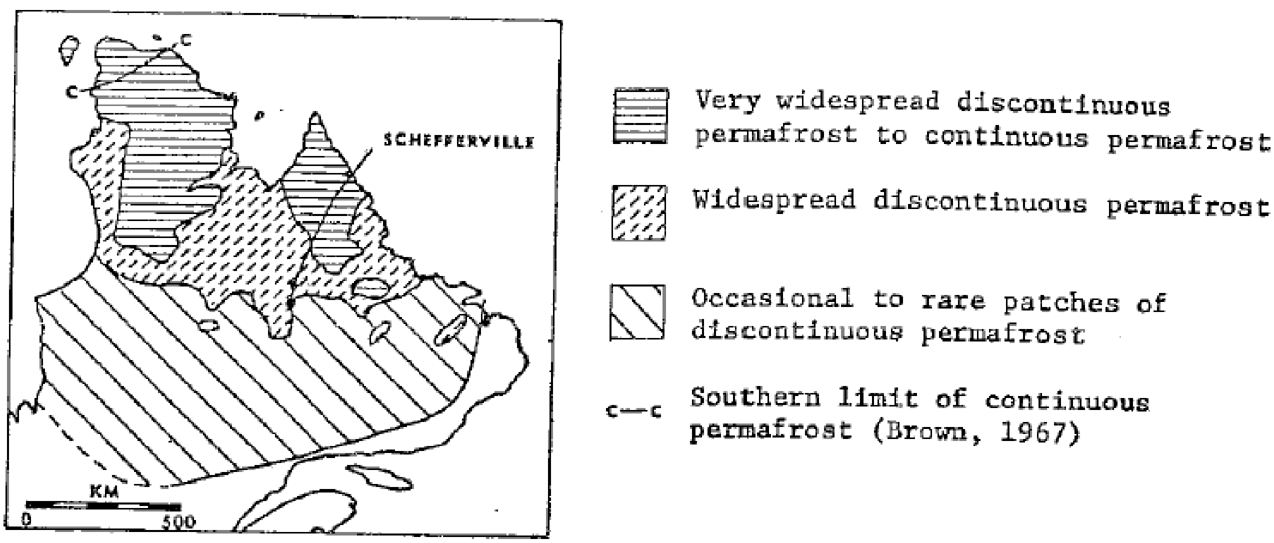
Mining near Schefferville after 1954, however, revealed evidence that permafrost was more widespread than had been estimated. Measurements by IOCC showed that permafrost extended over 60 m in depth (Pryer no date). A permafrost distribution map based on field observations (Brown 1960) showed a narrow coastal area of continuous permafrost along the shores of Hudson Strait and Ungava Bay, while the southern limit of discontinuous permafrost was drawn close to the 55th parallel of latitude, slightly to the north of Schefferville. On the basis of both field observations and ground temperature investigations near Schefferville, Ives (May 1962) predicted the occurrence of contemporary permafrost based on vegetative cover and topography.

Although the ground temperature investigations were inconclusive, the results suggested that, under the subarctic conditions of Labrador-Ungava, relief, snow cover and vegetation influence the development and preservation of permafrost (Ives 1961). Ives (1961) found that the spread of vegetation after deglaciation played a critical role in the degeneration of widespread permafrost into scattered areas of frozen ground in an unstable equilibrium with the contemporary climate.

Nicholson (February 1978) conducted research on permafrost distribution at various sites in the Schefferville area, including Timmins 4 and Fleming 7, at an elevation of 700 m, between 1973 and 1975. He concluded that extensive, deep permafrost underlies those areas that are higher in elevation, exposed and where tundra vegetation covers the ground. Permafrost at those sites ranges from 60 to 100 m in depth, though completely unfrozen areas occur in valleys on the margin of these sites. On less exposed and lower-lying ground, which is covered by woodland, no permafrost is present (Nicholson and Lewis 1976). Beneath those water bodies in the Schefferville area that are deep enough not to freeze solid during Winter, due to their capacity to produce higher ground temperatures, permafrost is expected to be absent; nor is it expected to occur within 100 feet from permanently covered shoreline (Nicholson February 1978).

Nicholson and Lewis (1976) also found that deep active layers to 10 m and more, and talik zones, typically 15 to 30 m deep, are found in association with wet lines, in which there is substantial groundwater movement. Due to the heat transport by moving ground water, possibly aided by the frozen ground being permeable along larger voids, the frost table retreats rapidly at times on deep active layer sites.

Figure 6.1: Distribution of Permafrost, Labrador-Ungava



Source: Nicholson and Lewis (1976).

6.5 WATER QUALITY

Table 6.1 summarizes water quality in Summer in 18 water bodies close to Schefferville some 25 years after the start of mining in the area. Burnt Lake and Hematite Lake were both receiving water pumped from mines at the time of sampling. Indeed, Burnt Lake had been so severely disrupted by mining that it had virtually no natural catchment, and the stream above it was actively eroding mine wastes that were encroaching on its banks

(Drake 1981a: 290). Bean Lake was at the time of the study fed by a stream that received water pumped from a mine and that drained the railway switch-yards (Drake 1981a: 291). Drake (1981a: 295) concluded that "Little change has followed the development of iron mines in the area, and the changes that have occurred are less than the local intra-regional variation".

Table 6.1: Means and Standard Deviations (in parentheses) of Water Chemistry Data

Site	Temperature (ºC)	pH	Ca	Mg (mg l^{-1})	HCO_3 (mg l^{-1})	SiO_2 (mg l^{-1})
1. Setter Lake	13.5 (–)	7.1 (–)	12.9 (3.0)	10.4 (1.1)	81.0 (15.8)	2.3 (2.5)
2. Ares Lake	15.6 (1.9)	7.6 (0.5)	6.7 (1.2)	3.1 (1.0)	59.9 (7.5)	2.4 (1.1)
3. Knob Lake	13.7 (3.7)	6.9 (0.3)	6.6 (0.5)	4.1 (0.8)	24.4 (4.4)	2.1 (0.9)
4. Dolly Lake	11.6 (0.5)	6.9 (–)	8.6 (0.2	6.2 (0.1)	21.1 (–)	2.4 (0.9)
5. John Lake	12.6 (0.7)	7.1 (0.1)	10.2 (0.4)	6.9 (0.4)	51.9 (1.1)	1.1 (1.3)
6. MaryJo Lake	13.5 (0.4)	6.5 (–)	8.1 (2.2)	6.7 (1.6)	53.3 (–)	1.1 (0.5)
7. Lac Dian	10.3 (4.3)	6.6 (0.6	4.7 (1.4)	4.2 (1.1)	23.1 (4.7)	5.4 (3.7)
8. Burnt Lake[a]	11.6 (1.7)	7.7 (0.3)	14.7 (4.4)	9.4 (0.9)	90.9 (15.5)	5.5 (1.8)
9. Hematite Lake[a]	13.1 (2.0)	5.1 (0.1)	1.2 (–)	0.7 (–)	1.9 (1.7)	0.6 (0.1)
10. Hanas Lake	17.2 (3.1)	6.9 (0.5)	3.5 (0.6)	1.8 (1.3)	15.8 (3.1)	3.2 (1.3)
11. Elizabeth Lake	12.9 (–)	7.7 (–)	5.4 (0.6)	3.3 (0.4)	26.7 (–)	0.8 (0.8)
12. Hope Lake	13.0 (–)	5.7 (–)	9.8 (–)	6.9 (–)	59.9 (–)	(–) (–)
13. Lac LeJeune	10.4 (4.3	6.8 (0.8)	11.0 (3.0)	7.1 (1.5)	68.1 (12.0)	8.4 (4.1)
14. Bean Lake[a]	13.3 (1.2)	6.7 (0.6)	12.6 (1.3)	8.2 (0.5)	63.9 (13.0)	2.9 (1.0)
15. Gemini Lake	15.6 (2.9)	8.2 (0.7)	11.5 (2.4)	7.3 (2.3)	75.4 (16.3)	4.3 (1.4)
16. Pinette Lake	14.0 (3.6)	5.8 (0.4)	1.2 (0.6)	0.7 (0.4)	5.1 (2.6)	2.0 (1.7)
17. Howells River (Irony Mountain)	15.3 (2.8)	7.0 (0.5)	6.0 (1.6)	2.4 (0.4)	29.8 (8.7)	3.0 (1.1)
18. Howells river (Menihek Road)	11.1 (5.6)	6.7 (0.6)	4.6 (1.0)	2.1 (1.1)	25.6 (5.5)	4.2 (2.1)

Source: Drake (1981a).

[a] Indicates a significant mining impact.

Dubreuil (December 1979: 23-24) demonstrated that the physico-chemical characteristics of the water in Kata Creek, as reflected in conductivity and suspended solids, returned to normal within a few months of the cessation of pumping water from the Fleming 3 mine, but that the aquatic flora and fauna were recovering much more slowly.

For lakes in areas influenced by the geological constituents of the Labrador Trough, the predominant cation is Ca, and the usual order of concentration of major cations tends to be: Ca > Mg > Na > K. In Menihek Lake, the Ca:Mg ratio of 2.53 recorded by Duthie and Ostrofsky (1974) is typical of lakes lying on the dolomite, limestone and other sedimentary rocks of the Labrador Trough.

The highest alkalinity values in the Lakes Plateau region, a region of numerous water bodies connected by short streams and situated at a general elevation of 400-600 m, are also found in Trough lakes. Menihek Lake conforms with this observation, having an alkalinity value (as $CaCO_3$) of 14.3 mg/l (Scruton 1984). Shield lakes typically exhibit alkalinities in the range of 6-8 mg/l. Chloride concentrations in the Plateau lakes are low, owing to the relatively minor influence of the marine environment.

Among the metallic ions, only iron is present in significant amounts (0.05 mg/l) in Menihek Lake (Scruton 1984). Despite extensive mining activities in the Schefferville region between 1954 and 1982, iron concentrations in the Menihek system are much the same as for more remote lakes on the Plateau.

Menihek Lake's pH has been measured as 6.5. Duthie and Ostrofsky (1974) observed that this was among the higher pH values for lakes in western Labrador, due to the location of its drainage basin on the Labrador Trough. Lakes not associated with the Trough tend to have pH values of about 6.0.

Based on the literature, turbidity in the Plateau lakes rarely exceeds 6 JTU (a measure that approximates NTU), unless influenced by high runoff, as in Spring (Curtis February 2004). In relation to water softness, Scruton (1984) reports that the salinity of water bodies on the Lakes Plateau has a mean value of 6.1 mg/l, placing these freshwater bodies among the softest in the world.

Conductivity in Menihek Lake has been measured by Duthie and Ostrofsky (1974) as being 31 µmho/cm.

Dissolved oxygen in the Plateau lakes ranges from 8 mg/l to 13 mg/l, and lakes are usually near oxygen saturation during the open-water period. This is considered to be a function of the low biological productivity of the lakes, in combination with their lack of stratification. Some degree of oxygen depletion (72-77%) has been observed near lake bottoms immediately after ice-out (Duthie and Ostrofsky 1974). Such depletion, caused during the ice-cover period by the oxygen demand of organic sediments and organisms near the lake bottom, can be biologically important in small lakes or pools, where the total volume of water becomes significantly reduced in Winter (Curtis February 2004).

The Plateau lakes do not usually display any thermal stratification during the short Summer season, given the low solar energy input and the intensity of wind-induced water circulation (Duthie and Ostrofsky 1974; Scruton 1984). Maximum lake water temperatures reach 16-18^{o}C.

Ice thickness on lakes throughout the region reaches a maximum of about 1 m. Snow cover on the ice is also roughly 1 m thick, unless reduced by high winds. Thermal stratification in the lakes is typical under ice cover during late Winter, when near-bottom waters are warmed to 3.5-5°C (Penn 1971). This general feature of subarctic lakes is caused largely by geothermal heat. In conditions of low snow cover, near-surface lake water may also warm rapidly in response to solar radiation. In Spring, immediately after snowmelt from the ice cover, some lakes may have water temperatures of 4-5°C immediately below the ice (Penn 1971).

Water-sampling conducted for the LIOP in the Howells River basin in September, 2003 (Curtis February 2004); September and November, 2005, and March, late May and July, 2006 (Gartner Lee Limited July 2006) yielded the following results:

September, 2003

One sampling station was installed in each of Chimo, Rosemary, Fleming, Ione and Contact lakes.

As shown in Table 6.2, lake-water concentrations of Ca, Mg, K and Na ions were similar in each of the waterbodies sampled and are consistent with what would be anticipated for lakes with drainage basins associated with the mineral-rich rocks of the Labrador Trough (Penn 1971). The slightly alkaline pH values recorded are consistent with this observation, in that the lakes are well-buffered, as indicated by higher Ca ion concentrations than would be found in waterbodies of the Canadian Shield.

Table 6.2: Lake-Water Concentrations of Ca, Mg, K and Na Ions

Lake Sampling Station	Calcium Ion Concentration (Ca mg/l)	Magnesium Ion Concentration (Mg mg/l)	Potassium Ion Concentration (K mg/l)	Sodium Ion Concentration (Na mg/l)
Chimo	14.8	4.50	0.12	0.44
Fleming	8.34	2.89	0.12	0.54
Ione	3.65	2.20	0.17	0.48
Rosemary	8.37	3.00	0.14	0.55
Contact	9.03	3.06	0.14	0.51

Source: Curtis (February 2004).

Temperature, conductivity and dissolved oxygen measurements demonstrated that the conditions found in the Howells River system are largely typical of what would be expected for waterbodies associated with the Labrador Trough. The conductivity measurements, however, showed somewhat greater variability, ranging from 38.1 μmho/cm in Ione Lake to 102.0 μmho/cm in Chimo Lake. An unusual finding for subarctic lakes was a de-oxygenated layer of bottom water in Fleming Lake, from a depth of 5 m to bottom. The most likely cause, according to Curtis (February 2004), is a period of density stratification, during which time the oxygen demand of organics from an intense plankton bloom may have locally depleted oxygen from the bottom waters.

September and November, 2005, and March, late May and July, 2006

Surface water samples were collected from roughly 30 locations (Figure 6.2).

The overall water quality in the water features sampled (lakes, ponds, tributaries and Howells River) was excellent: the water was universally non-turbid (<1 NTU) and soft (hardness 20-60 mg/l; alkalinity 10-60 mg/l); most metals were below detection limits, except for some salts, Mn and Mg, which were present in very low concentrations.

One sample in the November 2005, sampling event contained elevated Pb concentrations, but, since Pb was almost undetected in the other sampling events, it does not appear to be a widespread or persistent result.

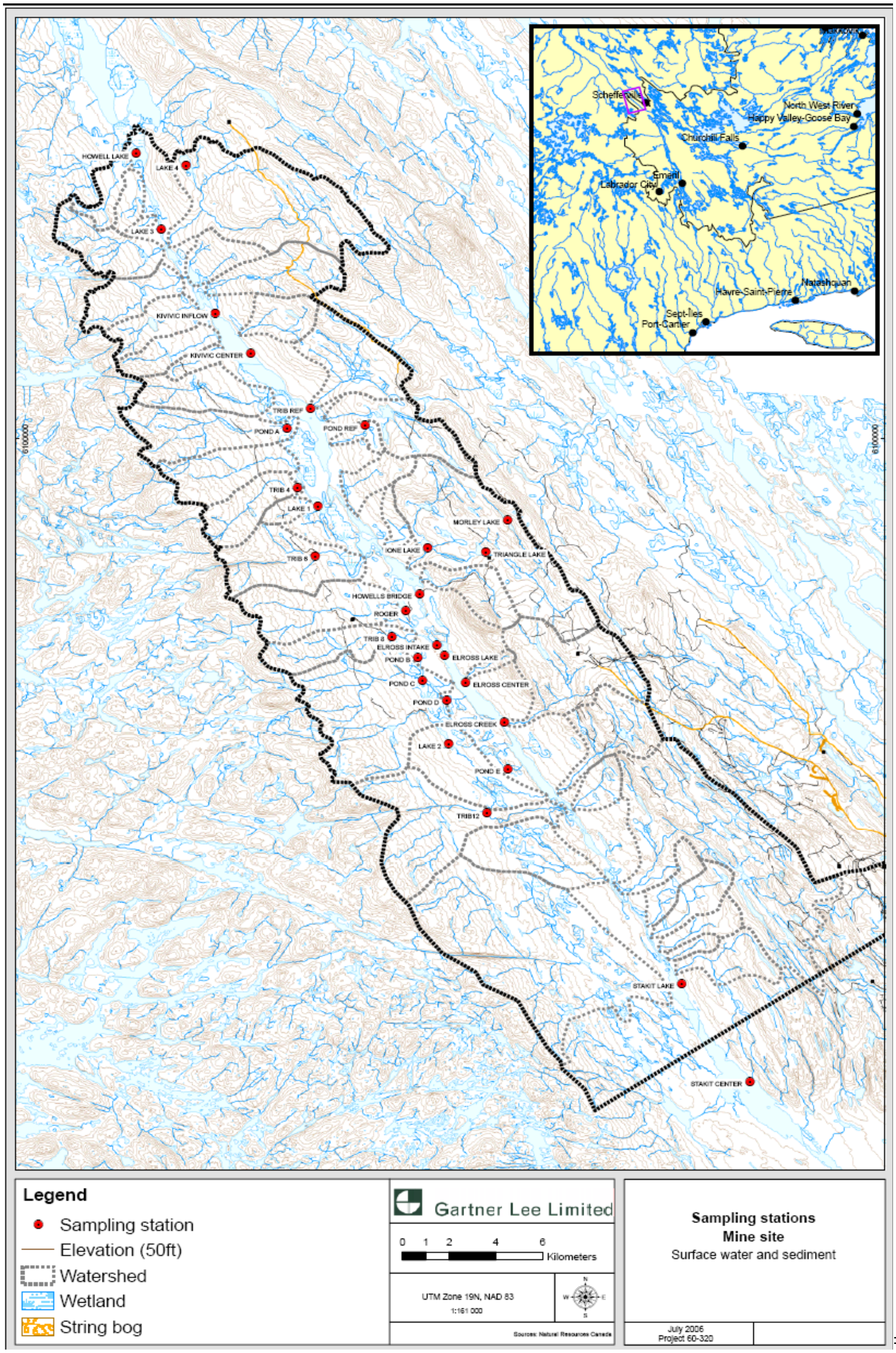
The water was nutrient-poor, while phosphorus (the limiting nutrient in the eutrophication of watercourses) was generally below 0.01 mg/l and always below 0.03 mg/l.

The physical parameters measured (including dissolved oxygen, temperature, pH, conductivity and TDS) were consistent with good water quality in such environments.

The conductivity measurements ranged from 0.019 μmho/cm to 0.14 μmho/cm.

No evidence of lake stratification was observed.

Figure 6.2: Location of Surface Water Sampling Stations in Howells River Basin, September and November 2005 and March, late May and July 2006



Source: Carreau (August 18, 2006).

6.6 AIR QUALITY

A report on ambient air sampling in the Howells River valley, from 29 August, 2006, to 20 October, 2006 (Lawson 2008) demonstrates that the particles in suspension, the concentration of metals and the particles inferior to 2.5 µm generally met air quality standards.

Table 6.3 presents the metals tested for and the range of concentration recorded for each of them. The presence of chrome and nickel, may reflect the intense use of helicopters and skidders near the station at the time of sampling.

Table 6.3: Results for Metal Concentrations – August to October, 2006

Metal	Range of concentrations (µg/m³)
Arsenic	< 0.00021 - < 0.00067
Beryllium	< 0.000021 - < 0.000067
Cadmium	< 0.00011 - < 0.00023
Chrome	0.0016 - 0.053
Lead	< 0.0011 - < 0.0034
Mercury	0.000007 - 0.00016
Nickel	0.00074 - 0.32
Vanadium	< 0.0011 - < 0.0023
Zinc	0.0064 - 0.057

Source: Lawson (2008).

Drake (1981b) reported that dust from the mine dumps in the vicinity of Schefferville could advance the date of snowmelt, but that this effect was very limited spatially and appeared to be of very limited persistence once the disturbance ceased.

6.7 SEISMICITY

The Schefferville station of the FDSN is located within the Eastern Background seismic zone, in which low-level but occasionally significant seismicity may occur. The region is seismically quiet in all directions from the station for more than 300 km (FDSN no date). Blasts from the mines near Labrador City are recorded several times weekly. They normally range from 2<MN<3.

7. DESCRIPTION OF BIOLOGICAL ENVIRONMENT

7..1 VEGETATION

The Schefferville area lies in the broad transitional zone between the boreal forest and the tundra, with a vegetation cover ranging from closed spruce forest to tundra at higher altitudes (Nicholson and Thom 1973; Jones 1976). The distribution of cover types is diverse and closely linked with drainage and microclimatic factors such as snow accumulation and exposure (Jones 1976).

Sectors 2 and 3 are located in the Taiga Shield Ecozone, which extends from coastal Labrador to central Northwest Territories (Gartner Lee Limited and Groupe Hemisphères December 2007).

Sectors 2 and 3 fall into two distinct ecoclimatic types: areas below about 680 m form part of the Low Subarctic Ecoclimatic region, while areas above 680 m are classed as Low Arctic Ecoclimatic Region (Acterre August 2006).

Acterre (August 2006) summarized the regional terrestrial ecosystems in the Howells River catchment as

> "Below 680 m the landscape is largely forested, with forested and non-forested wetlands in depressions. Below 680 m […] but above the lowest elevations along the river there are extensive areas of the xeric and submesic rock dominated communities, where tills have been scoured during glacial wasting. Submesic reindeer lichen woodlands are also common. Richer subhygric communities enriched by seepage occur in linear drainage channels between rapidly to well drained sites. At the lowest elevations along the river there are extensive wetlands formed by complexes of forested and non-forested fens. Wetland areas are interspersed with well drained sites composed primarily of mesic and submesic black spruce communities.
>
> Above 680 m a suite of largely treeless terrestrial ecosystems occurs that more closely resemble arctic tundra ecosystems of northern Labrador and Quebec. Treeless, mesic communities on deep till blankets dominate the landscape and are characterized by scattered dwarf birch, blackberry, bog blueberry, partridgeberry, reindeer lichens and feathermoss. Moister sites occur on protected areas on bouldery lag deposits where bog birch is much more productive and dominant, and may form a continuous cover that protects a richer herb flora. Feathermosses form a continuous cover in the moss layer. Wetlands occur in linear landscape depressions and are mostly medium rich fens on thin peats and are dominated by cotton grasses (*Eriophorum spissum*, *E. vaginatum*, *E. angustifolium*) and sedges (*Carex aquatilis*, *C. vaginatum*)."

A study conducted in the Ferriman area (Sector 2) (Ives 1961) defined and mapped three vegetation cover types: the lichen heath-rock desert; the woodland-heath transition zone;

and the sub-arctic woodland. Some years later, a classification of five different cover types was used for the Timmins 4 area (Sector 3) (Jones 1976). However, it is only with the study conducted by Waterway *et al.* (1984) that a list of native species is recorded, this time for six vegetation complexes broadly defined in the general Schefferville area. Table 7.1 presents the different categorizations used by Ives (1961), Jones (1976) and Waterway *et al.* (1984) in relation with one another.

Table 7.1: Vegetation Cover Types in the Schefferville Area

Ives (1961) Ferriman area	**Jones (1976)** Timmins 4	**Waterway *et al.* (1984)** Schefferville area
1. Lichen heath-rock desert	a) Bare ground	i) Alpine tundra
2. Woodland-heath transition	b) Discontinuous cover c) Continuous lichen mat with scattered woody plants	ii) Subalpine heath
3. Sub-arctic woodland	d) Continuous shrub	iii) Spruce-lichen woodland
	e) Sphagnum, mosses and sedge	iv) Shoreline
		v) Mire
		vi) Spruce-Feather Moss Forest

Source: Ives (1961); Jones (1976); Waterway *et al.* (1984).

Tables II-1 – II-6 (Appendix II) list the species that were identified by Waterway *et al.* (1984).

Spruce-feather moss forests occur only on moist and relatively nutrient rich sites.

Spruce-lichen woodlands cover well-drained valley sites.

Subalpine heath occurs at the transition between the spruce-lichen woodlands and the tundra vegetation found at higher altitudes. Heaths are fairly widespread and can easily be seen on Houston and Irony mountains and along parts of the Sunny Mountain road near Greenbush Lake.

Subalpine tundra vegetation covers Sunny Mountain and Irony Mountain.

Patterned mires vary from minerotrophically rich fens in areas influenced by runoff from dolomitic substrates to poor fens at other locations. Good examples of minerotrophically rich fens can be found near Greenbush Lake, near Albanel Lake, north of Astray Lake and just west of Iron Arm of Attikamagen Lake. A fen just east of Goodream Lake is unusual in the Schefferville area because of the large palsa mound found at its northern end. A complex of poor fens and marshy lake shores occurs in the area to the east of Dolly Ridge. They are more acidic and much poorer in vascular plant species than fens described above (Waterway *et al.* 1984).

Shoreline vegetation occurs along the larger rivers in the region and along lake shores (Waterway *et al.* 1984).

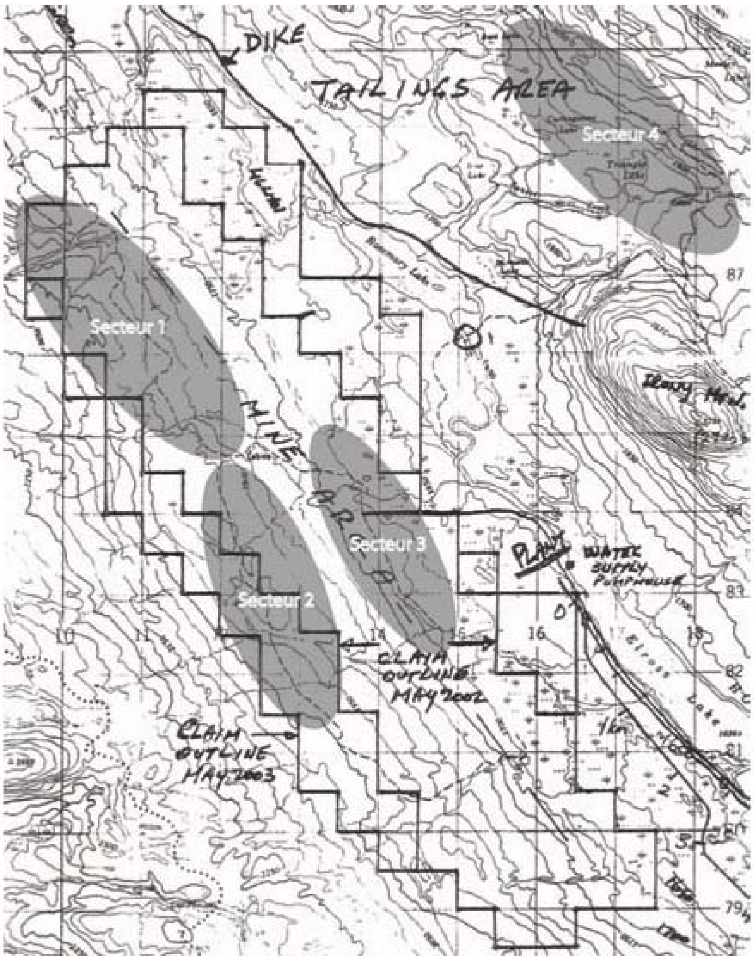
More recently, Gartner Lee Limited and Groupe Hémisphères (December 2007) conducted terrestrial ecosystem mapping of the study area of the LIOP using over twenty ecotypes and describing the vegetation diversity within each of them. They recorded similar vegetation species to Waterway *et al.* (1984). However, because the landscape differs greatly from the site of the Project – some of the infrastructure of which is located at higher altitudes – their data were not included in the tables in Appendix II.

7..2 FAUNA

7..2.1 Herpetofauna, Micro-mammals, Chiroptera and Insects

In a literature review conducted for the LIOP, Brunet et Duhamel (juillet 2005) identified those species of herpetofauna, micro-mammals and chiroptera that might be present in the Howells River valley and in the surrounding area, including Sectors 2 and 3. In Summer 2005, they conducted a survey. Figure 7.1 shows the four (areas) that they studied. A subsequent survey was undertaken in the Howells River basin in 2006.

Figure 7.1: Areas in Howells River Valley Sampled for Herpetofauna, Micro-mammals and Chiroptera



Source: Brunet et Duhamel (décembre 2005).

Micro-mammals

Based on the review of literature and on observations by Brunet et Duhamel, the following species of micro-mammals may be present in Sectors 2 and 3:

Table 7.2: Species of Micro-mammals Potentially Present and Recorded in the Schefferville Region

Common English Name	Common French Name	Scientific Name	Literature Review	2005 Survey	2006 Survey
Cinereus shrew	Musaraigne cendrée	*Sorex cinereus*	X	X	X
Meadow jumping mouse	Souris sauteuse des champs	*Zapus hudsonius*	X	X	X
Meadow vole	Campagnol des champs	*Microtus pennsylvanicus*	X	X	X
Northern bog lemming	Campagnol-lemming boréal	*Synaptomys borealis*	X		X
Pygmy shrew	Musaraigne pygmée	*Microsorex hoyi*	X		X
Rock vole	Campagnol des rochers	*Microtus chrotorrhinus*			X
Southern red-backed vole	Campagnol à dos roux de Gapper	*Clethrionomys gapperi*	X	X	
Star-nosed mole	Condylure à nez étoilé	*Condylura cristata*	X		
Ungava collared lemming	Lemming d'Ungava	*Dicrostonyx hudsonius*	X		
Water shrew	Musaraigne palustre	*Sorex palustris*	X		
Western heather vole	Phénacomys	*Phenacomys intermedius*	X	X	X
Woodland jumping mouse	Souris sauteuse des bois	*Napaeozapus insignis*			X

Source: Brunet et Duhamel (juillet 2005); Brunet et Duhamel (décembre 2005); Brunet, Duhamel et Léger (janvier 2008).

During the 2005 survey, the Southern red-backed vole was the most abundant micro-mammal and was found in all four areas (Figure 7.1), followed by the Western heather vole, which was found in three sectors.

Brunet et Duhamel (décembre 2005) interpreted the findings of the 2005 survey as indicating relatively low population densities, and they noted that inter-annual variations in the size of populations of micro-mammals are particularly great in northern latitudes. They speculated that such fluctuations might explain the absence of Ungava lemmings.

The Southern bog lemming (*Synaptomys cooperi*) was recorded in riverine and bog habitats between the 52nd and 53rd parallels of latitude south-west of Schefferville (Fortin *et al*. 2004). The following species were identified between 1999 and 2001, near the Manicouagan Reservoir close to the 51st parallel south of Schefferville (Fortin and Doucet 2003): Southern red-backed vole (*Clethrionomys gapperi*); Meadow vole (*Microtus pennsylvanicus*); Northern bog lemming (*Synaptomys borealis*); Southern bog lemming (*Synaptomys cooperi*); Western heather vole (*Phenacomys intermedius*); Cinereus shrew (*Sorex cinereus*); Pygmy shrew (*Microsorex hoyi*); Arctic shrew (*Sorex arcticus*); Meadow jumping mouse (*Zapus hudsonius*); Woodland jumping mouse (*Nepaeozapus insignis*); and Deer mouse (*Peromyscus maniculatus*).

Fortin and Doucet concluded (2003: 52) that the presence of a 95-m right-of-way for a distribution line in an area of boreal forest was enough to influence locally the relative abundance of certain species of micro-mammals. The richness of species and the total relative abundance of small mammals were not reduced in the right-of-way as compared to the adjacent mature forest. The Southern red-backed vole was the only species captured significantly less often in the right of way than in the mature forest.

According to Girard (November 2003), small mammals, such as Ungava lemmings (*Dicrostonyx hudsonius*), Common voles (*Microtus arvalis*) and Least weasels (*Mustela nivalis*) also occur.

Herpetofauna

Based on a review of the literature and on two surveys, the following species of herpetofauna are present or are likely to occur in the area:

Table 7.3: Species of Herpetofauna Potentially Present and Recorded in the Schefferville Region

Common English Name	Common French Name	Scientific Name	Literature Review	2005 Survey	2006 Survey
American toad	Crapaud d'Amérique	*Bufo americanus americanus*	X	X	X
Blue-spotted salamander	Salamandre à points bleus	*Ambystoma laterale*	X		
Mink frog	Grenouille du Nord	*Rana septentrionalis*	X		X
Northern green frog	Grenouille verte	*Rana clamitans melanota*			X
Northern spring peeper	Rainette crucifère	*Pseudacris crucifer crucifer*		X	
Northern two-lined salamander	Salamandre à deux lignes	*Eurycea bislineata*	X		
Wood frog	Grenouille des bois	*Rana sylvatica*	X	X	X

Sources: Brunet et Duhamel (juillet 2005); Brunet et Duhamel (décembre 2005); Brunet, Duhamel et Léger (janvier 2008).

The Wood frog and the Northern spring peeper were recorded in all four areas (Figure 7.1). The Northern spring peeper outnumbered the Wood frog in all four. The American toad was found only in Area 3.

Brown (June 2005) also recorded the American toad in the Howells River valley, and he was advised that it belonged to the *copei* subspecies.

No salamanders or snakes were recorded during the 2005 and 2006 surveys.

Brunet et Duhamel (juillet 2005) noted that few inventories of herpetofauna have been conducted in northern regions and that knowledge of the northern limits of the distribution of herpetofauna is consequently limited. Table 7.4 lists the species whose confirmed geographic distribution is limited to the south of Sectors 2 and 3, but that may nevertheless occur there.

Table 7.4: Species of Herpetofauna Potentially Present in the Schefferville Region

Common English Name	Common French Name	Scientific Name
Boreal chorus frog	Rainette faux-grillon boréale	*Pseudacris maculata*
Four-toed salamander	Salamandre à quatre doigts	*Hemidactylium scutatum*
Northern dusky salamander	Salamandre sombre du Nord	*Desmognathus fuscus*
Northern spring salamander	Couleuvre à ventre rouge	*Gyrinophilus porphyriticus*

Redbelly snake	Couleuvre à ventre rouge	*Storeria occipitomaculata*

The Northern spring peeper was found at several locations between Radisson and the Caniapiscau Reservoir close to the 53rd parallel of latitude west of the study area (Fortin no date(a)).

Fortin (no date(a)) did not record eggs of the Spotted salamander (*Ambystoma maculatum*) at any of the 20 stations sampled between Radisson and the Caniapiscau Reservoir, but he did record the northernmost occurrence of that species close to Mistissini, slightly north of the 50th parallel of latitude.

Fortin (no date(b)) recorded the Northern two-lined salamander close to the 54th parallel of latitude some distance west of Schefferville, and he cited other records south and south-east of Schefferville.

Chiroptera

According to Brunet et Duhamel's (juillet 2005) literature review, the Silver-haired bat (*Myotis lucifugus*) may be present in the Howells River catchment. One species, belonging to the *Myotis* genus, was identified by them during a 2005 survey.

A survey based on sound recordings of responses to broadcasts of bat vocalization conducted at two stations in the Howells River valley between August and October 2006 did not indicate the presence of any bats (Envirotel 3000 inc. février 2008)

Insects

In a literature review, Brunet et Duhamel (juillet 2005) identified those species of insects that may be present in the region of the Province of Québec encompassing Sept-Îles and Schefferville. Their findings are presented in Table III-1 (Appendix III).

In a survey of insects in the Schefferville region from August 10-11, 1974, Minot (no date) identified insects belonging to the following Orders: Coleoptera, Hemiptera, Hymenoptera, Lepidoptera, Plecoptera, Psocoptera, Trichoptera and Odonata.

In a conversation on 14 February, 2008, Mr Brian Skinner, MRNF, confirmed that knowledge about insects that may be present in northern Québec is very incomplete. MRNF cannot at this time provide a list of insects for northern Québec in general or for the Schefferville region in particular.

Appendix III also summarizes the results of a 10-day survey of butterflies in the Schefferville region in July, 1967 (Anthony March 1969).

Anthony (March 1969) noted that "Most of the species we took were extremely limited in their altitudinal and environmental preferences…"

None of the specimens came from the Howells River valley, but at least one was from the adjacent Irony Mountain.

7..2.2 Avifauna

Appendix IV summarizes observations of birds in the Howells River valley between 1983 and 2006.

The numbers of breeding waterfowl and shorebirds observed during the two-week survey conducted by Global Environnement/Golder Associates in mid-June to early July, 2005 (November 2005) were low, but that is probably attributable to the fact that waterfowl and shorebird nesting surveys in that area are best conducted in May (CQ-WBPS 2001) and that the major waterfowl flyways do not pass over or through the Schefferville and Howells River regions (Thomasson-Grant 1988).

According to Naskapi informants, the Howells River valley is used by geese and ducks from Spring to Fall. Girard (November 2003) reported sighting Canada geese (*Branta canadensis*) on the banks of Ione Lake. The wetlands around Kivivic Lake, as well as Boundary and Harris lakes, represent a refuge for waterfowl by serving as staging and nesting areas during Spring/early Summer. During the Fall migration, geese are said to rest and feed on berries on the hills bordering the valley on the east (Weiler November 2006).

Brown (June 2005) reports sighting many ospreys (*Pandion haliaetus*) within the Howells River catchment.

According to Brown (June 2005) the number of Bald eagles (*Haliaeetus leucocephalus*) that he observed south and east of the Howells River since 1989 is on the increase. The regular presence of Bald eagles in the catchment has been confirmed by Naskapi informants (Girard November 2003).

Brown (June 2005) reports sighting one Golden eagle (*Aquila chrysaetos*) in the Howells River valley in 1991, adding, however, that no eagle nest sites are known to exist there.

Rusty blackbirds (*Euphagus carolinus*) have been sighted in a swamp bordering Ione Lake (Girard November 2003).

Minaskuat Limited Partnership (January 2008) reports sighting a Northern goshawk in the Howells River valley in March 2006.

7.2.3 Big and Small Game

The species of big and small game observed by Brown (June 2005) along the Howells River between May and October over the 1983-2002 period include: caribou *(Rangifer tarandus)*; Black bear (*Ursus americanus*); Grey wolf (*Canis lupus*); beaver (*Castor* *canadensis*); otter (*Lutra canadensis*); mink (*Mustela vison*); ermine (*Mustela erminea*); Red fox (*Vulpes vulpes*); Red squirrel (*Tamiasciurus hudsonicus*); muskrat (*Ondatra zibethicus*); and Snowshoe hare (*Lepus americanus*). Although rare, moose (*Alces alces*) are known to travel as far north as the Schefferville region in spring and summer (Brown June 2005).

According to Girard (November 2003), who conducted field work in the area located north-west of Irony Mountain and Sector 3, in September 2003, Naskapis frequently observe wolves, ermines and porcupines (*Erethizon dorsatum*) in that area, while moose and Canada lynx (*Lynx canadensis*) are seen more rarely.

Brown (June 2005) notes that the most commonly observed mammal in the catchment is caribou. According to his observations, the precise direction in which caribou migrate in the Howells River catchment both in the Autumn and in the Spring is influenced first by the topography and second by old mine sites east of the catchment, the location of which coincides with Sector 3. The preferred migration routes of the caribou are high ridges and open black spruce-lichen forest. They have adapted to the formerly mined area by using old mining roads should they happen to be leading in the same direction as that in which they are migrating. The direction of caribou movements in the area of the old mine sites as observed by Brown and as evidenced by recently used trails is presented on Figure 7.2 and Photograph 7.1.

Based on information from a representative of FAPAQ, Girard (November 2003) concluded that the caribou using the area belong to the George River Herd and are at the southern limit of their usual range. The area is not used as a calving ground, and no protective measures for caribou are in force there.

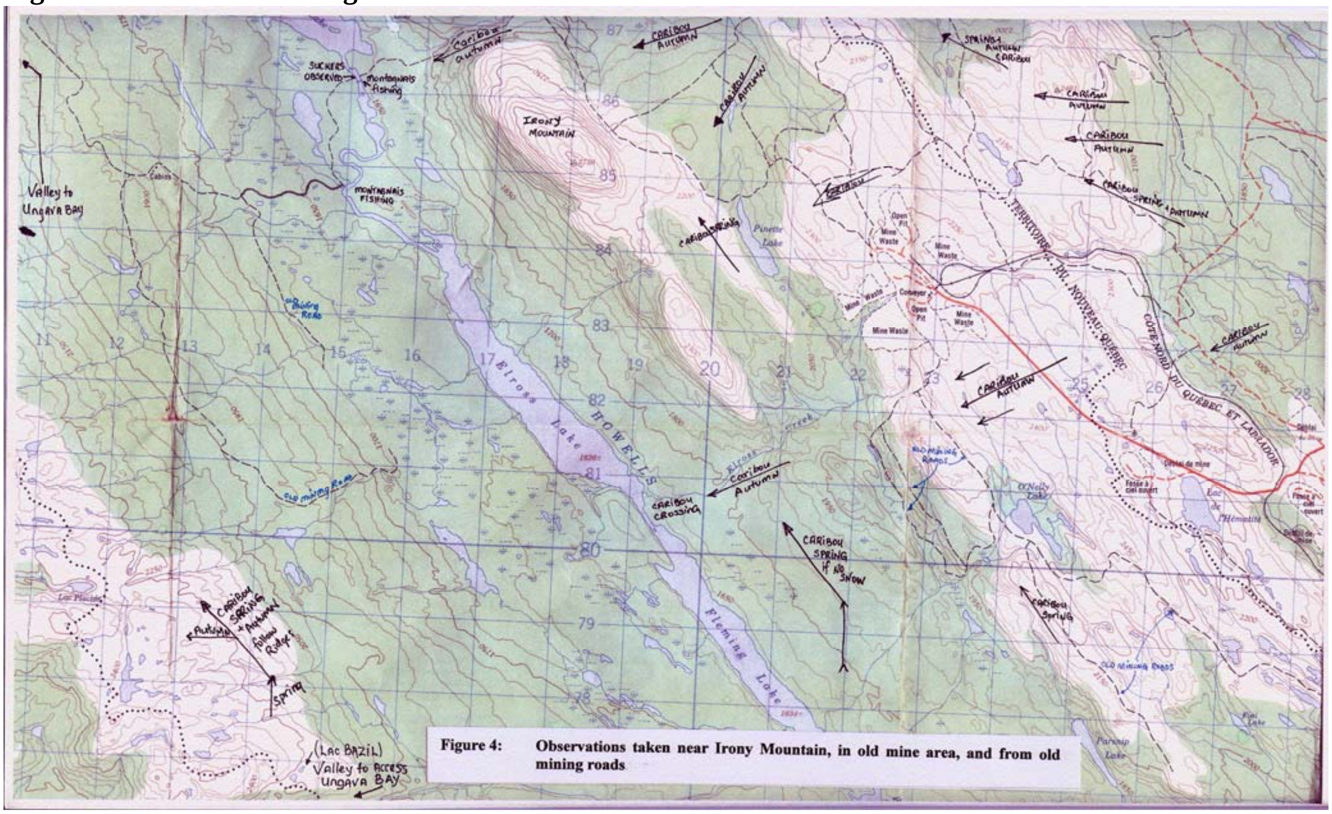
Minaskuat Limited Partnership (January 2008) reports sighting a a caribou during a field survey completed in the Howells River valley in March 2006, but it is uncertain whether it belonged to the Woodland caribou (lac Joseph) herd or the Barren Ground caribou (George River) herd, both of which occur in the area.

Thirty-three caribou were sighted in the lac Harris area during a monitoring programme for caribou movements that took the form of a weekly helicopter overflight between 28 July and 19 October, 2007 (NML January 2008).

The only sightings of wolves by Brown (June 2005) coincided with the presence of caribou, and he observed no denning sites.

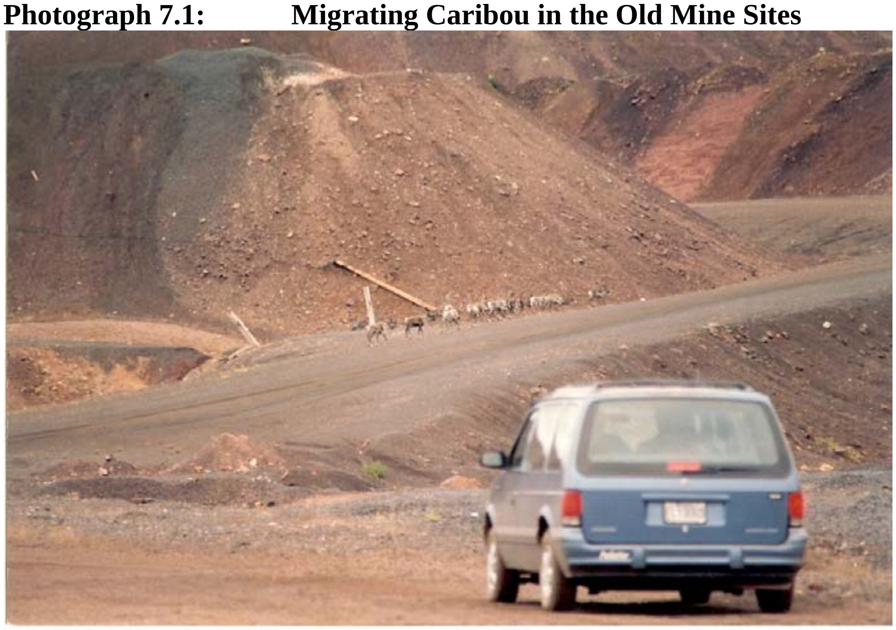
Brown (June 2005) observed on numerous occasions the presence of Black bears both in the old burns located adjacent to the lower portion of the Howells River and in the former mined area. According to him, individuals enter the area to gain access to the Schefferville landfill site. He observed no Black bear denning sites or cubs in the Howells River valley, but he did observe a female and two cubs near Greenbush Lake in the adjacent catchment area in 1995.

Figure 7.2: Caribou Migration Routes in and around Old Mine Sites



Source: Brown (June 2005).

Photograph 7.1: Migrating Caribou in the Old Mine Sites



Source: Brown (June 2005).

7.2..4 Fish and Fish Habitat

Table 7.5 presents the species of fish that have been recorded in the Schefferville region and in the Howells River basin.

Table 7.5: Fish Species Present in the Schefferville Region and in the Howells River Basin

Common English Name	Common French Name	Scientific Name
Brook trout	Omble de fontaine	*Salvelinus fontinalis*
Burbot	Lotte	*Lota lota*
Lake chub	Méné de lac	*Couesius plumbeus*
Lake trout	Touladi	*Salvelinus namaycush*
Lake whitefish	Grand corégone	*Coregonus clupeaformis*
Landlocked Atlantic salmon (ouananiche)	Saumon atlantique (ouananiche)	*Salmo salar*
Longnose sucker	Meunier rouge	*Catostomus catostomus*
Northern pike	Grand brochet	*Esox lucius*
Round whitefish	Ménomini rond	*Prosopium cylindraceum*
Slimy sculpin	Chabot visqueux	*Cottus cognatus*
White sucker	Meunier noir	*Catostomus commersoni*

Source: Scruton (1984), cited in Curtis (February 2004); Brown (June 2005); Weiler (November 2006); Lee (July 2006).

White and Longnose suckers usually comprise the most important component of fish biomass in the larger lakes of the region, where more than 50% of biomass may be composed of suckers and Lake trout (Scruton 1984). Brook trout is the dominant species in the smaller lakes. Individuals of that species have been observed in all aquatic habitat types encountered by Lee during visual surveys in the Howells River valley in September 2005 (Lee July 2006). According to his visual estimates, Brook trout ranged in age from young of the year (0+) to five-year-old (5+) individuals. Young of the year and 1+ were usually encountered in upwelling areas, on stream margins and in small side channels. Older Brook trout (5+) were generally present in pools, deeper sections and on pond margins (July 2006).

A DFO gill-net survey of western Labrador lakes in 1982 indicated that Lake trout accounted for 37% of the biomass of the salmonid catch (Scruton 1984, cited in Curtis February 2004).

Brown (June 2005) did not observe any juvenile ouananiche in any of the tributaries of the Howells River that he visited; nor did he observe any obstacles restricting passage anywhere along the river. However, a one-day angling survey conducted within a 3.5-km section of the Howells River immediately above Stakit Lake in September 2005 resulted in the capture of 16 juvenile ouananiche (Lee July 2006).

Ouananiche have been observed migrating up the Howells River every year from 1983 to 2002 in great numbers during August and September to spawn (Brown June 2005). Brown (June 2005) searched for the actual spawning beds and/or redds throughout the lower part of the Howells River without success, not having observed any spawning behaviour or witnessed any alevins or kelts. He speculated that spawning may take place between Fleming and Stakit lakes.

Brown (June 2005) believes that 1,000 to 1,500 ouananiche may spawn in the Howells River each year, and that the Howells River represents critical habitat for it.

It appears that the population of ouananiche in the Howells River has what it needs in order to sustain its long-term health (Brown June 2005). Essentially, its survival depends on food, cover, reproduction and water quality, all of which are currently provided directly or indirectly through its use of appropriate habitat types (spawning sites, rearing areas, growth and feeding areas and passable migration routes).

According to Curtis (February 2004), the fact that Lake trout are present in Ione Lake was unanticipated, given that this species is not generally found in such small water bodies. He believes that the fact that the fish of Ione Lake and its tributaries appear to be isolated from those of the lower Howells River system by a 3-m waterfall on the stream connecting Ione Lake to Rosemary Lake may mean that the fish in Ione Lake are genetically distinct from those in other parts of the Howells River watershed. The degree of genetic distinctness would depend upon the time during which the fish have been isolated and the selective forces acting on them over that timeframe. Observations of the general appearance of the fish did not reveal any overt evidence of their being morphologically different from fish in other parts of the Howells basin.

The former Timmins 2 mine, in which it is proposed to store tailings, is not connected to any natural waterbody (Balakrishnan 7 April, 2008). We assume, therefore, that it does not contain any fish, although that assumption will be tested by experimental fishing. At a meeting held on 23 April 2008, several Naskapi informants expressed the conviction that there are indeed no fish in Timmins 2.

7.2.5 Traditional Ecological Knowledge

Appendix VI contains preliminary data on some of the Traditional Ecological Knowledge of the members of the NNK.

They reveal the following:

- there are several ashkui (areas of permanently open water in Winter) along the Howells River, but none in the area that will be directly affected by the Project;

- caribou cross the study area predominantly in a south-west to north-east direction;

- there are no recent camps in the area that will be directly affected by the Project;
- beavers are rare in the area, and none were recorded in the area that will be directly affected by the Project.

7.3 SPECIES WITH STATUS AND LIKELY TO BE DESIGNATED

Appendix V summarizes knowledge of species with status or likely to be designated.

Table 7.6 lists the only such species the presence of which has actually been confirmed in the Howells River valley.

Table 7.6: Species with Status or Likely to be Designated Present in the Howells River Valley

Common English Name	Common French Name	Scientific Name	SARA Status	COSEWIC Status	Status in Québec	Status in Labrador
Rock vole	Campagnol des rochers	*Microtus chrotorrhinus*	---	---	Likely to be designated	[1]
Bald eagle	Pygargue à tête blanche	*Haliaeetus leucocephalus*	---	---	Vulnerable	---
Golden eagle	Aigle royal	*Aquila chrysaetos*	---	---	Vulnerable	---
Rusty blackbird	Quiscale rouilleux	*Euphagus carolinus*	---	Special concern	---	---

[1] There are no endangered species of small mammals in Labrador, but the GNL asked to be informed of any occurrences of Rock vole (Rodrigues June 27, 2006).