composed of diatoms, which made up more than 99% (numerically) of the sampled periphyton. The most common diatom species found in streams were *Diatoma tenue*, *Achnanthes minutissima*, and *Diatoma tenue elongatum*. Mean periphyton taxa richness ranged from 8 genera/sample at Windy Outflow to 13 genera/sample at Patch and P.O. outflows. Simpson's diversity indices for periphyton communities were relatively high at all sites (0.64 to 0.86) except Windy Outflow (0.32).

3.3.2 Benthic Invertebrates

Comprehensive lake and stream benthos baseline sampling programs were conducted in lakes/ponds and streams in the Madrid Area in 2009 (Rescan 2010f, 2011g). Additional baseline data are available for some lakes from 1995 to 1998, 2000, and 2006 to 2010, and for some streams from 1996, 1997, 2000, and 2006 to 2009 (Table 1.1-1; Figure 2.5-7).

Most lakes in the Madrid Area had benthos densities lower than 4,000 organisms/m^2, with densities ranging from 159 organisms/m^2 in Glenn Lake to 23,600 organisms/m^2 in Imniagut Lake in 2009. Lake benthic communities were generally dominated by dipterans (44 to 100% of organisms numerically), although pelecypods, ostracods, and oligochaetes were also common. Benthic communities in Wolverine and P.O. lakes differed slightly. In these lakes, dipterans comprised smaller fractions of the benthic communities (~15%, numerically) while pelecypods and ostracods were more numerous. Benthic genera richness and Simpson's diversity index were generally higher in the shallow depth zone compared to the mid and deep depth zones of lakes. Within the shallow depth zone, genera richness ranged from 2 genera/sample in Glenn Lake to 10 genera/sample in Wolverine Lake and Simpson's diversity ranged from 0.30 in Glenn Lake to 0.75 in Imniagut Lake.

Stream benthos density ranged from 3,160 organisms/m^2 in Patch Outflow to 12,300 organisms/m^2 in Ogama Outflow in 2009. Stream benthos assemblages were dominated by dipterans, which represented 43 to 88% of the stream benthic organisms. Nematodes, oligochaetes, and ostracods were also common in the study area, although they were not present at all sites. Benthic richness was consistent across streams in the Madrid Area, ranging from 14 to 16 genera/sample. Simpson's diversity was also similar across streams, ranging from 0.66 in Ogama Outflow to 0.83 in P.O. Outflow.

3.3.3 Fish Habitat and Fish Community Sampling

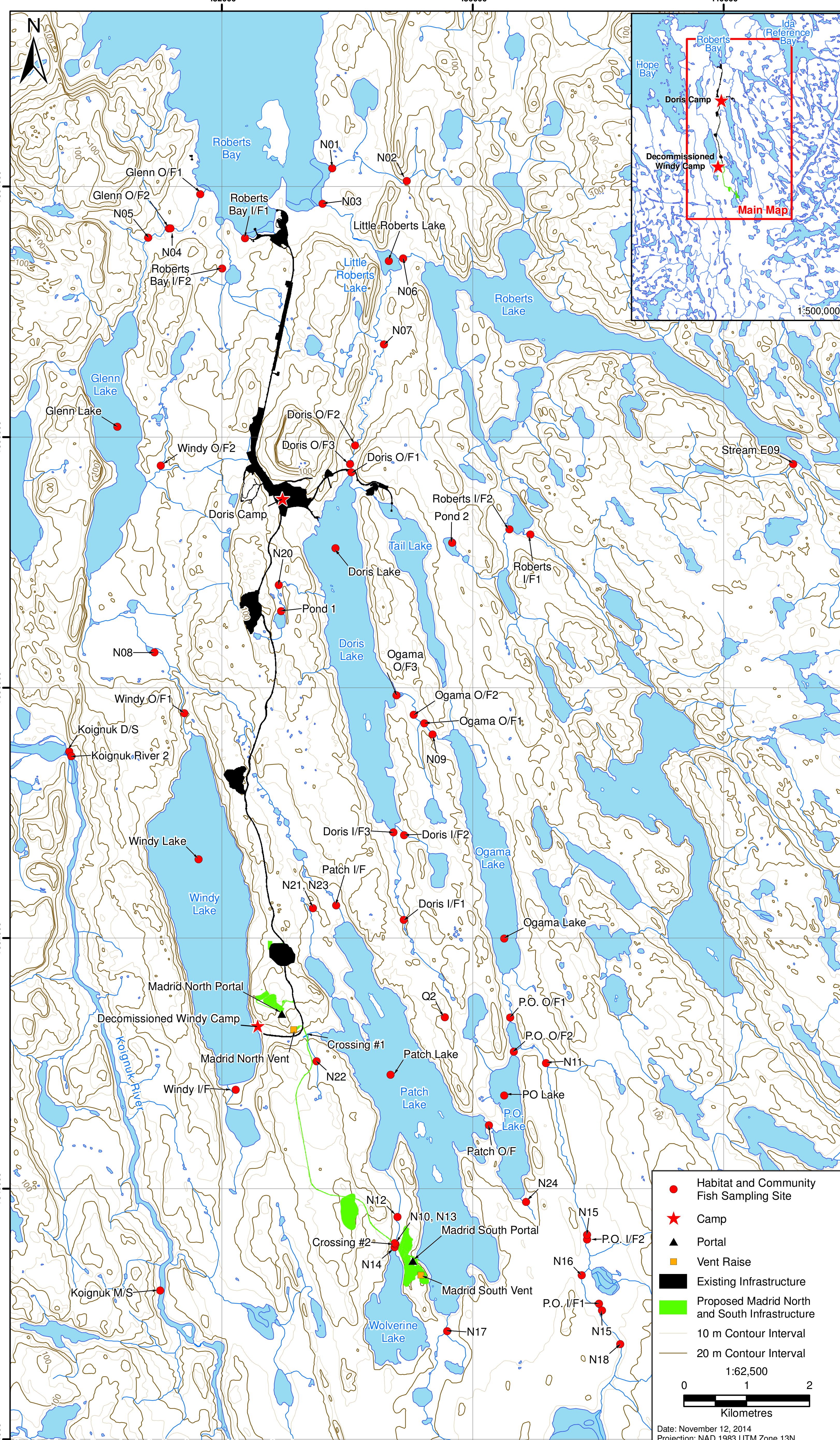
Baseline fish studies were conducted in the Belt from 1993 to 2009. Comprehensive baseline programs were also carried out in 2009 and 2010 within the Madrid Area (Rescan 2010f, 2011a). Baseline fish habitat and fish community information was collected for multiple waterbodies (i.e., lakes/ponds and streams) located adjacent to or at proposed infrastructure over these two years (Figure 3.3-1).

Fish habitat, defined as those environmental components that are required either directly or indirectly by fish to carry out their life processes, including spawning and rearing areas, food production areas, migration routes, and over-wintering areas, was assessed using a variety of methods. Lake and pond habitat was evaluated using hydroacoustics and/or visual observations, whereas streams were evaluated using either the detailed Fish Habitat Assessment Procedure (FHAP) or Sensitive Habitat Inventory Mapping (SHIM) survey methods depending on the site and potential infrastructure effects on the site.

Lakes were the predominant form of fish habitat in the Madrid Area and supplied the greatest amount of perennial fish habitat. A total of eight lakes from the Madrid Area were included in baseline studies, ranging in surface area from 83.1 ha (P.O. Lake) to 1,062.8 ha (Reference Lake B). Fines (e.g., silt clay or mud) were found to be the predominant substrate type in lakes. Reference lakes showed relatively higher percentages of hard substrates such as bedrock and boulder, while Patch Lake showed concentrations of fish associated with deepwater habitat over substrates of mud or fines. Ponds (maximum depth is <3 m) assessed in the Madrid Area were rated as having limited habitat.

Figure 3.3-1

Fish Habitat and Fish Community Sampling in the Madrid Area, 2009 to 2010



The SHIM method is used as a standard for watercourse and fish habitat mapping in British Columbia; methods were tailored and adapted for streams encountered in Nunavut (Mason and Knight 2001). This method attempts to ensure the collection and mapping of reliable, high quality, current and spatially accurate information about fish habitats and watercourses. It is particularly helpful for providing the necessary information when assessing the potential effects of specific infrastructure on fish and fish habitat.

Overall, channel and instream habitat characteristics were similar among streams and typical of slow moving streams flowing through tundra wetlands. Mean channel gradients ranged from 1 to 3.5 % and the dominant habitat unit was wetland. Instream vegetation was the dominant cover type. Deep pools were rarely observed. Organic material was the dominant substrate type in all streams. Hard rocky substrates were rarely observed. Ninespine Stickleback was the only fish species identified in the assessed streams. Overall, habitat quality was generally marginal except in N15 (upstream of Ogama Lake, in which overall habitat quality was classified as important.

Information collected through FHAP surveys indicated that streams in the Madrid Area were generally ephemeral and offered temporary habitat for fish during the spring and early summer months. Outflow streams from lake sources were relatively larger and permanent (e.g., Patch Outflow). These streams supplied relatively high quality habitat, especially for small-bodied fish species such as Ninespine Stickleback (*Pungitius pungitius*). Juvenile Lake Trout (*Salvelinus namaycush*) and Arctic Char (*Salvelinus alpinus alpinus*) were also observed utilizing these large streams for rearing habitat. High quality habitat was also found in P.O. Inflow, P.O. Outflow, Windy Inflow, and N15.

Large-bodied fish communities in lakes were assessed using RISC standard monofilament gillnets and with hydroacoustic gear at Patch Lake. The fish community of stream sites was primarily assessed using backpack electrofishing gear. Fish communities were defined in terms of total number and number-by-species at each sampling location, total Catch-Per-Unit-Effort (CPUE) and species-specific CPUE for each type of assessment gear. Biological features of fish such as length, weight, condition, age and diet were also measured as were tissue metal concentrations.

Specific information with regards to fish habitat and fish community sampling throughout the Madrid Area and pertinent adjacent areas is summarized in Section 4.

4. Fisheries

4. Fisheries

4.1 BACKGROUND

The Madrid Area bulk sample sites are located south of Doris North camp within the Windy-Glenn and Doris-Roberts watersheds (Figure 2.5-2). The Windy-Glenn Watershed originates just south of Windy Lake; it drains north through Windy Lake and then Glenn Lake before discharging into the ocean at Roberts Bay. In the Doris-Roberts Watershed, Wolverine Lake drains into Patch Lake in the upper reaches of the watershed. The watershed then drains through a series of lakes, including P.O., Ogama, and Doris Lake. Downstream of Doris Lake, Doris Creek flows over a 4 m high waterfall, and then joins the Roberts Watershed in Little Roberts Lake (downstream of Roberts Lake). Roberts Creek flows from Little Roberts Lake northwest for approximately 1.5 km where it enters Roberts Bay. The EIS for the Doris North Mine (Miramar 2005) was approved in 2006; this document described the environmental setting for the Doris Watershed adjacent and downstream of the mine, including Doris Lake and Little Roberts Lake. These two lakes will not be addressed further in this application as the EIS (Miramar 2005) provided a comprehensive review.

The proposed Madrid South bulk sample site is located on a narrow section of land between Patch Lake (to the east) and Wolverine Lake (to the west). This site falls completely within the Doris-Glenn Watershed. A new access road 5 km in length would extend south from the existing Windy - Doris Camp road. The proposed access road would primarily be located within the Doris-Roberts Watershed; a section less than 1 km in length would be in the Koignuk Watershed (Figure 2.5-2). The section of road in the Koignuk Watershed is located on top of a ridge far from any Koignuk Watershed waterbody. This section of road will not directly or indirectly impact the Koignuk Watershed, so this watershed will not be assessed further in this application.

This road extension would require two crossings (Figure 2.5-2). The most northern crossing (Crossing #1) is located slightly upstream of an inflow to Patch Lake, whereas the more southern crossing (Crossing #2) is situated at one of the outflows (most southern end) of Wolverine Lake (inflow to Patch Lake). Only Crossing #2 is fish-bearing (with confirmed ninespine stickleback). It is currently anticipated that closed-bottom culverts will be installed at these two locations since neither crossing location contains fish that are part of a recreational, commercial or Aboriginal fisheries, or that support such a fishery, as per the *Fisheries Act* (1985).

The Madrid North bulk sample site is located adjacent to the existing Windy Lake Camp between Patch Lake and Windy Lake (Figure 2.5-2), straddling the divide between the Windy and Doris Watersheds. Access to this site would utilize the existing Windy - Doris Camp road.

Extensive fish and fish habitat studies have been completed in waterbodies around the Madrid Area bulk sample sites between 1995 and 2013 (Table 4.1-1). The following section summarizes historical sampling for lakes and streams in the Doris-Roberts and Windy-Glenn watersheds downstream of the Madrid Area. Waterbodies are organized by watershed; within watersheds they are ordered from upstream to downstream.

Table 4.1-1. Historical Sampling of Freshwater Fish Habitats and Fish Communities in Waterbodies Adjacent to the Madrid Advanced Exploration Program Area, 1995 to 2013

Watershed	Waterbody or Site	Environment	Species	Sampling Years
Doris-Roberts	Wolverine Lake	Lake	CS, NSB	2006, 2007, 2008
	Imniagut Lake	Lake	N/A	Not sampled; to be sampled in 2014
	Patch Lake	Lake	CL, LT, LW, NSB, CS	1995 to 1999, 2006 to 2009
	P.O. Lake	Lake	CL, LT, LW, NSB	2006, 2007, 2009
	Ogama Lake	Lake	CL, LT, LW, NSB	1996, 2006, 2007, 2009
	Wolverine Outflow	Stream	NSB	1997, 2010
	Imniagut Outflow	Stream	N/A	Not sampled; to be sampled in 2014
	Patch Outflow	Stream	N/A	2006, 2009
	P.O. Outflow	Stream	NSB	2006, 2007, 2009
	Ogama Outflow	Stream	LT, LW, CL, NSB	1995, 1997, 2005 to 2007, 2009, 2010
Windy-Glenn	Nakhaktok Lake	Lake	N/A	Not sampled; to be sampled in 2014
	Windy Lake	Lake	LT, LW, CL, NSB	1996, 1997, 1999, 2008, 2009, 2012, 2013
	Glenn Lake	Lake	AC, LT, LW, CL	1997, 2000, 2006, 2007, 2009
	Nakhaktok Outflow	Stream	N/A	Not sampled; to be sampled in 2014
	Windy Outflow	Stream	LT, NSB, AC	1996, 1997, 2003, 2009, 2010
	Glenn Outflow	Stream	AC, LT, NSB, CCG, SFL	1997, 2000, 2003, 2009, 2010

*Fish Species Codes: CS = Least Cisco**, *NSB = Ninespine Stickleback, CL = Lake Cisco**, *LT = Lake Trout, LW = Lake Whitefish, AC = Arctic Char, CCG = Slimy Sculpin, SFL = Starry Flounder, N/A = fish community not sampled*
** It is difficult to identify Cisco to the species level, so these identifications should be interpreted with caution.*

4.2 DORIS-ROBERTS WATERSHED

4.2.1 Wolverine Lake and Outflow

Fish community baseline data were collected from Wolverine Lake in 2006, 2007, and 2008 (Golder 2008a, 2008b, 2009e). Over 4,000 fish were sampled using a range techniques and only two species were caught; Least Cisco (Coregonus sardinella) and Ninespine Stickleback (Table 4.1-1). The Least Ciscoes in Wolverine Lake were significantly smaller than in other local lakes, possibly due to the small, isolated size of the lake and the lack of a predatory fish species (Golder 2009b). No habitat data exists for Wolverine Lake.

Wolverine Lake has two outflows that connect this lake to Patch Lake; one flows to the north (Crossing #2) and one to the east. Both channels were sampled once for fish community in 1997 and once for habitat in 2010. Habitat assessments found that neither outflow has a clearly defined channel, as water seeps through vegetation over a broad area. Both channels are ephemeral, typically containing flowing water only during snow melt in spring. Water depth is minimal even during spring snowmelt (maximum water depth was 20 cm during 2010 spring surveys), there are no pools, and habitat is generally of poor quality (Rescan 2011b).

During 1997 spring freshet sampling, Ninespine Stickleback were caught in both outflows immediately upstream of Patch Lake (includes Crossing #2). The sample sites were described as flooded wetlands, reflecting the ephemeral nature of the channels. Both outflows of Wolverine Lake provide limited seasonal rearing habitat for juvenile and small-bodied fish during spring freshet. However, the connectivity between Patch Lake and Wolverine Lake appears to be limited.

4.2.2 Imniagut Lake and Outflow

The fish community and habitat quality of Imniagut Lake and Outflow have not previously been sampled; however, sampling of these waterbodies is scheduled for 2014.

A Sensitive Habitat Inventory and Mapping (SHIM) survey was completed on an inflow to Imniagut Lake in 2010 (Rescan 2011b). A section of creek 1,873 m in length was assessed, ending at the confluence with Imniagut Lake. Channel morphology was primarily a mixture of riffles and flooded wetlands. This inflow does not provide overwintering habitat due to its shallow depth and limited pool habitat. The overall habitat in this tributary was rated as marginal.

An assessment of the outflow of Imniagut Lake has not been completed, but aerial photographs indicate that it discharges into Patch Lake through a short outflow channel (approximately 50 m in length). Connectivity for fish movement between Patch Lake and Imniagut Lake has not been assessed.

4.2.3 Patch Lake, Outflow and Inflow

Fish community studies were conducted at Patch Lake from 1995 to 1999 and from 2006 to 2009, including an extensive Lake Trout population estimation study in 2007. Based on these studies, the fish community is composed of Lake Trout, Lake Whitefish (*Coregonus clupeaformis*), Least Cisco, Lake Cisco (*Coregonus artedii*) and Ninespine Stickleback (Table 4.1-1). CPUE for each fish species was highly variable between years due to various gillnet mesh sizes used for each study. The abundance of the three large-bodied species were relatively similar, regardless of gillnet mesh size. Mean fork length for Lake Trout and Lake Whitefish ranged from 433 to 702 mm and 372 to 475 mm, respectively. Lake Cisco fork length showed consistency between studies, ranging from 225 to 267 mm. Lake Whitefish showed the highest mean condition with values ranging from 1.20 to 1.33 g/mm^3 among studies. Ranges in mean condition for Lake Trout and Lake Cisco were considerably lower, ranging from 0.94 to 1.03 g/mm^3 and 0.77 to 1.09 g/mm^3, respectively. Stomach contents, sampled from Lake Trout and Lake Whitefish in 2008, indicated that Lake Trout fed predominantly on fish at time of sampling, while Lake Whitefish fed on isopods, gammarids and chironomids. Samples of muscle and liver were taken from Lake Trout and Lake Whikefish between 1995 and 1998 for baseline metals analyses.

Patch Lake Outflow is a short section of stream (less than 200 m) that connects Patch Lake to P.O. Lake. Beach seining in the outflow did not catch fish in 2006, but Lake Trout and Ninespine Stickleback were observed in the outflow during habitat assessments in 2009 (Table 4.1-1). The outflow appears to provide good connectivity between Patch and P.O. Lake, and the lower section (closer to P.O. Lake) provides the best quality fish habitat.

An eastern-flowing water source flows into Patch Lake at its northwestern end. The proposed road crossing (Crossing #1) is located along the drier and mostly underground headwater portion of this inflow; however, to the west and slightly upstream, the inflow consists of ephemerally-connected ponds. The most downstream reach situated just upstream of the lake is relatively steep (measured 8% near the mouth). The inflow is considered non-fish bearing; no fish were captured during fishing surveys conducted in 2010 (either through electrofishing along the inflow or minnow traps set in the ponds situated upstream).

4.2.4 P.O. Lake and Outflow

Fish community studies were conducted on P.O. Lake in 2006, 2007 and 2009. Lake Trout, Lake Whitefish, Lake Cisco and Ninespine Stickleback were captured in all studies (Table 4.1-1). Relative abundance of fish species varied among years. In 2006 and 2007 the predominant species captured was Lake Whitefish, while the Lake Cisco were the predominant species in 2009. Mean length of all species was consistent among study years. The range in mean fork length for each species was: Lake Trout (494 to 597 mm); Lake Whitefish (365 to 408 mm); and Lake Cisco (209 to 227 mm). Mean fork length of Ninespine Stickleback was 47 mm. Mean condition of Lake Whitefish in P.O. Lake was high relative to other lakes in the Project area, with means ranging from 1.36 to 1.53 g/mm3. Lake Trout displayed lower condition, with means ranging from 0.84 to 1.10 g/mm^3. The predominant food items observed through stomach content analysis of Lake Trout conducted in 2009 included chironomids and fish, while amphipods were the main diet of Lake Whitefish at time of fishing. Muscle and liver tissues were also sampled from Lake Trout (n = 10) and Lake Whitefish (n = 4) in 2009 for the evaluation of baseline metals concentrations.

P.O. Lake Outflow flows through a small lake (sometimes referred to as P.O. Connector Lake) and connects P.O. Lake to Ogama Lake. Fish community and fish habitat studies were conducted in 2006, 2007 and 2009. Ninespine Stickleback were the only fish species captured using electrofishing and beach seining gear. The mean fork length of fish captured ranged from 36 to 48 mm, while the mean condition was 0.97 g/mm^3 reported in 2009. The habitat value was highly rated due to varied habitat types and abundant cover for fish.

4.2.5 Ogama Lake and Outflow

Fish community studies were conducted at Ogama Lake in 1996, 2006, 2007 and 2009. The fish community was consistent with other lakes in the Doris Watershed, and included Lake Trout, Lake Whitefish, Lake Cisco and Ninespine Stickleback (Table 4.1-1). Lake Cisco was the most abundant large-bodies species in the catch. Lake Trout were the largest species captured with mean fork lengths ranging from 291 to 646 mm, while Ninespine Stickleback were the smallest with a mean fork length of 58 mm. Lake Trout displayed relatively low condition with means ranging from 0.89 to 0.93 g/mm^3 among study years. Lake Whitefish had the highest mean condition, ranging from 1.24 to 1.29 g/mm^3. Diet and tissue metal concentration data are not available for Ogama Lake.

Ogama Outflow was studied for fish habitat and fish community in 1995, 1997, 2005, 2006, 2007, and 2009. The fish community was represented by four species: Lake Trout, Lake Whitefish, Lake Cisco and Ninespine Stickleback (Table 4.1-1). Lake Trout were the largest species captured, with mean fork lengths ranging from 389 to 535 mm. Ninespine stickle back were the smallest fish captured with mean fork lengths ranging from 43 to 56 mm. Lake Whitefish displayed the highest mean condition at 1.56 g/mm^3, while Lake Trout had the lowest mean condition at 1.08 g/mm^3. Additional fish community variables such as diet and tissue metals were not examined in past studies.

Ogama Outflow is characterized by long stretches (i.e., 100 m) of riffle and glide habitat, and short stretches (i.e., 10 m) of pool habitat. Stream gradient ranged from 1.2 to 4.0%. Stream channel dimensions ranged from 4.0 m to 12.2 m for bankfull width, and 1.5 m to 2.2 m for bankfull depth. While the primary bed material present was fines, there was a diverse mixture of substrates, at least relative to other streams within the Project area. The major source of cover for fish within Ogama Outflow was instream cover. Trace amounts of overhanging vegetation and large woody debris were also present. Overall habitat quality was rated as marginal.

4.3 WINDY-GLENN WATERSHED

4.3.1 Nakhaktok Lake and Outflow

Nakhaktok Lake is a small lake in the upper reaches of the Windy Watershed. The fish community and fish habitat of this lake have not been sampled.

The lake discharges into a wetland area that lacks a clearly defined channel. Field crews working in Windy Lake noted that discharge between Nakhaktok Lake and Windy Lake is braided and ephemeral, and there is likely poor connectivity for fish between these lakes.

4.3.2 Windy Lake and Outflow

Fish habitat and fish community studies were conducted on Windy Lake and Outflow in 1996, 1997, 1999, 2008, 2009, 2010, 2012, and 2013 (Table 1.1-1). The fish community consists of Lake Trout, Lake Whitefish, Lake Cisco, and Ninespine Stickleback (Table 4.1-1). Gillnet CPUE show that Lake Cisco were captured in the highest relative abundance in most studies. Compared to Lake Trout sampled from other lakes in the Project area, Lake Trout sampled from Windy Lake are relatively large. Mean fork length for Lake Trout from Windy Lake ranged from 434 to 910 mm. Lake Cisco were also relatively large with mean fork lengths ranging from 291 to 344 mm. The mean condition of Lake Trout and Lake Cisco ranged from 1.04 to 1.12 g/mm^3, and from 0.93 to 1.11 g/mm^3, respectively. Stomach contents of Lake Trout and Lake Cisco examined in 2008 and 2009 indicated that Lake Trout fed primarily on gammarids, amphipods and fish, while Lake Cisco fed predominantly on mysids. Muscle and liver tissues collected from Lake Trout in 1999 and 2009 showed similar levels of mercury.

Windy Lake was selected for an enhancement project to partly compensate for impacts to fish habitat caused by infrastructure construction. Compensation and reference sites were selected in 2010 and shoals were constructed in 2011 (Figure 4.3-1). Two years of monitoring (2012 and 2013) have tracked the development of periphyton, invertebrate, and fish communities at enhancement sites. Two compensation shoals and one natural shoal reference site are located adjacent to the shoreline immediately to the west of the proposed Madrid North bulk sample sites.

The fish community and habitat of Windy Lake Outflow was sampled in 1996, 1997, 2003, 2009, and 2010 (Table 1.1-1). Windy Outflow is composed of pool, riffle and glide habitat types. Stream gradient ranged from 0 to 1.3%, while the stream bank dimensions ranged from 4.5 m to 9.2 m, for bankfull width, and 0.8 m to 1.5 m, for bankfull depth. The stream bed material was predominantly composed of fines. The total amount of cover available for fish within the stream was abundant, ranging from 78 to 90%. Overall habitat quality was rated as marginal.

Lake Trout, Ninespine Stickleback and Arctic Char (a single juvenile) have been captured in Windy Outflow (Table 4.1-1). Anadromous Arctic Char overwinter in Glenn Lake, but have never been caught in Windy Lake despite extensive sampling. A section of the creek between Windy and Glenn Lake may restrict the ability of migrating Arctic Char to reach potential overwintering habitat in Windy Lake. During habitat surveys, this section was described as a “marshy area” and it was noted that the channel was poorly defined, creating a seasonal restriction when anadromous fish return in the fall.

4.3.3 Glenn Lake and Outflow

Studies of Glenn Lake fish habitat and fish community were conducted in 1997, 2000, 2006, 2007 and 2009. The fish community comprised Arctic Char, Lake Trout, Lake Whitefish and Lake Cisco (Table 4.1-1). Arctic Char were not captured during the 2009 study. Lake Trout have also been documented to migrate to and from Glenn Lake and Roberts Bay via the Glenn Lake outflow. Lake Cisco showed the highest relative abundance in gillnet catches. Lake Trout were the largest species captured, with mean fork lengths ranging from 439 to 527 mm. The mean fork length of Arctic Char was 223 mm, representing the smallest species captured by gillnets in 2006 and 2007. Condition for each species were relatively high throughout the study periods. Lake Whitefish displayed the highest mean condition at 1.45 g/mm^3, while Lake Trout showed the lowest mean condition at 0.85 g/mm^3. Fish tissue metal samples have not been collected from Glenn Lake.

The fish habitat and fish community of Glenn Outflow was sampled in 1997, 2000, 2003, 2009, and 2010. Fish habitat was composed of pool, riffle and glide habitat types. The stream gradient ranged from 0 to 3.2%. Stream bank dimensions ranged from 5.1 m to 8.0 m for bankfull width, and 1.1 m to 1.5 m for bankfull depth. Fines were the predominant substrate type present. Cover available for fish in the outflow ranged from 3.2 to 20%. Instream cover and undercut banks were the primary cover types present. Overall habitat quality was rated as important because Glenn Outflow is a migratory route for anadromous Lake Trout moving to and from Glenn Lake and Roberts Bay. Juvenile Arctic Char, Lake Trout, whitefish spp. and Lake Cisco have also been captured near Roberts Bay (Table 4.1-1).

The fish community of Glenn Outflow was represented by Arctic Char, Lake Trout, Ninespine Stickleback, Slimy Sculpin (*Cottus cognatus*) and Starry Flounder (*Platichths stellatus*). Starry Flounder was captured in 2009 (n = 1), while remaining species were captured in all study years. Mean fork lengths for Arctic Char ranged from 205 to 820 mm, while mean fork lengths for Lake Trout ranged from 142 to 390 mm. Mean fork lengths of Ninespine Stickleback and Slimy Sculpin were 45 mm and 58 mm, respectively. Condition for Arctic Char and Lake Trout were calculated in the 2003 study. Mean condition of Arctic Char and Lake Trout were 1.17 g/mm^3 and 1.01 g/mm^3, respectively.

4.4 ABORIGINAL, COMMERCIAL, AND RECREATIONAL SPECIES SUMMARIES

Baseline fish community sampling identified seven freshwater fish species in the Madrid Area (Table 4.4-1). Life history types and habitat preferences of fish of Aboriginal, commercial or recreational importance are summarized below. Information was summarized from McPhail and Lindsey (1970), Scott and Crossman (1973), Richardson et al. (2001), and references therein.

Table 4.4-1. Fish Species Captured in the Hope Bay Belt Project Area

Common Name	Scientific Name	Habitat	Spatial Distribution	Watershed
Lake Trout	*Salvelinus namaycush*	Freshwater	Benthopelagic	D,W
Arctic Char	*Salvelinus alpinus*	Anadromous	Benthopelagic	W
Lake Whitefish	*Coregonus clupeaformis*	Freshwater	Demersal	D,W
Lake Cisco	*Coregonus artedi*	Anadromous	Neritopelagic	D,W
Least Cisco	*Coregonus sardinella*	Freshwater	Neritopelagic	D
Slimy Sculpin	*Cottus cognatus*	Freshwater	Demersal	W
Ninespine Stickleback	*Pungitius pungitius*	Freshwater	Benthopelagic	D,W

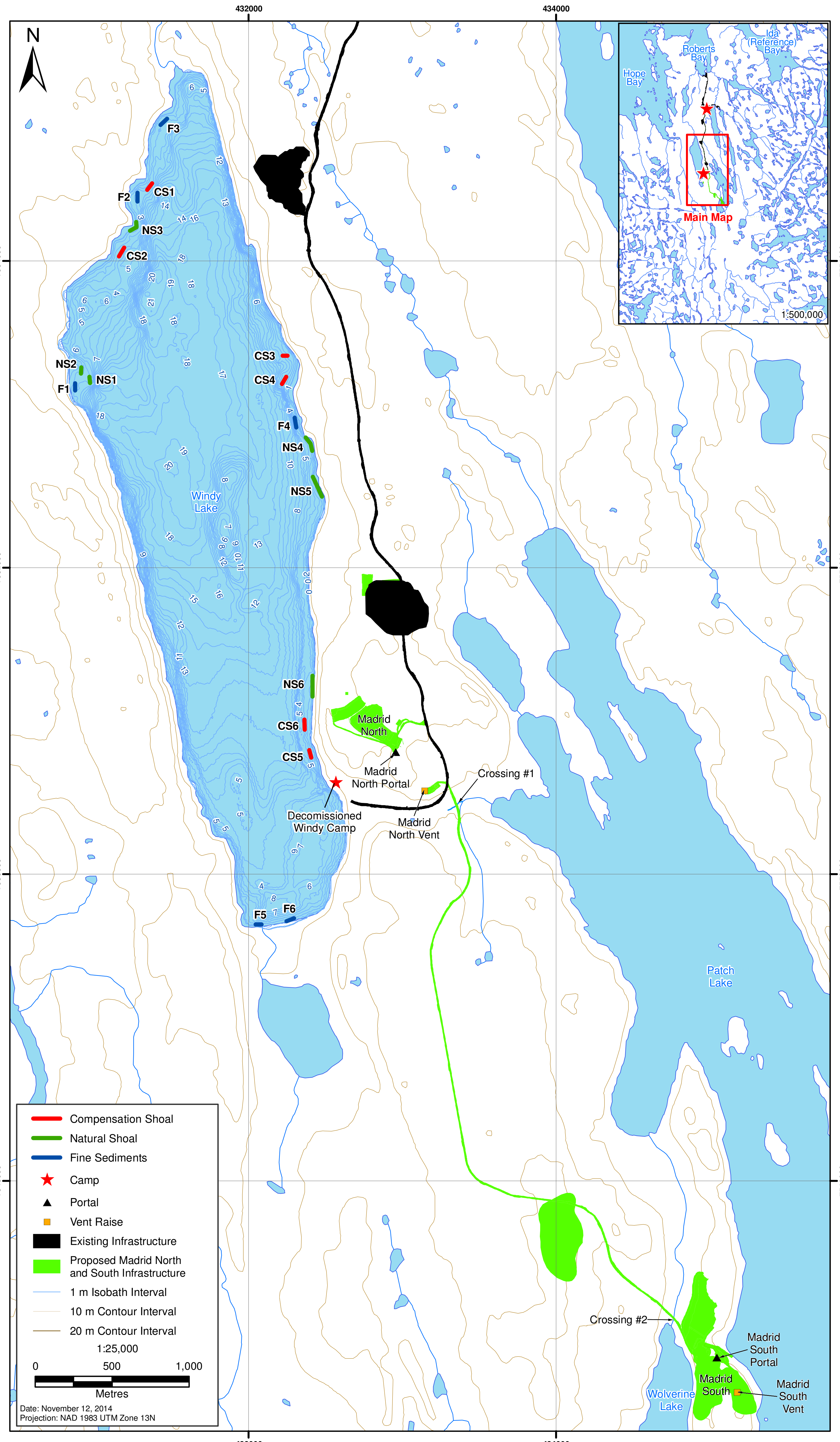
Watershed codes: D = Doris-Roberts, W = Windy-Glenn

4.4.1 Lake Trout

Lake Trout typically exhibit both lacustrine (lake resident) and adfluvial (river resident) life history types, but in the Hope Bay Belt there are unusual anadromous populations (migrate between freshwater and marine environs (Swanson et al. 2010)). Lake Trout spawn in fall, from September to October in northern regions. Spawning grounds are almost always associated with cobble, boulder and gravel substrates, where there is no vegetative cover, in depths less than 1 m to greater than 10 m. Eggs settle into cracks and crevices amongst the rocks, where they incubate for 4 to 5 months, with eggs usually hatching in March or April. Young-of-the-year remain in spawning areas from several weeks to several months, moving into deeper areas as water temperatures rise to greater than 15°C. Young-of-the-year and juveniles both prefer areas of cobble and boulder substrate for cover, and inhabit waters with a depth range of 2 to >10 m or alternatively inflows and outflows of the lake. Juveniles are often associated with large boulders, which they use for cover. Adult Lake Trout disperse into deeper water habitats, >10 m in depth, and are often found in the pelagic zone. Lake Trout feed on a wide variety of prey items including fish, molluscs, crustaceans, freshwater sponges and small mammals.

Figure 4.3-1

Fish Habitat Compensation and Reference Sites in Windy Lake



4.4.2 Arctic Char

Arctic Char occur in northern coastal regions in rivers, lakes, estuaries, and marine environments. They exhibit both anadromous and resident lacustrine life history types. Anadromous Arctic Char are found in several watersheds with a suitable set of habitats. Lakes must be of sufficient size to provide suitable overwintering habitat and these lakes need to be connected to the ocean by streams that can be navigated by adults, even during periods of low discharge in the fall. Freshwater populations feed on planktonic crustaceans, amphipods, molluscs, insects, and fishes, while marine populations are primarily piscivorous and feed almost exclusively on marine resources. Arctic Char require cold, highly oxygenated water and are extremely sensitive to water pollution. Arctic Char are the most economically important fish to the Inuit population of Nunavut. In the Melville Sound area, commercial fisheries operate during upstream runs in Elu Inlet and the Kulgayuk River (DFO 2004).

Arctic Char spawn in freshwater in the fall, usually September or October, over gravel and cobble shorelines of lakes and occasionally larger rivers. In the Belt area, and the central Canadian Arctic in general, spawning usually takes place in lakes because most streams and rivers freeze completely in winter. Males arrive first on the spawning grounds and establish and defend territories. Females are “courted” by males as they arrive later. The female digs a nest or redd in water typically 3 to 6 m deep, in which the eggs are deposited. The eggs incubate under ice for about six months. In most systems char are ready to take their first migration to sea at 4 to 5 years of age and a length of 150 to 250 mm (Johnson 1980). Young Arctic Char do not venture much past the brackish water of river estuaries, but as they grow, they develop a tolerance to higher salinity sea water. They feed in nearshore areas along the coast for the duration of the summer. More abundant food resources in marine waters allow anadromous Arctic Char to grow faster and larger than the freshwater form. At sea, char feed mainly upon invertebrates and fishes. In the fall, all char return to freshwater to overwinter (Johnson 1980).

4.4.3 Lake Whitefish

Lake Whitefish are found throughout Nunavut, predominantly in lakes, although they are also found in large rivers and brackish waters. Lake Whitefish may exhibit lacustrine, adfluvial and anadromous life history types. They spawn in both lakes and rivers over gravel, cobble and boulders at depths of less than 5 m. Eggs are released over the substrate and fall into interstices between rocks where they incubate for several months, hatching sometime from March to May. Young-of-the-year are commonly found in the spawning area in shallow water (<1 m) near the surface, and prefer substrates of boulder, cobble and sand with abundant emergent vegetation and woody debris. Adults are usually found in the open water at depths >10 m and do not show a preference for substrate. Adults are predominantly benthic, although they may be found in the pelagic zone. Lake Whitefish have been reported to make onshore movements into shallow water at night, possibly to feed.

5. Traditional Water and Land Use Areas

5. Traditional Water and Land Use Areas

5.1 BACKGROUND

The Hope Bay Belt Property is located in the Kitikmeot region of Nunavut, approximately 685 km northeast of Yellowknife. The closest settlements to the Madrid district are Umingmaktok (~70 km) and Kingaok (~150 km). The communities of Cambridge Bay (~130 km) and Kugluktuk (~350 km) are the closest major regional centres. Other communities within the region that are further removed from the project location, include Gjoa Haven (~445 km), Taloyoak (~550 km) and Kugaaruk (~690 km; Figure 5.1-1). Distances are approximate and direct (HBML 2011).

The Nunavut Planning Commission (NPC), as established under the Nunavut Land Claim Agreement, is currently developing a Nunavut Land Use Plan (NLUP) for all Nunavut regions that are outside of municipal boundaries. Once in place, the NLUP will be used to guide and direct resource use and development into the future. This Nunavut-wide planning approach was adopted to address inefficiencies in the previous regional approach. Until recently, land use planning in Nunavut had been approached regionally (HBML 2011; Rescan 2012c).

The Hope Bay Belt, including the Madrid North and South site, lies within the former West Kitikmeot Regional Land Use Plan (WKRLUP) boundary. The WKRLUP was in draft form before the regional planning process was halted and replaced with the Nunavut-wide approach. In the absence of an approved plan, the values and interests expressed by the WKRLUP from the original regional planning process are considered. The Hope Bay Belt also falls within the traditional “Areas of Influence” (as defined by the WKRLUP) of the communities of Bathurst Inlet, Umingmaktok, and Cambridge Bay. Areas of Influence encompass broad areas of land and sea that are included in traditional land use patterns by community members (HBML 2011; Rescan 2012c).

The Inuit people of the Kitikmeot have a longstanding relationship of reciprocity and respect with their region’s wildlife and environment as a whole, as is manifested within Inuit Qaujimajatuqangit (Golder 2003b). In Inuit culture, the environment is valued as a whole: the value of one ecosystem component cannot be ranked or differentiated from the value of another. As such, the relative value of ecosystem components is not considered within Inuit Qaujimajatuqangit and traditional practices. Despite the ongoing Westernization of Inuit society, Inuit Qaujimajatuqangit, including ways of respecting wildlife and the environment as a whole, persist and continue to be passed from generation to generation (Golder 2003b). The values that guide traditional activities and subsistence harvests are reflected in the Inuit approach to historic and contemporary land and resource use activities in the Kitikmeot Region (Rescan 2012c).

5.2 INUIT QAUJIMAJATUQANGIT

As part of the Environmental Impact Statement (EIS) of the Doris North Project, *Inuit Qaujimajatuqangit* (IQ) provided assistance in obtaining baseline data for the Hope Bay Belt, which includes the Madrid North and South sites (Miramar Hope Bay Ltd. 2005). IQ for the Hope Bay Belt area was augmented with results from a three-day IQ Workshop in 2003 that was held in Iqaluktuuttiaq (Cambridge Bay; Golder 2003b).

Figure 5.1-1
Communities within the Kitikmeot Region of Nunavut

For generations, Nunavummiut have had to monitor water quality to ensure survival. For example, careful observation of variations in suspended sediment determines if water is fit for drinking. Both fish and animals are used as indicators when observing changes in water quality. Given this history, Inuit understand that changes to water quality can have far reaching effects on animals and fish, and the ecosystem as a whole. The record of documented IQ of environmental change includes observations of changes in water levels and water quality throughout the Kitikmeot region (Miramar Hope Bay Ltd. 2005). IQ has also shown that melting permafrost and the consequent increase in suspended sediments in major river bodies, such as in the Coppermine River, has had a profound influence on water quality (Miramar Hope Bay Ltd. 2005).

Lake Trout are important to local Inuit for food, while fishing is central to culture, identity and recreation. Arctic Char are considered most valuable for subsistence living by local communities, followed by Lake Trout and Lake Whitefish. The Hope Bay Belt in general has always been a popular region for fishing. Participants in the IQ Workshop commented that most of the lakes in the Project area were commonly fished. Although many traditional names for waterbodies in the Project area have not been recorded, there is still evidence of fishing camps throughout the region (Golder 2003b; Miramar Hope Bay Ltd. 2005).

In the Kitikmeot region, Caribou continue to be the most important subsistence mammal. Today, as in the past, Caribou are hunted for food, clothing, tools and other materials and the act of Caribou hunting is central to Inuit identity, culture and subsistence.IQ indicates that the region around the Hope Bay Belt is important Caribou habitat, particularly for calving (i.e., historical grounds for the Bathurst herd), and that Caribou are indicators of environmental change (Golder 2003b). There are three Caribou herds whose ranges may occur near the Project Area: the Bathurst, the Ahiak (meaning "berries" or "from where there are berries" [i.e., the mainland]) and the Dolphin-Union herds (Miramar Hope Bay Ltd. 2005). Historically the Hope Bay Belt area has been important for Bathurst Caribou migration and calving. According to IQ, the Bathurst herd has been calving on the west or south side of Bathurst Inlet for the last few years. Inuit expect that the Bathurst herd will return to the east side of the inlet, as it is common for the herd to alter calving ground location between areas of Bathurst Inlet, primarily as a function of annual climatic conditions and the associated state or quality of habitat (e.g., vegetation, ice). Locals report that other factors that influence the shifting of calving grounds include fidelity, human activity, escape from predators, and open spaces. Elders also reported that some mixing occurs between the Bathurst and Ahiak herds, and that the Dolphin-Union Caribou are starting to migrate to the treeline (which they have not done in the past), and are mixing with mainland herds (Golder 2003b).

Inuit have always held respect for Wolverines for their tenacious and often unpredictable behaviour. Wolverines have always been hunted, particularly for their fur. IQ indicates that the Wolverine is common in the Hope Bay Belt, due to the abundance of prey animals for scavenging (i.e., Caribou, Seals) and the presence of suitable habitat, such as eskers (Golder 2003b). Participants from the 2003 IQ Workshop also commented that Grizzly Bears are common in the Hope Bay Belt area, due to the abundance of prey animals (e.g. Caribou) and the presence of suitable habitat, such as eskers (Golder 2003b). Eskers are important for predators such as the Wolverine and the Grizzly Bear in that they provide habitat for denning, feeding and travel (Golder 2003b).

The participants of the 2003 IQ Workshop commented that the Hope Bay Belt area is known to be the home of many nesting bird species. Inuit have long observed that extensive cliff formations throughout Bathurst Inlet and the surrounding region provide important raptor habitat. Accordingly, the participants of the Workshop commented that Eagles and Gyrfalcons are common in the Hope Bay Belt and near the Project area (Golder 2003b). Participants mentioned that raptors nest in the highlands and that cliffs and mesas are important landscape features because they provide key nesting habitat. The workshop participants explained that eagles and Gyrfalcons feed on a variety of prey, including

Ground Squirrels, Arctic Hare and Canada Geese. Fluctuations in raptor populations have been observed, probably due to changes in prey abundance (Golder 2003b).

5.3 HISTORICAL LAND AND RESOURCES USE

Very little was known about the history and people of the central Arctic mainland until several scientific expeditions visited the region in the early 1900s. The local residents of this central Arctic coastline at the time of the early studies were identified as Copper Eskimo (or Inuit) due to their use of copper. Subsistence and settlement patterns of inhabitants of this region in the past were probably fairly similar throughout the period subsequent to the arrival of European explorers (i.e., after the passing of John Franklin's expedition along the coast), since they were dependent on the same types of resources. According to historic sources, from December to May, Copper Inuit people congregated at the coastline to conduct breathing-hole sealing. The period from May to November was spent travelling inland, hunting and fishing in small family groups. The focus was Caribou and people camped at good hunting localities, such as grass meadows or river narrow (Jenness 1922 as cited in HBML 2011).

Local residents reported numerous archaeological and traditional sites in the general region to the Nunavut Planning Commission Transition Team (NPCTT), stating that the Aimaokatalok Lake area was extensively used for Caribou hunting in the early 1900s or earlier (NPCTT 1996 as cited inHBML 2011). The Nunavut Atlas identifies the Koignuk River as an important resource gathering and camp location (Riewe 1992: 44, 167 as cited inHBML 2011). Elders were interviewed during the Doris North traditional knowledge study by Golder in 2003. One informant stated that archaeological sites could be found along any good sized river system, main Caribou migration routes and on islands. It was mentioned that archaeological sites could include sealing, hunting and fishing camps, food caches, burial sites and *inukhuit* or *taluit* (hunting blinds)(Golder 2003b).

5.4 TRADITIONAL LAND AND RESOURCES USE

Throughout Nunavut, traditional pursuits, such as hunting, trapping, and fishing, continue to be an important part of the economy and quality of life for Nunavummiut (Rescan 2012c). The importance of traditional activities and subsistence harvests is reflected in contemporary land and resource use activities and management in the Kitikmeot Region. This includes, most notably, renewable resource use, including hunting, trapping, fishing, and gathering of berries and other products (HBML 2011). Hunting, fishing, and the gathering of plants and berries provide dietary contributions to residents and their families (HBML 2011). Country foods are always available in Kitikmeot communities and, for many, continue to be eaten on a daily basis. This is particularly true for the smaller more traditional communities (Rescan 2012c). Trapping activities are also important, and primarily result in pelts for sale, personal use, and crafts (HBML 2011).

River and lake systems are integral to both fish and wildlife, and are also valued as a source of drinking water. In smaller communities where no public services are available, such as Bathurst Inlet and Umingmaktok, water is sourced from ice and river water (Rescan 2012c). Deep lakes and underground water are also valued highly for their water quality. Water used for drinking purposes possess several qualities that are desirable, including clarity, source, and ultimately taste and smell (Golder 2003b).

A large proportion of residents participate in harvesting activities. In 2006, the majority of Kitikmeot community members hunted, fished, trapped, or gathered wild plants and berries. This compares to data for all Aboriginal residents in Nunavut, in which 71% reported that they hunted, 76% fished, 79% gathered wild plants and berries, and 30% trapped (Statistics Canada 2008a, 2008b). Furthermore, statistics indicate that an increasing proportion of the Kitikmeot population is participating in traditional economic activities (HBML 2011).

Local Hunting and Trapping Organizations (HTOs) are recognized by the Nunavut Department of Environment to represent the interests of hunters and trappers at the local level. Government funding to HTOs depend on the number of general hunting licences within the community, fur returns and HTO work plans (Nunavut Department of Environment 2007 as cited in HBML 2011)). Kingaok, Umingmaktok and Cambridge Bay each have a local HTO. Primary information about current land use activities was obtained through interviews with HTO representatives in each Kitikmeot community, local hunters, and government land and resource managers. Additionally, in November 2011, a land use focus group session was held with people from Umingmaktok (Bay Chimo), the community closest to the Project. Travelling on the land, hunting, and fishing remain important cultural activities within the vicinity of the Hope Bay Belt and throughout the Kitikmeot Region. Subsistence land use in nearby areas is illustrated in Figure 5.4-1.

The results of interviews did not identify any specific locations that people visit for ceremonial and spiritual reasons. However, it was noted that an Elders group has recently started to go to old camp sites and places where relatives were born with the purpose of visiting the sites with family and friends. While prominent fishing areas were noted, fishing occurs throughout the region and is not limited to the specifically identified areas. During the land use focus group session, Roberts Lake was also highlighted as having abundant fish and as being especially important to the family who lived at an outpost camp there for many years (M. Avalak, pers. comm.; Figure 5.4-1). Larger lakes and rivers that connect to the ocean are important as they usually have an abundance of fish such as Char, Whitefish and Trout. Local land users stand up and pile rocks to mark good fishing spots. When travelling the land, people follow big lakes and rivers and look for fish markers. The big lakes, thus, have a long history of use (Land use focus group participants, pers. comm.).

While there are two regularly used camps located near the Madrid North and South sites (Figure 5.4-1), camping may take place anywhere as local land users camp in many places as they travel through the area hunting and fishing (J. Avalak, pers. comm.). In addition, as noted by Elders, camps have historically been located along the shores of Roberts Bay, around Hope Bay, and at river mouths and confluences (Golder 2003b).

Local travel patterns are seasonally-dependent as Kitikmeot residents travel to hunting, fishing, and camping areas. Although most people originally from Umingmaktok have moved to Cambridge Bay, they go back and forth to Umingmaktok. During the ice season (usually late November to early June), travel is predominantly by snowmobile and includes travel over ice and over land covered by ice and snow. During the ice-free period, travel over land is dominated by ATVs, though boats are also used during this period. Inland travel usually ends by mid-May, as snowmelt increases difficulties associated with travel, shifting to use of the coastal areas for travel (Anonymous, pers. comm.; Land use focus group participants, pers. comm.).

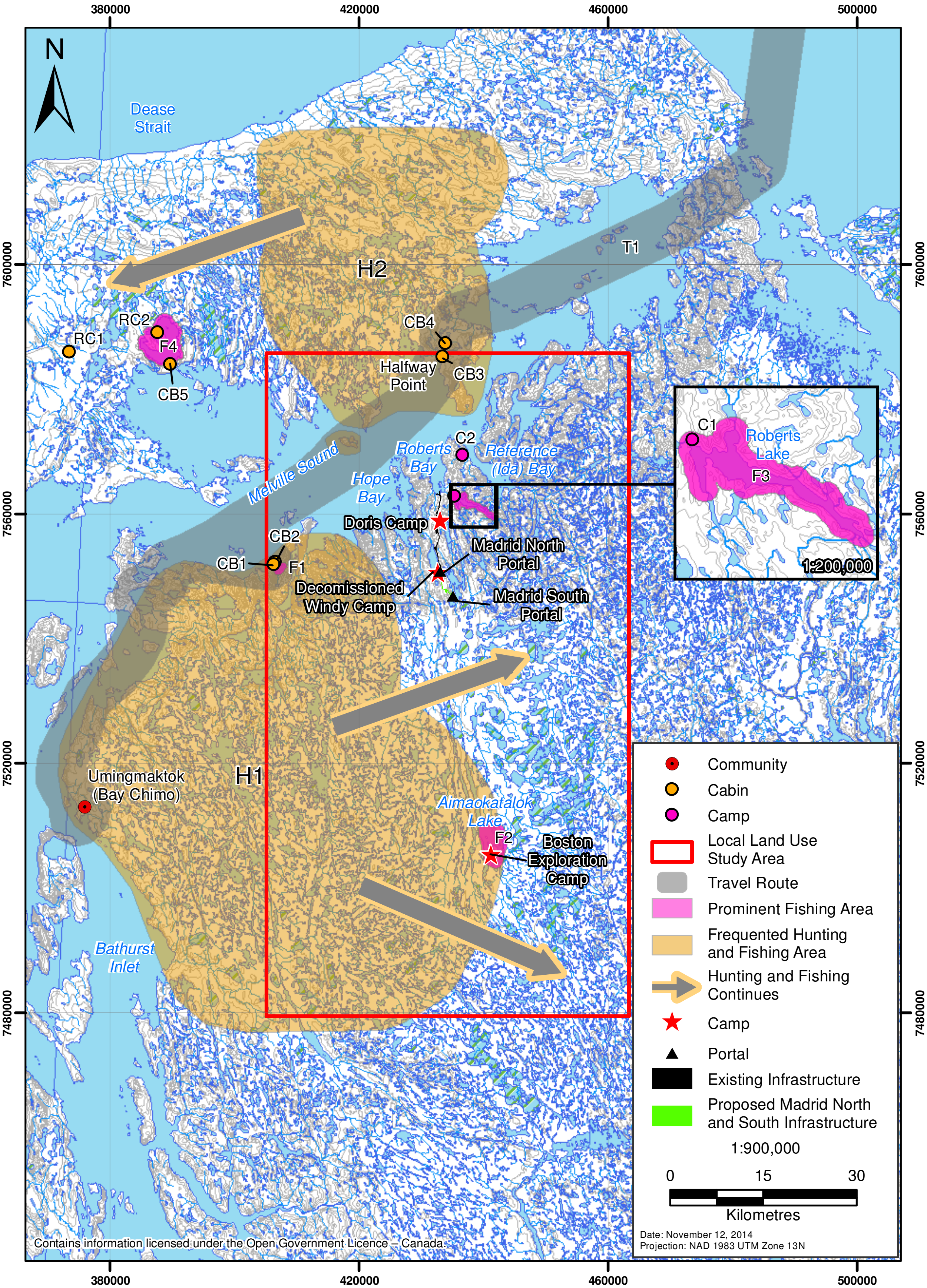
5.5 HARVEST ACTIVITIES

The Nunavut Wildlife Harvest Survey, conducted between 1996 and 2001, remains the most current and comprehensive information source on subsistence harvests in the Kitikmeot Region (NWMB 2004). The survey collected data on non-commercial hunting, trapping, gathering, and fishing of mammals, birds (and their eggs and feathers), fish, and shellfish.

Approximately 17 to 18 hunters were registered annually in Bathurst Inlet; three were classified as intensive land users, four as active, and the remainder reported occasional activity (NWMB 2004). Harvest data indicate that the majority of hunters harvested Caribou, with an annual mean harvest of 93 animals, while Arctic Ground Squirrel, Arctic Fox, Red Fox, Wolverine, Grey Wolf, Arctic Hare, and Seal were also common prey.

Figure 5.4-1

Local Traditional Land Use



Ptarmigan (Willow Ptarmigan and Rock Ptarmigan) were the most commonly hunted bird species, and Seagull eggs were also popular. Fishing activities were practiced by nearly all hunters, with catches including Arctic Char, Cod, Lake Trout, and Whitefish. It is noted that many hunters leave Bathurst Inlet for the winter to live in other centres (e.g., Cambridge Bay, Kugluktuk), returning to the community for the summer months.

In Umingmaktok, the number of hunters decreased from 31 in 1996/97 to only 11 in 2001, which likely reflects an overall decline in the population of the community (NWMB 2004). There were no intensive hunters in any year, while approximately three hunters were classified as active, although actual numbers varied greatly with changes in the population. Caribou was the most-hunted game, with an annual average of 176 kills, and Arctic Ground Squirrel, Grey Wolf, Arctic and Red Fox, Wolverine, and Seal were also common. Canada Goose, Eider Duck, and Ptarmigan were the most popular among birds, as were goose, duck, and seagull eggs. Similar to Bathurst Inlet, fishing activity focused on Arctic Char, Cod, and Lake Trout (Rescan 2012c).

Interview focus group results conducted for the 2012 baseline study confirmed that residents from Bathurst Inlet, Umingmaktok, and Cambridge Bay are known to hunt and fish in areas nearby the Hope Bay Belt area (Figures 5.1-1 and 5.4-1). Residents of Gjoa Haven, Taloyoak, and Kugaaruk do not hunt or fish as far west, typically remaining within an 80 to 100 km range of the community, often only going out on day-trips (Rescan 2012c). The results of interviews conducted for the 2012 baseline study have indicated that the current number of intensive and active hunters in Bathurst Inlet, Umingmaktok, and Cambridge Bay is approximately as reported in the NWMB (2004) survey. Approximately 20 to 25 hunters are reported to be active within and near the Hope Bay Belt area, 10 from Umingmaktok and Bathurst Inlet and 10 to 15 from Cambridge Bay (Rescan 2012c).

5.6 CONSULTATION

In September 2003, a three day Inuit Qaujimajatuqangit[2](IQ) workshop was held in Iqualuktuuttiaq (Cambridge Bay) in an effort to augment documented IQ and respond to the information gaps identified in a preceding literature review and gap analysis. Elders from each of the communities Umingmaktok (Bay Chimo), Kingauk (Bathurst Inlet), Kugluktuk, and Iqualuktuuttiaq nominated workshop participants according to their familiarity with the Hope Bay Belt. To complement the workshop, interviews were held with several IQ experts now living in Iqualuktuuttiaq but formerly of the Bathurst Inlet region and familiar with Hope Bay belt. The interviews were conducted on both an individual and group level in Iqaluktuuttiaq (Golder 2003b). The Kitikmeot Heritage society and Golder associates ltd. Interviewed seven elders from Iqaluktuuttiaq and Umingmaktok (Bay Chimo) to document their knowledge of traditional place names in the area surrounding the Hope Bay Belt (Golder 2003b).

Through the literature review, gap analysis, interviews, and workshop, a variety of IQ was collected that is pertinent to the Hope Bay Belt and Doris North Project. Definitions for IQ and an understanding of climate change, air quality, noise, landscape and terrain, hydrology and water quality, aquatic organisms and habitat, vegetation, terrestrial wildlife and habitats, archaeology, cumulative environmental effects and valued ecosystem components were documented (Golder 2003b).

Workshop participants and interviewees made several recommendations related to the Doris North Project. These included, but were not limited to, the inclusion of Innuinnaqtun place names for rivers, lakes and places (resulting in a traditional place names study), the reduction of noise levels, access to

[2] Inuit Qaujimajatuqangit (IQ) is Traditional Knowledge specific to Inuit.

environmental studies and dissemination of information, and overall respect for the environment (Golder 2003b).

Community-based research detailed in the Socio-Economic and Land Use Baseline Report completed by Rescan (2012c) consisted of site visits and the completion of interviews with key informants from each study community. A focus group session was also held with land users from Umingmaktok, the community closest to the Project location. Community visits to conduct interviews were also conducted in Cambridge Bay, Kugluktuk, Taloyoak, Gjoa Haven, and Kugaaruk, with a second visit to Cambridge Bay in November 2011 (Rescan 2012c).

Key informants included government representatives, service providers, business leaders, and other organization representatives. Representation was provided across a number of areas: local and regional governance, economic development, education and training, health and well-being, housing, safety and protection services, planning and resource management, hunting and trapping, and guide outfitting. The hunter focus group included some Elders (Rescan 2012c). Results of the interviews held with the hunter focus group are discussed in Section 1.5.3.

References

References

1985. *Fisheries Act*, RSC. C. F-14.

1994. *Migratory Birds Convention Act*, SC. C. 22.

2002. *Species at Risk Act*, SC. C. 29.

2003. *Wildlife Act*, SNu. C. 26.

Banci, V. 1994. Wolverine. In *The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the Western United States*. Eds. L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, L. J. Lyon, and W. J. Zielinski. USDA Forest Service. General Technical Report RM-254.

BC MOF and BC MFLNRO. 1996. *Channel Assessment Procedure Field Guidebook*. British Columbia Ministry of Forests: Victoria, BC.

Burt, P. 2003. *Summary of Vegetation Baseline Studies, 2003, Doris North Project, Kitikmeot Region, Nunavut*. Prepared by Outcrop Ltd. for Miramar Hope Bay Ltd.: Yellowknife, NT.

CCME. 1999. *Canadian Water Quality Guidelines for the Protection of Aquatic Life*. Prepared by the Canadian Council of Ministers of the Environment: Winnipeg, MB.

CESCC. 2005. *Nunavut Ranking Wild Species Canada*. http://www.wildspecies.ca/wildspecies (accessed October 2014).

Church, M. 1974. *Hydrology and permafrost with reference to northern North America*. J. Demers, Ed. Proceedings of a workshop seminar on permafrost hydrology Ottawa, ON: Secretariat, Canadian National Committee, International Hydrological Decade, Environment Canada.

COSEWIC. 2002. *COSEWIC assessment and update status report on the grizzly bear (Ursus arctos) in Canada*. Committee on the Status of Endangered Wildlife in Canada: Ottawa, ON.

COSEWIC. 2003. *COSEWIC assessment and update status report on the wolverine (Gulo gulo) in Canada*. Committee on the Status of Endangered Wildlife in Canada: Ottawa, ON.

COSEWIC. 2005. *Nunavut Ranking Wild Species Canada*. http://www.wildspecies.ca/wildspecies (accessed October 2014).

COSEWIC. 2007. *COSEWIC assessment and update status report on the Peary caribou (Rangifer tarandus pearyi) and the barren-ground caribou (Rangifer tarandus groenlandicus) (Dolphin and Union population) in Canada*. www.sararegistry.gc.ca/status/status_e.cfm (accessed October 2007).

COSEWIC. 2014. *COSEWIC Species Database: Caribou, Barren-ground*. http://www.cosewic.gc.ca/eng/sct0/status_change_e.cfm (accessed January 2013).

DFO. 2004. *Cambridge Bay Arctic char*. Fisheries and Oceans Canada, Canadian Science Advisory Section. Stock Status Report 2004/010. 15 p.: Ottawa, ON.

Dyke, A. S. and V. K. Prest. 1986. *Late Wisconsinan and Holocene retreat of the Laurentide ice sheet*. Geological Survey of Canada: Ottawa, ON.

EBA. 1996. *Surficial Geology and Permafrost Features*. Project No. 0101-96-12259. Prepared for Rescan Environmental Services Ltd. by EBA Engineering Consultants Ltd.: Nanaimo, BC.

ERM Rescan. 2014a. *Doris North Project 2013 Compliance Monitoring Program - Meteorology*. Prepared for TMAC Resources Inc. by ERM Rescan: Yellowknife, NT.

ERM Rescan. 2014b. *Doris North Project: 2013 Hydrology Compliance Monitoring Report*. Prepared for TMAC Resources Inc. by ERM Rescan: Yellowknife, NT.

Golder. 2003a. *Doris North Project Aquatic Studies 2003*. Prepared for Hope Bay Mining Limited by Golder Associates: Edmonton, AB.

Golder. 2003b. *Inuit Qaujimajatuqangit Literature Review, Gap Analysis and Workshop Results Related to the Doris North Project Hope Bay Belt, Nunavut*. Report submitted to Miramar Hope Bay Limited: North Vancouver, BC.

Golder. 2003c. *Report on Air Quality and Noise Assessment of the Miramar Doris North Project*. Prepared for Hope Bay Mining Limited by Golder Associates: Edmonton, AB.

Golder. 2005a. *Doris North Gold Mine Project: Wildlife Baseline Data Synthesis 2005*. Prepared for Hope Bay Mining Limited by Golder Associates: Edmonton, AB.

Golder. 2005b. *Doris North Gold Mine Project: Wildlife Cumulative Effects Assessment 2005*. Prepared for Hope Bay Mining Limited by Golder Associates: Edmonton, AB.

Golder. 2005c. *Doris North Gold Mine Project: Wildlife Habitat Suitability Models 2005*. Prepared for Hope Bay Mining Limited by Golder Associates: Edmonton, AB.

Golder. 2005d. *Doris North Project Aquatic Studies 2004*. Prepared for Hope Bay Mining Limited by Golder Associates: Edmonton, AB.

Golder. 2005e. *Miramar Doris North Project Wildlife Studies: Annual Report 2005*. Prepared for Hope Bay Mining Limited by Golder Associates: Edmonton, AB.

Golder. 2005f. *Supporting Document B3 -- Doris North Project -- Air Quality Assessment Methods*. Prepared for Hope Bay Mining Limited by Golder Associates: Edmonton, AB.

Golder. 2005g. *Supporting Document F2 - Human and Ecological Risk Assessment for the Environmental Impact Statement for the Proposed Doris North Project*. Prepared for Hope Bay Mining Limited by Golder Associates: Edmonton, AB.

Golder. 2006a. *Bathymetric Surveys, Hope Bay Project, Hope Bay, Nunavut*. Prepared for SRK Consulting Canada, Inc. by Golder Associates Ltd.: Burnaby, BC.

Golder. 2006b. *Doris North Project Aquatic Studies 2005*. Prepared for Hope Bay Mining Limited by Golder Associates Ltd: Edmonton, AB.

Golder. 2006c. *Report on Wildlife Mitigation and Monitoring Program for the Doris North Gold Mine Project*. Prepared for Hope Bay Mining Limited by Golder Associates: Edmonton, AB.

Golder. 2007a. *Doris North Project "No Net Loss" Plan*. Prepared for Miramar Hope Bay Limited by Golder Associates Ltd.: Edmonton, AB.

Golder. 2007b. *Doris North Project Aquatic Studies 2006*. Prepared for Hope Bay Mining Limited by Golder Associates: Edmonton, AB.

Golder. 2008a. *Boston and Madrid Project Areas 2006-2007 Aquatic Studies*. Prepared for Hope Bay Mining Limited by Golder Associates: Edmonton, AB.

Golder. 2008b. *Doris North Project Aquatic Studies 2007*. Prepared for Hope Bay Mining Limited by Golder Associates: Edmonton, AB.

Golder. 2009a. *Air Quality Monitoring Summary: Doris North*. Prepared for Hope Bay Mining Limited by Golder Associates: North Vancouver, BC.

Golder. 2009b. *Doris North Project Aquatic Studies 2008*. Prepared for Hope Bay Mining Limited by Golder Associates: Edmonton, AB.

Golder. 2009c. *Doris Project Area 2008 Hydrology Baseline Update – Draft Report*. Prepared for Hope Bay Mining Limited by Golder Associates: Edmonton, AB.

Golder. 2009d. *Hope Bay Belt, Nunavut: Preliminary regional ecological land classification*. Prepared for Hope Bay Mining Ltd. by Golder Associates Ltd.: Vancouver, BC.

Golder. 2009e. *Hope Bay Mining Ltd. 2008 Annual Hope Bay Aquatic Studies Report*. Prepared for Hope Bay Mining Ltd. by Golder Associates Ltd.: Edmonton, AB.

HBML. 2011. *Phase 2 Hope Bay Belt Project Proposal: Madrid, Patch, and Boston Mining Districts.* Prepared for the Nunavut Impact Review Board by Hope Bay Mining Ltd.: North Vancouver, BC.

Hornal and Associates Ltd. 2003a. *A Socio-Economic Impact Assessment of the Proposed Doris North Project in the Kitikmeot Region Nunavut*. Prepared by Hornal and Associates Ltd.: n.p.

Hornal and Associates Ltd. 2003b. *Supporting Document E2 - Socio-Economic Baseline Studies of the Kitikmeot Communities, Nunavut and Yellowknife Northwest Territories*. Prepared by Hornal and Associates Ltd.: n.p.

Hubert and Associates Ltd. 2001. *Data Report Wildlife Studies May-August 2000 - Hope Bay Joint Venture Gold Project (March 2001)*. Prepared by Hubert and Associates Ltd.: Calgary, AB.

Hubert and Associates Ltd. 2002a. *Abundance and Distribution of Caribou in Hope Bay Study Area: 1996-2000*. Prepared by Hubert and Associates Ltd.: Calgary, AB.

Hubert and Associates Ltd. 2002b. *Data Report Wildlife Studies Jun-July 2002 - Hope Bay Joint Venture Gold Project*. Prepared by Hubert and Associates Ltd.: Calgary, AB.

Hubert and Associates Ltd. 2002c. *Data Report Wildlife Studies May-August 2001 - Hope Bay Joint Venture Gold Project*. Prepared by Hubert and Associates Ltd.: Calgary, AB.

Hubert and Associates Ltd. 2002d. *Terrestrial Wildlife of Hope Bay, Nunavut: an integration and overview of data collected from 1994-2002*. Prepared by Hubert and Associates Ltd.: Calgary, AB.

Hubert and Associates Ltd. 2003. *Data Report - Wildlife Studies Jun-July 2003 - Hope Bay Nunavut*. Prepared by Hubert and Associates Ltd.: Calgary, AB.

Hubert and Associates Ltd. 2004. *Data Report Wildlife Studies Jun-August 2004 - Hope Bay, Nunavut*. Prepared by Hubert and Associates Ltd.: Calgary, AB.

Johnson, L. 1980. The Arctic charr, Salvelinus alpinus. In *Charrs: Salmonid fishes of the genus Salvelinus*. Ed. E. K. Balen. 928. The Hague, Netherlands: Dr. W. Junk, Publisher.

Keith, D., J. Arqviq, L. Kamookak, and J. Ameralik. 2005. *Inuit Quajimaningit Nunurnut Inuit Knowledge of Polar Bears*. Gjoa Haven, NU: Gjoa Haven Hunters' and Trappers' Organization and CCI Press.

Klohn-Crippen Consultants Ltd. 1995. *BHP Minerals Canada Ltd - Doris Lake 1995 Environmental Study*. Vancouver, BC.

Lemmen, D., F. Warren, J. Lacroix, and E. Bush. 2008. *From impacts to adaptation: Canada in a changing climate 2007*. Ottawa, ON: Government of Canada.

Magoun, A. J. and J. P. Copeland. 1998. Characteristics of wolverine reproductive den sites. *Journal of Wildlife Management*, 62: 1313–20.

Mason, V. and R. Knight. 2001. *Sensitive habitat inventory and mapping*. Community Mapping Network.: Vancouver, BC.

McLoughlin, P. C., M. K. Taylor, H. D. Cluff, R. J. Gau, R. Mulders, R. L. Case, and S. Boutin. 2003. Demography of barren-ground grizzly bears. *Canadian Journal of Zoology*, 81: 294-301.

McLoughlin, P. C., M. K. Taylor, H. D. Cluff, R. J. Gau, R. Mulders, R. L. Case, and F. Messier. 2003. Population viability of barren-ground grizzly bears in Nunavut and the Northwest Territories. *Arctic*, 56: 185-90.

McLoughlin, P. C., L. R. Walton, H. D. Cluff, P. C. Paquet, and M. A. Ramsay. 2004. Hierarchical habitat selection by tundra wolves. *Journal of Mammology*, 85: 576-80.

McPhail, J. D. and C. C. Lindsey. 1970. *Freshwater fishes of northwestern Canada and Alaska*. Bulletin of the Fisheries Research Board of Canada No. 173.:

Meteorological Services of Canada (MSC). 2004. MSC Guidelines for Co-operative Climatological Autostations, Version 3.0. *Environment Canada, MSC, Surface Weather, Climate & Marine Division, Atmospheric Monitoring Survey Branch*.

Miramar Hope Bay Ltd. 2005. *Final Environmental Impact Statement - Doris North Project*. Vancouver, BC.

Mulders, R. 2000. *Wolverine ecology, distribution, and productivity in the Slave Geological Province*. Final Report to the West Kitikmeot/Slave Study Society: Yellowknife, NT.

National Research Council Canada. 2011. *National Building Code of Canada 2010*.

Northwest Territories Environment and Natural Resources. 2010. *NWT Species Monitoring Infobase*. http://www.enr.gov.nt.ca/_live/pages/wpPages/Infobase.aspx (accessed December 2010).

NPC. 2004. *West Kitikmeot Regional Land Use Plan: Preliminary Draft*. Nunavut Planning Commission: Cambridge Bay, NU.

NWMB. 2004. *Nunavut Wildlife Harvest Survey*. Prepared for the Nunavut Wildlife Management Board by H. Priest and P.J. Usher Iqaluit, NU.

Points West Heritage Consulting Ltd. July 2004. *Hope Bay Project Summary Report Archaeological Field Work* Langley, BC.

Points West Heritage Consulting Ltd. and Rescan. 2000. *Archaeological Investigations - Hope Bay Joint Venture 2000*. Prepared by Points West Heritage Consulting Ltd. and Rescan Environmental Services Ltd.: Langley, BC and Vancouver, BC.

Points West Heritage Consulting Ltd. and Rescan. 2002. *Archaeological Investigations - Hope Bay Joint Venture 1995-2000*. Prepared by Points West Heritage Consulting Ltd. and Rescan Environmental Services Ltd.: Langley, BC and Vancouver, BC.

Points West Heritage Consulting Ltd. and Rescan. 2003a. *Supporting Document E5 - Doris North (Hope Bay) Project, Nunavut, Archaeological Investigations in 2003 (November 2003) - (NU Archaeologist's Permit 03-05A)*. Prepared by Points West Heritage Consulting Ltd. and Rescan Environmental Services Ltd.: Langley, BC and Vancouver, BC.

Points West Heritage Consulting Ltd. and Rescan. 2003b. *Supporting Document F5 - Doris North (Hope Bay) Heritage Resource Protection Plan 2003 (November 2003)*. Prepared by Points West Heritage Consulting Ltd. and Rescan Environmental Services Ltd.: Langley, BC and Vancouver, BC.

Rescan. 1997a. *BHP World Minerals Hope Bay Belt Project: 1996 Environmental Data Report*. Prepared for BHP World Minerals by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 1997b. *BHP World Minerals Hope Bay Belt Project: 1997 Environmental Data Report*. Prepared for BHP World Minerals by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 1997c. *BHP World Minerals Hope Bay Belt Project: Environmental Baseline Studies Report and Appendices 1996*. Prepared for BHP World Minerals by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 1998. *BHP World Minerals Hope Bay Belt Project: Environmental Baseline Studies Report and Appendices 1997*. Prepared for BHP World Minerals by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 1999. *Hope Bay Belt Project - 1998 Environmental Data Report*. Prepared for BHP World Minerals by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2001. *2000 Supplemental Environmental Baseline Data Report Hope Bay Belt Project*. Prepared for Hope Bay Mining Limited by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2002. *1993 - 2002 Data Compilation Report for Meteorology and Hydrology*. Prepared for Hope Bay Joint Venture by Rescan Environmental Services: Vancouver, BC.

Rescan. 2007. *Noise Baseline Report*. Prepared for Hope Bay Mining Limited by Golder Associates: Edmonton, AB.

Rescan. 2008. *2008 Hope Bay Project: Baseline Review and Gap Analysis Report December 2008*. Prepared for Hope Bay Mining Limited by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2009a. *2009 Meteorology Baseline Report, Hope Bay Belt Project*. Prepared for Hope Bay Mining Ltd. by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2009b. *Hope Bay Belt Project: 2009 Hydrology Baseline Report*. Prepared for Hope Bay Mining Ltd. by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2010a. *2009 Freshwater Baseline Report, Hope Bay Belt Project*. Prepared for Hope Bay Mining Limited by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2010b. *2009 Freshwater Fish and Fish Habitat Baseline Report, Hope Bay Belt Project*. Prepared for Hope Bay Mining Limited by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2010c. *Doris North Gold Mine Project Noise Abatement Plan*. Prepared for Hope Bay Mining Limited by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2010d. *Doris North Gold Mine Project: 2010 Meteorology Compliance Report*. Prepared for Hope Bay Mining Ltd. by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2010e. *Doris North Gold Mine Project: Aquatic Effects Monitoring Plan*. Prepared for Hope Bay Mining Limited by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2010f. *Hope Bay Belt Project: 2009 Freshwater Baseline Report*. Prepared for Hope Bay Mining Ltd. by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2010g. *Hope Bay Belt Project: 2010 Ecosystems and Vegetation Baseline Report*. Prepared for Hope Bay Mining Limited by Rescan Enviornmental Services Ltd.: Vancouver, BC.

Rescan. 2011a. *2010 Freshwater Fish and Fish Habitat Baseline Report, Hope Bay Belt Project*. Prepared for Hope Bay Mining Limited by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2011b. *2010 Freshwater Fish and Fish Habitat Baseline Report, Hope Bay Belt Project*. Prepared for Hope Bay Mining Limited by Rescan Environmental Services Ltd. May 2010: Vancouver, BC.

Rescan. 2011c. *Doris North Gold Mine Project: 2011 Meteorology Compliance Report*. Prepared for Hope Bay Mining Ltd. by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2011d. *Doris North Project: Hydrology Compliance Report 2011*. Prepared for Hope Bay Mining Ltd. by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2011e. *Hope Bay Belt Project 2010 Air Quality Baseline Report*. Prepared for Hope Bay Mining Limited by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2011f. *Hope Bay Belt Project 2010 Ecosystems and Vegetation Baseline Report*. Prepared for Hope Bay Mining Limited by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2011g. *Hope Bay Belt Project 2010 Freshwater Baseline Report*. Perpared for Hope Bay Mining Limited by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2011h. *Hope Bay Belt Project 2010 Noise Baseline Report*. Prepared for Hope Bay Mining Limited by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2011i. *Hope Bay Belt Project: 2010 Hydrology Baseline Report*. Prepared for Hope Bay Mining Ltd. by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2011j. *Hope Bay Belt Project: 2010 Terrain and Soils Baseline Report*. Prepared for Hope Bay Mining Limited by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2012a. *Doris North Gold Mine Project: 2012 Meteorology Compliance Report*. Prepared for Hope Bay Mining Ltd. by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2012b. *Doris North Project: Hydrology Compliance Report 2012*. Prepared for Hope Bay Mining Ltd. by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2012c. *Hope Bay Belt Project 2011 Socio-economic and Land Use Baseline Report*. Prepared for Hope Bay Mining Ltd.: Vancouver, BC.

Rescan. 2012d. *Hope Bay Belt Project: 2011 Hydrology Baseline Report*. Prepared for Hope Bay Mining Ltd. by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2012e. *Hope Bay Belt Project: 2011 Meteorology Baseline Report*. Prepared for Hope Bay Mining Limited by Rescan Environmental Services Ltd.: Vancouver, BC.

Richardson, E. S., J. D. Reist, and C. K. Minns. 2001. *Life history characteristics of freshwater fishes occurring in the Northwest Territories and Nunavut, with major emphasis on lake habitat requirements*. Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 2569.

RL&L Environmental Services Ltd./Golder Associates Ltd. 2002a. *Aquatic Baseline Studies Doris Hinge Project Data Compilation Report 1995-2000*. Prepared for Hope Bay Mining Limited by RL&L Environmental Services Ltd. / Golder Associates Ltd.: Edmonton, AB.

RL&L Environmental Services Ltd./Golder Associates Ltd. 2002b. *Doris North Project Aquatic Studies 2002*. Prepared for Hope Bay Mining Limited by RL&L Environmental Services Ltd. / Golder Associates Ltd.: Edmonton, AB.

Roscoe Postle Associates Inc. 2013. *Preliminary Economic Assessment Study on the TMAC-Hope Bay Project, Nunavut, Canada*. NI 43-101 Report. Prepared for TMAC Resources Inc. by Roscoe Postle Associates Inc.: Toronto, ON.

Ross, P. I. 2002. Update COSEWIC status report on the grizzly bear Ursus arctos in Canada. In *COSEWIC assessment and update status report on the Grizzly Bear Ursus arctos in Canada*. Eds. T. Ruskeeniemi, S. Frape, L. Moren, and P. Degnan. 1-91. Committee on the Status of Endangered Wildlife in Canada. Report of Phase 1, Permafrost Project GTK-SKB-POSIVA-NIREX-OPG.

RWED. 2000. *Vegetation classification for the West Kitikmeot/Slave Study Region*. 1999/2000 Annual Report Submitted to the West Kitikmeot/Slave Study Society by the Department of Resources, Wildlife and Economic Development, Government of the Northwest Territories: Yellowknife, NT.

Scott, W. B. and E. J. Crossman. 1973. *Freshwater Fishes of Canada*. Bulletine of the Fisheries Research Board of Canada No. 184.

SRK. 2009. *Hope Bay Gold Project: Stage 2 Overburden Characterization Report*. Prepared for Hope Bay Mining Limited by SRK Consulting (Canada) Inc.: Vancouver, BC.

SRK. 2011a. *Patch 14 Inflow and Water Quality Updates – DRAFT*. Prepared for Hope Bay Mining Limited by SRK Consulting (Canada) Ltd.: Vancouver, BC.

SRK. 2011b. *Technical Specifications Earthworks and Geotechnical Engineering. Hope Bay Project, Nunavut, Canada. Revision G – Issued for Construction*. Report Prepared for Hope Bay Mining Ltd. by SRK Consulting (Canada) Inc.: Project Number: 1CH008.027.

SRK. 2014. *Hope Bay Project Quarry G and H Management and Monitoring Plan*. Report Prepared for TMAC Resources by SRK Consulting (Canada) Inc.: Vancouver, BC.

Statistics Canada. 2008a. 2006 Profile of Aboriginal Children, Youth and Adults. http://www12.statcan.gc.ca/census-recensement/2006/dp-pd/89-635/index.cfm?Lang=eng (accessed March 2011).

Statistics Canada. 2008b. *Inuit Health, Education and Country Food Harvesting*. http://www.statcan.gc.ca/pub/89-637-x/89-637-x2008004-eng.pdf (accessed March 2011).

Swanson, H. K., K. A. Kidd, J. A. Babaluk, R. J. Wastle, P. P. Yang, N. M. Halden, and J. D. Reist. 2010. Anadromy in Arctic populations of lake trout (Salvelinus namaycush): otolith microchemistry, stable isotopes, and comparisons with Arctic char (Salvelinus alpinus). *Canadian Journal of Fisheries and Aquatic Sciences*, 67 (5): 842-53.

Thorpe, N., N. Hakongak, S. Eyegetok, and Kitikmeot Elders. 2002. *Thunder on the Tundra, Inuit Qaujimajatuqangit of the Bathurst Caribou*. Vancouver, BC: Generation Printing.

Thurber Engineering Ltd. 2003. *Hope Bay Doris North Project, Nunavut Surficial Geological Mapping*. Project Number 17-713-35. Letter Report Prepared for SRK Consulting (Canada) Inc.: n.p.

TMAC. 2013. *Preliminary Economic Assessment Study on the TMAC-Hope Bay Project, Nunavut Territory, Canada NI 43-101 Report*. December 31, 2013. n.p.

Walton, L. R., H. D. Cluff, P. C. Paquet, and M. A. Ramsay. 2001. Movement patterns of barren-ground wolves in the Central Canadian Arctic. *Journal of Mammalogy*, 82: 867-76.

Warner, B. G. and C. D. A. Rubec, eds. 1997. *The Canadian Wetland Classification System: The National Wetlands Working Group*. Waterloo, ON: University of Waterloo: Wetlands Research Centre.

Weaver, J. L., P. C. Paquet, and L. F. Ruggiero. 1996. Resilience and conservation of large carnivores in the Rocky Mountains. *Conservation Biology*, 10: 964-76.

Westroad Resource Consultants. 1998. *Terrestrial Ecosystems and Bioterrain of the Hope Bay Belt, Northwest Territories, Canada*. Prepared by Westroad Resource Consultants: n.p.

WKRLUP. 2005. *West Kitikmeot Regional Land Use Plan. Draft*. Public Hearing, Cambridge Bay, January 18-19, 2005.

Personal Communications

Anonymous. 2011. Cambridge Bay. Interview: February 3, 2011.

Avalak, J. 2011. Hunter, Cambridge Bay. Interview: February 3, 2011.

Avalak, M. 2011. Umingmaktok area resident. Land Use Focus Group, Cambridge Bay: November 16, 2011.

Land Use Focus Group. 2011. Participants from Umingmaktok: J. Avalak, M. Avalak, C. Keyok, C. Klengenberg, J. Naigak, and J. Tikhak. Land Use Focus Group Session: Cambridge Bay, November 16, 2011.

Dumond, M. 2010. Wildlife Manager, Government of Nunavut – Department of Environment.