DUCKS UNLIMITED CANADA

RENEWABLE RESOURCES ASSESSMENT
RAMPARTS RIVER AND WETLAND CANDIDATE PROTECTED AREA
NORTHWEST TERRITORIES

1740176

August 2006

EBA Engineering Consultants Ltd.
p. 867.920.2287 • f. 867.873.3324
PO Box 2244 • 201, 4916 - 49 Street • Yellowknife, Northwest Territories X1A 2P7 • CANADA

EXECUTIVE SUMMARY

The Northwest Territories Protected Areas Strategy (NWT-PAS) is a system to identify and protect areas with special ecological and cultural attributes. This strategy is implemented through an eight-step approach, the first step identifying priority areas. Ts'ude'hliline-Tuyetah (herein named Ramparts River and Wetlands Candidate Protected Area (CPA)), Northwest Territories (NWT) has been identified by the Sahtu Land Use Planning Board as an area valued for its biological, cultural, and historical richness, and has been identified as a priority area (see Figure 1 for the study area). The Yamoga Land Corporation in Fort Good Hope has initiated the Ramparts River and Wetlands CPA into the PAS process. Consequently, Ducks Unlimited Canada (DUC) is working in cooperation to ensure step 5 of the PAS process, which includes a Renewable Resource Assessment of Ramparts River and Wetlands CPA is completed following PAS Guidelines.

The Renewable Resources Assessment process is a multi-phased approach. Four phases of the Renewable Resource Assessment Guidelines requires a common systematic approach in collecting, reviewing, evaluating, and reporting existing published information on renewable resources and their use within the study area, and identify data gaps.

DUC retained EBA Engineering Consultants Ltd. (EBA) to conduct a Renewable Resources Assessment Phases 1, 2, and 4 on Ramparts River and Wetlands CPA, consistent with the NWT PAS Renewable Resource Assessment Guidelines. The objective of these three Phases of the PAS process requires the collection of existing renewable resource knowledge, evaluating patterns and importance of use, and reporting of information and data gaps. Recommendations are then put forward to fill in significant knowledge gaps.

Both traditional and non-traditional use of renewable resources, including climate, carving rocks, aquatics, vegetation, fish, and wildlife were discussed. Information on the traditional use of renewable resources (characterized by living off the land, local consumptive use of resources, or inherited cultural lifestyles) are limited, however, some important harvest areas have been mapped within the study area. Traditional use of aquatic resources, vegetation, fish, and wildlife within the study area has historically played an important role in the lives of the Sahtu Dene and Métis and Mountain Dene ancestors, and continue to do so today. Although wind and solar energy was harnessed for daily tasks, such as food preservation, light, and heat, this energy supply is not unique to the study area. Today, passive use of solar and wind energy is harnessed at existing cabins.

Non-traditional renewable resource use (such as large-scale commercial and industrial resource development) is currently limited within the study area, and includes some industrial water use (*e.g.* seismic and oil and gas exploration) and outfitted hunting. Although additional renewable resources are available within the study area (such as solar, wind, vegetation, and fish), limiting factors reduce the feasibility of future exploitation or use. However, there is potential for future development/ use of specific renewable resources following further evaluation, including: solar power, potable and industrial use of water resources, hydro development, sport hunts, and ecotourism.

Identified knowledge gaps that are of most priority are listed below.

- Collecting baseline water quantity and quality data is considered a medium priority since industrial development (predominantly seismic and oil and gas exploration) has occurred within the study area, and is expected to increase in the future.
- A baseline survey to document abundance and distribution of traditional use plants is considered a low - medium priority. Areas used the most (both historically and today), particularly the Ramparts Wetlands are considered a more priority than opposed to areas with limited access, such as the northwestern corner of the study area.
- A baseline fish survey to document abundance and distribution is considered a medium priority since limited data exists within the study area.
- Baseline wildlife surveys to document wildlife distribution and abundance is considered a low-medium priority. Areas where wildlife distribution and abundance data has been completed, such as within the Ramparts Wetlands are a low priority; however, areas with poor survey coverage have a medium priority.
- Monitor populations of wildlife species used for traditional and non-traditional use, including grizzly bears is considered a low - medium priority since the Department of Environment and Natural Resources (ENR) already monitors some wildlife populations, including woodland caribou, moose, beaver, marten, Dall's sheep, and grizzly bear. Medium priority is given to species not already monitored by ENR.

In addition to further studies, it is recommended the Ramparts River and Wetlands CPA boundary be shifted to further protect fur-bearers, moose, and Dall's sheep habitats and harvest areas. It is recommended the present CPA boundary be shifted slightly north along the Mackenzie River, as well as south to the Mountain River.

There are no further recommendations to allow Ramparts River and Wetlands CPA to proceed through the PAS process.

PAGE

PAGE

PAGE

PAGE

FIGURES

1.0 INTRODUCTION

The Northwest Territories Protected Areas Strategy (NWT-PAS) is a system to identify and protect areas with special ecological and cultural attributes. This strategy is implemented through an eight-step approach, the first step identifying priority areas. Ts'ude'hliline-Tuyetah (herein named Ramparts River and Wetlands Candidate Protected Area (CPA)), Northwest Territories (NWT) has been identified by the Sahtu Land Use Planning Board as an area valued for its biological, cultural, and historical richness, and has been identified as a priority area (see Figure 1 for the study area). The Yamoga Land Corporation in Fort Good Hope has initiated the Ramparts River and Wetlands CPA into the PAS process. Consequently, Ducks Unlimited Canada (DUC) is working in cooperation to ensure step 5 of the PAS process, which includes a Renewable Resource Assessment of Ramparts River and Wetlands CPA is completed following PAS Guidelines.

The Renewable Resources Assessment process is a multi-phased approach. Four phases of the Renewable Resource Assessment Guidelines requires a common systematic approach in collecting, reviewing, evaluating, and reporting existing published information on renewable resources and their use within the study area, and identify data gaps.

DUC retained EBA Engineering Consultants Ltd. (EBA) to conduct a Renewable Resources Assessment Phases 1, 2, and 4 on Ramparts River and Wetlands CPA, consistent with the NWT PAS Renewable Resource Assessment Guidelines. The objective of these three Phases of the PAS process requires the collection of existing renewable resource knowledge, evaluating patterns and importance of use, and reporting of information and data gaps. Phase 3, which is not part of this project, includes fulfilling data gaps. This Renewable Resources Assessment will be used as an information source to help determine the economic value of the given area, and will enable stakeholders to make informed decisions on renewable resource management, and subsequent long-term protection for the Ramparts River and Wetlands CPA.

1.1 OBJECTIVES

The main objective of this Renewable Resource Assessment is to collect published renewable resource information of the study area, evaluate existing data and knowledge, report data gaps, and recommend additional work to address the data gaps. The process for achieving these objectives follows the PAS Renewable Resource Assessment Guidelines.

Renewable resource knowledge presented in this report will be specific to the study area, wherever available, and will be divided into two groups based on lifestyles: traditional (*i.e.* subsistence living and fur trading) and non-traditional (*i.e.* commercial and industrial development). For this report, lifestyles considered traditional are those characterized by living off the land, consumptive use of resources (or use only what is required by an individual or local community), and may follow inherited aboriginal cultures, such as subsistence fishing, trapping, and local sawmills. For this report, renewable resources used

in a manner consistent with non-traditional lifestyles include the use of resources for large-scale commercial and industrial development. Renewable resource use is presented in this manner to provide a simple management tool for areas that may have restricted land use activities. Traditional and non-traditional uses of renewable resources discussed within this report are presented based on specific biophysical conditions including climate (particularly wind and solar), geology (particularly important stones), aquatics, vegetation, fish, and wildlife. Although geological material is a non-renewable resource, it is discussed within this report because of its strong traditional and cultural tie, most particularly with traditional carving stones, tools, and weaponry. This report focuses specifically on surficial material, and does not evaluate commercially valuable geological material such as oil and gas, and mineral deposits. Oil and gas, and mineral deposits will be discussed and evaluated in the Non-Renewable Resources Assessment, which is a separate part of the PAS guidelines.

Renewable resources will be assessed based on their importance, abundance, distribution, use (historical, current, and possible future), economic value, and feasibility or logistical constraints, wherever information is available. Potential renewable resource uses for non-traditional lifestyles discussed in this report are only possibilities with respect to resource capabilities, and are not to be taken as recommendations for development or exploitation. Some renewable resource opportunities presented in this report may contradict the Sahtu Dene and Métis Comprehensive Land Claim Agreement (1993) and the Draft Sahtu Land Use Plan.

The presence, abundance, and distribution of renewable resources within a given area are interconnected with existing ecological resources. In this report, a brief outline of the ecological environment is provided as an introduction to each renewable resource assessment.

1.2 RAMPARTS RIVER AND WETLANDS CANDIDATE PROTECTED AREA

One of the mandates of the Sahtu Land Use Planning Board is to protect and promote the cultural, social, and economic well being of local residents (Sahtu Land Use Planning Board 2002). To support this mandate, the Sahtu Land Use Planning Board has outlined areas considered biologically, culturally, historically, and traditionally valuable to the Sahtu people, and to all Canadians. One of these areas considered especially important includes Ramparts River and Wetlands CPA (Figure 2) (Sahtu Land Use Planning Board and the Sahtu GIS Project 2005). Ramparts River and Wetlands CPA is recognized as being important for wildlife and heritage resources.

Ramparts River and Wetlands CPA includes an area approximately 15,000 km^2 that is located along the western shore of the Mackenzie River across from Fort Good Hope, and continues south along the Mackenzie River to approximately the confluence with Mountain River. The southern border of the study area lies within the Mackenzie Mountains and encompasses the headwaters of the Ramparts River. The Gwich'in Settlement Area borders the western limit of the study area, just east of the Arctic Red River. The study area is centred on the Ramparts and Ontaratue Rivers.

The Ramparts River and Wetlands CPA has been described by local residents as critical for hunting moose, beaver, and muskrat, and is used to teach young hunters (Sahtu Heritage Places and Sites Joint Working Group 1999). It is also locally known as a critical waterfowl breeding area (Sahtu Heritage Places and Sites Joint Working Group 1999). In addition to moose, beaver, muskrat, and waterfowl, woodland caribou (both boreal and mountain ecotypes), fur-bearers, and fish are also commonly harvested from the area.

The Ramparts River and Wetlands CPA encompasses heritage and cultural sites, including Thunder Bird Place Heritage Site (ʔiditué Dáyı̨dá), that were historically used by the Sahtu Dene and Métis and Mountain Dene (Sahtu Land Use Planning Board 2002; Andrews pers. comm. 2006). The Thunderbird Place is located on the Ramparts River, and is considered a dangerous place where a giant Thunderbird often killed travellers until a powerful medicinal elder killed the Thunderbird (Sahtu Heritage Places and Sites Joint Working Group 1999). Additional heritage and cultural sites occurring in the Ramparts River and Wetlands CPA include archaeological sites, burial sites, meeting places, cabins, camping sites, and trails (Figure 2) (Yamoga Land Corportation 2006; Heritage Sites and Places Working Group 1999).

1.0 STUDY AREA

For this report, the study area is defined as an area encompassing Ramparts River and Wetlands CPA plus neighbouring Sahtu property to the north, south, and adjacent sections of the Mackenzie River (approximately 18,376 km^2). Neighbouring property is considered in this assessment to allow an evaluation of important renewable resource patterns, and will allow for possible boundary adjustments. The location of the study area and Ramparts River and Wetlands CPA are shown in Figure 2.

Residents of Fort Good Hope are the dominant users of the study area (Manuel pers. comm. 2006). Existing human structures and developments present within the study area are limited to a few cabins and trails. A few families from Fort Good Hope use the cabins within the study area mainly during the winter and spring (Manuel pers. comm. 2006). Only on rare occasions are the cabins within the study area used during the summer (Manuel pers. comm. 2006). No roads exist within the study area and the nearest community is Fort Good Hope (population of 549 as per 2001 Statistics Canada census), which lies across the Mackenzie River. The economy of Fort Good Hope relies on trapping, hunting, domestic fishing, and oil exploration (Indian and Northern Affairs Canada (INAC) 2004). INAC reported several renewable resources at Fort Good Hope including Arctic Grayling, Northern Pike, Lake Trout, Whitefish, black bear, moose, wolf, beaver, caribou, marten, muskrat, fox, and wood (INAC 2004).

The study area lies within the Taiga Plains and Taiga Cordillera ecozones[1], which are further subdivided into distinctive ecoregions[2]. The Taiga Plains ecozone is subdivided into 18 ecoregions. Of these 18 ecoregions, three occupy the study area including the Peel River Plateau, Fort MacPherson Plain, and the Mackenzie River Plain ecoregions (Figure 3) The Taiga Cordillera ecozone is subdivided into seven ecoregions, including the Mackenzie Mountains ecoregion that occurs within the study area (Figure 3).

TABLE 1. ECOZONES AND ECOREGIONS OF RAMPARTS RIVER AND WETLANDS CANDIDATE PROTECTED AREA

Ecozones	Ecoregions	Percent Covering the Study Area (%)
Taiga Plains	Peel River Plateau	41
	MacPherson Plain	35
	Mackenzie River Plain	8
Taiga Cordillera	Mackenzie Mountains	16

The Peel River Plateau ecoregion covers the western boundary as well as the majority of the southern half of the study area (Figure 3), and is characterized by a high subarctic ecoclimate with very cold winters and short cool summers (Ecological Stratification Working Group 1996). Terraces and rounded plateaus dominate the topography. In low-lying areas wetlands occur (cover approximately 25% of the ecoregion), such as peat plateau bogs, and ribbed and horizontal fens (Ecological Stratification Working Group 1996). Vegetation communities in these low-lying areas are dominated by species that favour and/ or tolerate poorly drained soils, such as sedge, cottongrass, and sphagnum moss. Open stunted spruce and tamarack characterize the upland vegetation communities. Understory species occurring in upland areas include dwarf birch, willow, ericaceous shrubs, cottongrass, lichen, and moss (Ecological Stratification Working Group 1996). Vegetation is influenced by continuous permafrost with high to medium ground ice content (Ecological Stratification Working Group 1996).

[1] An ecozone represents a large generalized unit at the top of an ecological hierarchy as defined by the Canada Committee on Ecological Land Classification.

[2] An ecoregion is part of an ecozone and is characterized by distinctive regional factors, including climate, physiography, vegetation, soil, water, fauna, and land use (Ecological Stratification Working Group 1996).

The northern portion of the study area lies within the Fort MacPherson Plain ecoregion (including Ramparts wetlands and Ontaratue River) (Figure 3). This ecoregion has a similar climate, flora, and fauna of the Peel River Plateau ecoregion, however it differs in topography, which is dominated by level to undulating moraine with deeply incised Arctic Red and Ontaratue rivers (Ecological Stratification Working Group 1996). Fifty percent of the land within the southern portion of the Fort MacPherson Plain ecoregion (including the Ramparts Wetlands) is covered by wetlands (Ecological Stratification Working Group 1996).

The Mackenzie River Plain ecoregion covers the northeastern limit of the study area along the Mackenzie River (Figure 3). The Mackenzie River Plain ecoregion is characterized by a subhumid high boreal ecoclimate that is dominated by medium to tall stands of black spruce and jack pine accompanied by feathermoss, lichens, blueberry, Labrador tea, and bog cranberry understory (Ecological Stratification Working Group 1996). Peat plateau bogs, and ribbed and horizontal fens cover 25-50% of this ecoregion. Black spruce, ericaceous shrubs, and sphagnum moss typically dominate these poorly drained areas (Ecological Stratification Working Group 1996). Permafrost within this ecoregion is described as being extensive and discontinuous, and contains sparse ice wedges with medium ice content (Ecological Stratification Working Group 1996).

The Taiga Plains ecozone gives way to the Taiga Cordillera ecozone. The Taiga Cordillera ecozone is characterized by its steep mountainous topography. The Mackenzie Mountains ecoregion, a subdivision of the Taiga Cordillera ecozone, covers the extreme southern limit of the study area (Figure 3). Upper elevations of this ecoregion are dominated by alpine tundra vegetation including intermediate to dwarf ericaceous shrubs, mountain avens, lichens, sedges, and cottongrass tea (Ecological Stratification Working Group 1996). The lower elevations of the Mackenzie Mountains ecoregion are covered by subalpine open woodland vegetation communities that are best described as open, discontinuous stands of stunted white spruce with occasional occurrence of alpine fir (Ecological Stratification Working Group 1996). Understory species include willows, dwarf birch, and Labrador tea (Ecological Stratification Working Group 1996). Permafrost cover is extensive, but discontinuous and includes variable ice content (Ecological Stratification Working Group 1996).

2.0 VALUABLE RENEWABLE RESOURCES

All renewable resources present in the study area having historical, current, or future use, and/or those considered important for stakeholders are discussed in this report. Traditional and non-traditional uses of renewable resources discussed within this report are organized based on biotic and abiotic environmental conditions including climate (particularly wind and solar), geology (particularly carving stones), aquatics, vegetation, fish, and wildlife.

Although numerous parameters were selected to represent the range of important renewable resource values existing within the Ramparts River and Wetlands study area, Beanlands and Duinker (1983) stated that it is impossible for an analysis to address all potential resource components. Therefore, only select renewable resource components identified as having economic or aesthetic value to stakeholders were discussed. For example, solar and wind energy, and carving stones were identified as being renewable resources important to stakeholders. However, since they have been identified as being important to the stakeholders and/or the PAS working group, they have been included within this report.

Valuable renewable resources include those resources considered to have special cultural, economic, and social importance, and were selected based on the following attributes:

- Renewable resources used for known historic, current, and/or future applications;
- Renewable resources considered traditionally and culturally important (*e.g.* important food source);
- Renewable resources that are common in the study area; and
- Renewable resources considered a significant economic source;

Table 2 outlines valuable renewable resources discussed within this report.

TABLE 2. VALUABLE RENEWABLE RESOURCES IN THE STUDY AREA

Environmental Components	Renewable Resources
Climate	Solar and Wind
Geology	Soils and Important Stones
Aquatics	Hydrology and Water Quality
Fish	General Fish
Ungulates	Woodland Caribou (Boreal and Mountain ecotypes), Moose, and Dall's Sheep
Fur-bearers	Grizzly Bear, Black Bear, Wolf, Wolverine, Red Fox, Marten, Beaver, Muskrat, and Snowshoe Hare
Birds	General Waterfowl and Grouse and Ptarmigan

3.0 CLIMATE

3.1 INTRODUCTION

As in many areas located throughout the Northwest Territories, the climate of Ramparts River and Wetlands Candidate Protected Area varies from long cold winters to short hot summers. Discontinuous meteorological data have been collected by Environment Canada from 1994 to 2002 at Ramparts River, at the central portion of the study area. Meteorological data from the Ramparts River station indicates the average annual temperature is approximately -3 degrees Celsius (ºC) (Environment Canada 2005). Wind

parameters were not measured at the Ramparts River meteorological station. Based on modelling predictions, the average annual precipitation within the study area varies throughout the study area. In the northern portion of the study area, an estimated 285.4 millimetres (mm) of precipitation falls a year (154.3 mm of rain and 131.1 mm of snow). Central portions of the study area receive approximately 294 mm of precipitation a year (147 mm of both snow and rain), and the southern mountainous portions of the study area receive a total 297 mm (160 mm of rain and 137 mm of snow) (Auld and Kershaw 2005). The small portion of the study area that lies adjacent to the Mackenzie River receives the highest amount of precipitation a year. Modelling estimates indicate the northeastern portions of the study area, adjacent to the Mackenzie River, receive 323 mm of precipitation a year (181 mm of rain and 142 mm of snow) (Auld and Kershaw 2005).

3.1.1 Wind

Although wind parameters were not measured at the Ramparts River meteorological station, wind data has been collected at the Fort Good Hope meteorological station since 1965 (Environment Canada 2004). Average monthly wind direction and wind speeds at Fort Good Hope in 1996 were randomly chosen to represent wind conditions in the study area, and are provided in Table 3.

The average wind direction and wind speeds remained relatively constant throughout the year. On average the wind blew from the north-northeast (between 6 º - 16.7 º true north) (Environment Canada 2004). In addition, wind speeds remained relatively low. The highest monthly wind speeds were recorded June, July, and September, respectively, and the lowest wind speeds were recorded in February, January, and November, respectively. The yearly average wind speed was calculated at 6.3 km/hr (Environment Canada 2004).

TABLE 3. FORT GOOD HOPE 1996 AVERAGE METEOROLOGICAL DATA[1]

Month	Average Monthly Wind Direction (degrees true north)	Average Monthly Wind Speed (km/hr) [2]
January	9.7	4.7
February	6.0	3.1
March	10.6	7.6
April	10.2	5.7
May	12.4	5.9
June	16.7	9.8
July	17.0	6.2
August	15.1	8.1
September	13.1	7.6
October	11.8	6.3
November	6.8	4.6
December	10.0	6.1
Yearly Average	11.6	6.3

1. (Environment Canada 2004)
2. Wind speed taken from 10 m above ground.

Canadian Wind Energy Atlas (Environment Canada 2004b) has modelled wind energy and wind speeds throughout Canada, including the study area, using meteorological data collected over a 43-year period. According to the Canadian Wind Energy Atlas, most of the study area is dominated by wind energy ranging between 100 – 200 watts per square meter (W/m^2)(30 m above ground level) (Figure 4), except for the Ramparts wetlands area, which has an estimated wind energy between 0 – 100 W/m^2 (Environment Canada 2004b). Wind energy at Fort Good Hope is estimated between 200 - 300 W/m^2 (Environment Canada 2004b) (Figure 4).

3.1.2 Solar

The amount of daylight hours varies considerable within the study area throughout the year. In the summer, the sun remains above the horizon for approximately one month (near summer solstice), but during the winter solstice, the sun is above the horizon for less than 3 hours a day (Dyke and Brooks 2000). Annually, the average daily global[3] solar radiation at

[3] Global Solar Radiation is defined as the total incoming direct and diffuse shortwave solar radiation received on the ground.

the study area has been estimated at 9.4 mega Joules per square meter per day[4] ($MJ/m^2/day$) (Marshall *et al.* 1999).

Although solar energy is fundamentally important in determining air temperature, wind acts to disperse heat to other areas. In addition, solar heat reaching the study area is dissipated by cold air coming in from the north.

3.2 RENEWABLE RESOURCE USE AND OPPORTUNITIES

3.2.1 Traditional Use

For this report, traditional use includes historical and current aboriginal and non-aboriginal use that is considered more conventional or customary.

3.2.1.1 Passive Solar and Wind Power

For thousands of years, people used solar energy for a number of purposes. In particular, meat, berries, hides, and vegetative material were dried in the sun to help preservation, and shelters were positioned to capitalize on the sun's light and heat. This concept of naturally harvesting the energies of solar and wind power is defined as passive solar energy use. Passive solar thermal is the capitalization of the sun's natural energy to passively heat or light.

Although, traditional use of wind and solar energies have not been documented specifically within the study area it is assumed passive solar energy use was historically and currently used at campsites and cabins. By simply designing a building to enhance passive solar heating, energy requirements to heat can be reduced by 10 - 20% (Rocky Mountain Institute ND). However, the economic value of passive solar and wind energy use within the study area is unknown.

The use of passive solar and wind energies is assumed to have been a daily routine at camps and cabins where food materials and hides were dried. Passive solar and wind energy could be used on a continual basis throughout the year within the entire study area (Figure 5).

3.2.2 Non-Traditional Use

Non-traditional use of renewable resources is defined as the use of modern technology and/ or large manufacturing, production, and commercial export of resources.

In Canada, there are over 300 remote communities that are not connected to the national electrical grid system (North American electrical grid) or natural gas networks (Ah-You and Leng 1999). These communities must rely on costly imported fuel oils. However, renewable energy sources, such as solar and wind, are readily available. In 2005, the

[4] One kilowatt hour = 3.6 mega Joules.

monthly electricity cost of a residence in Fort Good Hope was approximately $140.21, including government subsidies (GNWT 2005). It is assumed the monthly cost of electricity at existing cabins within the study area are similar, or slightly higher, than the cost in Fort Good Hope.

3.2.2.1 Active Solar Energy

Although solar energy is largely unexploited in the study area for heat and power, active solar energy development is possible throughout the study area since the NWT annually receives as much sunshine as southern Canada (RWED 2003a) (Figure 5). Dignard-Bailey and Filion (1998) indicated average daily solar radiation between 11 – 16 MJ/m^2 is considered a favourable solar resource for the sustainable operation of an active solar energy collection system. Although the study area receives a daily annual average of 9.4 MJ/m^2, the solar resource available in the region would be used essentially for summer months.

The active collection of solar radiation can be harnessed for heat (by active solar thermal collection systems) and electricity (through photovoltaic systems). Active solar thermal collection systems is the active collection and delivery of solar energy using an air handling or closed fluid circulation system for heating (RWED 2003a). Space heating using active solar thermal collection systems, such as solar water heaters and solar ventilation air heating systems, is considered a cost-effective solution in Canada's remote communities (Ah-You and Leng 1999).

Photovoltaic systems convert solar energy directly into electricity using semi-conductor materials (*e.g.* solar panels) (RWED 2003a). These photovoltaic systems are considered a cost-effective solution for off-grid energy supplies for exploration camps and remote cabins (Ah-You and Leng 1999). Typical solar panels in photovoltaic systems, approximately 120 cm x 30 cm in size, generate approximately 50 watts (W) of electricity in full sun, which can run three high-efficiency lights, a small television, and a water pump (Rocky Mountain Institute ND; Solar Energy Society of Canada Inc. 1997). The basic start-up cost for a 50-watt photovoltaic system (including the unit, solar panel, inverter, and battery) is approximately $700 (Solar Energy Society of Canada Inc. 1997). Larger or smaller photovoltaic systems are also available at varying costs.

To date, solar energy has not been harnessed for use within the study area. Local cabins do not actively harness solar power to generate heat and/ or electricity (Manuel pers. comm. 2006), however there is potential to utilize this renewable energy source (Figure 5). Existing cabins currently utilize wood and small generators for heat and power (Manuel pers. comm. 2006).

At Fort Good Hope in 2004, the cost of space heating using fossil fuels was $0.86 per litre (INAC 2004). In addition, the cost for diesel-generated electricity in remote communities throughout the NWT ranged between $0.30 per kilowatt (kW) - $2.00 per kW (RWED 2003a). By comparison, an active solar photovoltaic plant could produce electricity to a

remote community for approximately $0.40 - 0.70 kilowatt hours (kWh) (Dignard-Bailey and Filion 1998).

Both active solar thermal and photovoltaic solar systems can be used to supply energy to a single cabin, or to supplement diesel-generated electricity. However, since cabins within the study area are occupied predominantly during winter or spring months when the amount of daylight hours is limited, the feasibility to develop active solar heat and electricity systems is considered low. In addition, when comparing the cost of installing an active solar system with the price of diesel-generated power, the cost of active solar systems is high for the amount of solar output available to the user.

The remoteness of the area, its northern latitudes (particularly the short winters), and the need for a grid system or large battery storage to sustain energy levels during cloudy days or through the winter months hinders any future increase in solar energy production at the study area for large-scale developments. Due to these restrictions, the costs to develop solar resources may increase. However, the potential to develop solar resources within the study area depends on the size of the electrical or heating requirements and thus economic feasibility since it may be more cost effective to develop solar resources if the heat/electrical requirements are large.

Small-scale solar-generated power is an option for cabins or to support diesel-powered energy. However, future increase in solar energy use within the study area is restricted without the support of large battery storage or a grid system. The feasibility of developing active solar resources within the study area should be considered for each separate cabin or development depending on the location, energy requirements, seasonal use, and duration of use.

3.2.2.2 Active Wind Energy

The other potential natural energy source in the study area is wind. Although no large-scale wind turbines are operating in the NWT, small off-grid turbines are present (RWED 2003a). Whereas no communities or industry currently occupy the study area, small cabins do exist within the Ramparts wetlands and along the Mackenzie River. Wind energy is not used within the study area for power generation; local cabins use timber and fossil fuels for heat and power (Manuel pers. comm. 2006).

RWED (2003a) considers locations with wind speeds above 18 km/hr to have significant economic potential. Similarly, Aurora Research Institute (2003) indicates areas with an average wind speed less than or equal to 15.84 km/hr[5] are considered unsuitable for wind energy development. The average wind speed recorded at Fort Good Hope meteorological station for 1996 (10 m above ground level) was 6.3 km/hr. This wind speed is less than the required thresholds for a wind-powered energy source, therefore deeming the study area unsuitable for harnessing wind energy.

3.3 DATA GAP ANALYSIS

3.3.1 Data Gaps in Traditional Knowledge and Use

Passive solar and wind energy was historically used in the study area for a number of purposes and still is today. Although, solar and wind energy has been used within the study area, particularly for preserving meat, berries, and hides, the study area is not considered an important area for solar and wind resources. Solar and wind attributes at the study area are not uncommon throughout the region. There are no gaps in traditional knowledge regarding passive solar and wind energy use within the study area.

3.3.2 Data Gaps in Scientific Literature and Non-Traditional Use

To date, wind energy potentials within the study area are based on modelling estimates and data collected from the Fort Good Hope meteorological station. Wind data have not been collected specifically at the study area, though known solar information within the study area is appropriate for completion through the PAS process. No additional solar data are required.

4.0 GEOLOGY

4.1 INTRODUCTION

The geology of an area is described by the summation of the local topography, bedrock and surficial geological material, and soils. Although geological material is a non-renewable resource, it is briefly discussed in this renewable resource assessment since carving stones are considered a valuable traditional economic and heritage commodity. Commercial geological material including, but not limited to, ore, uranium, zinc, diamonds, and oil and gas are not discussed in this report.

The topography varies throughout the study area. The most prominent topographic feature of the study area is the rugged Mackenzie Mountains in the southern portion of the study area, where the land slopes at angles greater than 60% (CLBRR 1996). With the exception

[5] Wind speed calculated from 10 m above ground.

of the deeply incised Ontaratue River valley, the northern portion of the study area encompasses low-lying wetlands and undulating surface relief with slopes between 4 – 9% (Ecological Stratification Working Group 1996; CLBRR 1996). A small area in the west-central portion of the study area has slopes ranging between 16 – 30% (CLBRR 1996).

The bedrock of the study area is dominated by Cretaceous sedimentary rock (Auld and Kershaw 2005; INAC 2005). Glacial till, which is composed of gravels, sands, and silt, overlies the bedrock material throughout the study area, except in the southern mountainous areas and the small inclusions along major rivers and streams (Auld and Kershaw 2005).

Two types of soils can be found in the study area: Orthic Cryosolic and Organic Cryosolic. Orthic Cryosolic soil is a mineral soil that has permafrost within 1 to 2 m of the surface, and Organic Cryosolic soil has at least 40 cm of surface organic material that has been affected by permafrost. Organic Cryosolic soils dominate the Ramparts wetlands area, and also occur as small inclusions throughout the study area in poorly drained soils.

4.2 RENEWABLE RESOURCE USE AND OPPORTUNITIES

4.2.1 Traditional Use

4.2.1.1 Stone Tools and Crafts

Carving stones are considered a valuable economic and heritage commodity. Aboriginal people historically crafted weapons and tools from suitable rocks. Traditionally, Dene people did not carve arts (Andrews pers. comm. 2006). The working of stone for art began as an economic product in the 1950's (Andrews pers. comm. 2006). Today, stone carvings continue to play an important role in the local economy, and cultural identity of local aboriginals.

Soapstone and other culturally significant stones found in the NWT (*i.e.* serpentinite, siltstone, argillite, dolomite, quartz, and marble) are used for stone carvings. However, historic use of these stones in the study area is unknown, and no published information is available on locations of culturally significant geological material or historical quarry sites within the study area. However, traditional stone quarries are expected to be limited within the study area since glacial till overlies much of the bedrock, except in the mountainous areas. Culturally significant stones may be near surface in the mountainous areas located at the southern portion of the study area. If carving stones are available in this region, it is assumed the Mountain Dene utilized this resource. However, the extent of this resource use is unknown. The nearest known quarry site to the study area is located at the mouth of Thunder River (Sahtu Heritage Places and Sites Joint Working Group 1999), approximately 90 km north of the study area. No carving stone deposits are known to occur within the study area (Robinson and Irwin 2003).

Dominant use of the study area, both historic and current use, revolves around infrequent hunting, trapping, and fishing trips. Based on the limited number of individuals that utilize the study area, it is assumed the study area generates little economic value from the sale of carvings and other stone crafts. In addition, the potential to increase the use of this resource is considered very poor since carving stones may only occur in remote areas within the study area. In addition, Manuel (pers. comm. 2006), indicated residents of Fort Good Hope (the main users of the study area) do not carve stone.

4.2.2 Non-Traditional Use

4.2.2.1 Horticultural Peat Harvesting

Horticultural peat harvesting occurs in the boreal forest zone throughout southern Canada. In 1999, Canada's total revenue of horticultural peat was approximately $170 million, and provided employment for thousands of local residents (Daigle and Gautreau - Daigle 2001). It has been estimated approximately 16.9 x 10^6 ha of peatlands (wetlands that have peat and sphagnum including bogs and fens) occur in the NWT and Nunavut (Daigle and Gautreau - Daigle 2001). Although to date, peat harvesting has not occurred in the NWT.

The potential for developing this resource within the study area is unknown. However, these wetland types do occur within the study area, mainly within the Ramparts wetlands (approximately 148,284 ha dominated by wetlands) (Figure 6). The quality and quantity of peat available in the study area is unknown, and may not support a viable horticultural peat harvesting industry. According to Daigle and Gautreau – Daigle (2001), an area of 50 hectares is typically required for viable horticultural development, however smaller sites are occasionally developed. Since the quantity and quality of peat within the study area is unknown, the economic value of this resource is undetermined. In addition, a number of logistical limitations exist within the study area. Although there is a potential labour force from Fort Good Hope, access to the site is limited to small water craft along the Ramparts River. At this time, potential for development of a horticultural peat harvesting operation is considered very low due to the remoteness of the study area. In addition, peat harvesting disturbs wildlife habitat and is in conflict with traditional wildlife harvests.

4.3 DATA GAP ANALYSIS

4.3.1 Data Gaps in Traditional Knowledge and Use

No published information is available on the abundance and distribution of culturally significant geological material or quarry sites within the study area. Historic and current use of carving stones in the study area is assumed to be limited to the mountainous region in the southern portion of the study area. The extent of this resource use within the study area is unknown.

4.3.2 Data Gaps in Scientific Literature and Non-Traditional Use

The quantity and quality of peat within the study area for horticultural peat harvesting is largely unknown. Subsequently, the potential economic value of this resource is undetermined. Due to various limitations (*e.g.* remoteness of the study area, and conflicts with traditional harvest areas) and unknown quantity/quality of the resource, it is assumed there is little potential for developing a horticultural peat industry within the study area.

5.0 AQUATICS

5.1 INTRODUCTION

The study area is located within the Ramparts subwatershed, and encompasses the entire Ramparts River (approximately 312 km in length), as well as the upper portions of Ontaratue River. The Ramparts River headwaters lie within the southern reaches of the study area, in the Mackenzie Mountains, and flow north through the centre of the study area. The Ramparts River travels north from the Mackenzie Mountains and discharges into numerous ponds and wetlands (named Ramparts wetlands) before flowing into the Mackenzie River near Fort Good Hope. The Ramparts River drainage basin is approximately 10,683 km^2 (Dryden *et al.* 1973). Ramparts River is described as having extreme meanders, particularly through its lower reaches, which flow through stagnant lakes and pools of the Ramparts Wetlands (Dryden *et al.* 1973). Bottom substrate is considered heavily silted and the river is subject to summer flooding (Dryden *et al.* 1973).

The upper reaches of the Ontaratue River occur in the northwestern portion of the study area, and the middle reaches of the Ontaratue River (characterized by a deeply incised valley) are located at the northern portion. The Ontaratue River discharges into the Mackenzie River.

In addition, the Hume and Mountain rivers (length approximately 196 km and 328 km, respectively) occur within the study area. Both Hume and Mountain rivers originate from the mountains and flow east towards the Mackenzie River. The Hume River drainage area is approximately 5,117 km^2 (Dryden *et al.* 1973). The Hume River is described as extremely meandering, and flows through wetlands in the lower reaches (Dryden *et al.* 1973). These wetlands and meanders decreases flow velocities. Mountain River drains a basin area approximately 22,033km^2 (Dryden *et al.* 1973). Mountain River is a multi-channeled river that includes numerous gravel bars and islands. The lower reaches of the river have generally low riverbanks surrounded by flat, flood prone plains (Dryden *et al.* 1973). The riverbanks in the upper reaches, within the mountains, are high bedrock cliffs reaching heights of 91 m (Dryden *et al.* 1973). Mountain River is considered a swift flowing river (Dryden *et al.* 1973).

In 1985, a hydrometric station was installed on Ramparts River, approximately 35 km southwest of Fort Good Hope (Figure 7) (Environment Canada 2006). Data was collected on a relatively continuous basis until 1996. Based on data collected at the hydrometric

station, average discharge rates varied throughout the year depending on snowmelt and rainfall. From 1985 to 1996, the lowest average monthly discharge rates were recorded in April (1.32 m^3/s), followed by March (1.39 m^3/s), February (1.85 m^3/s), and January (2.66 m^3/s) (Environment Canada 2006). The highest discharge rates were recorded in June (156 m^3/s), followed by May (145 m^3/s), and September (60 m^3/s) as a direct result of snowmelt and summer rains (Environment Canada 2006). The yearly average discharge rate at Ramparts River was 41.8 m^3/s (Environment Canada 2006).

A hydrometric station was also installed on Mountain River, at the southeastern limit of the study area (Figure 7). This hydrometric station was in operation from 1975 till 1994. The average annual flow at Mountain River was approximately 123.0 m^3/s (Kokelj 2001). Water levels in the Mountain River fluctuate with precipitation and snowmelt events, and peak flows occur between May and August (Environment Canada 2006). This is typical of mountain rivers with steep riverbanks and little storage capacity (*i.e.* wetlands) (Kokelj 2001). Lowest flow rates were recorded between December and April (Environment Canada 2006). The average flow rates were lowest in March (12.5 m^3/s), followed by February (13.0 m^3/s), and April (14.2 m^3/s) (Environment Canada 2006).

Water quality samples were also taken from the several rivers within and adjacent to the study area from 1969 to 1974, including Ramparts, Hare Indian, Mountain, and Mackenzie River near Fort Good Hope (Yamoga Land Corporation 2006). Water quality of these rivers was considered excellent, and water parameters rarely exceeded the Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for drinking water (Yamoga Land Corporation 2006). Parameters that exceeded water quality guidelines were colour and turbidity, which can be attributed to the size of the rivers and bank substrate (Yamoga Land Corporation 2006). The banks of the Ramparts River commonly include undercut banks, mud flows, and slumps (Dryden *et al.* 1973).

5.2 RENEWABLE RESOURCE USE AND OPPORTUNITIES

5.2.1 Traditional Use

5.2.1.1 Travel Corridors

Major rivers and tributaries, in particular Ramparts, Hume, and Mountain rivers within the study area historically have been used as major travel routes and are still used today (Manuel 2006; Heritage Sites and Places Working Group 1999). Ramparts and Hume rivers are used as travel corridors throughout the year, in particular during spring and fall hunts using canoes and dog teams (Manuel pers. comm. 2006; Johnson and Ruttan 1993; Sahtu Heritage Places and Sites Joint Working Group 1999). Ramparts River is also used as a snowmobile travel corridor during the winter. Although the Ontaratue River is less commonly used as a travel route, it is used during the spring (Manuel pers. comm. 2006). The Mountain River was an important traditional trail for the Mountain Dene, who traveled the river by mooseskin boats (Sahtu Heritage Places and Sites Joint Working Group 1999). The

Mountain River was also considered the shortest route to Dall's sheep hunting areas (Sahtu Heritage Places and Sites Joint Working Group 1999). It is assumed all rivers, streams, and lakes within the study area were traditionally used as travel corridors throughout the year. The economic value of these travel corridors is undetermined.

Fort Good Hope was established in 1908 as the first fur trading post in the lower Mackenzie valley (Auld and Kershaw 2005). Shiht'a Got'ine (from the Mackenzie Mountains), Gwich'in (to the west and north of the study area), and Inuvialuit (north of the study area) travelled to Fort Good Hope to trade furs (Auld and Kershaw 2005). An important traditional trail used by the Shiht'a Got'ine travels across the study area from the headwaters of the Arctic Red River (in the Mackenzie Mountains) to Fort Good Hope (Heritage Sites and Places Working Group 1999). This important trail was travelled on foot in the fall and winter months for centuries (Heritage Sites and Places Working Group 1999). This important trail was also used as an access route to important hunting grounds (Heritage Sites and Places Working Group 1999).

5.2.1.2 Potable Water

Occupants of the cabins throughout the study area are expected to utilize the rivers, streams, and lakes as potable water sources during periods of residency (predominantly during winter and spring). In addition, these water sources would have been used all year during hunting, fishing, and trapping trips throughout the study area (Figure 7).

There are no existing communities that draw potable water from the study area. The nearest community is Fort Good Hope, which draws potable water from the Mackenzie River to fill water reservoirs (INAC 2004). It is estimated each person living in communities along the Mackenzie River use between 450 – 500 litres of water a day (Mackenzie River Basin Board 2004). The community of Fort Good Hope withdraws 18,000 cubic meters of water from the Mackenzie River each year, which is a negligible amount compared to the total annual flow of the Mackenzie River (Mackenzie River Basin Board 2004).

The quality and quantity of potable water within the study area is largely unknown, however, current demand is considered negligible since existing cabins are used only by a few families during spring and winter months.

5.2.2 Non-Traditional Use

Aquatic resources within the study area are currently not being utilized by non-traditional means. However, future exploitation of aquatic resources is possible.

5.2.2.1 Hydroelectric Power

Power requirements in the study area are limited to possibly a few cabins that are scattered throughout the study area, particularly along the Ramparts, Hume, Mountain, and Mackenzie rivers systems, as well as the Ramparts Wetlands. To date, large energy demands

are not required within the study area because of its remoteness and low market demand. However, future opportunities may exist for hydroelectric development.

Small hydro facilities have been reported to supply a cost-effective source of energy to remote communities that have suitable hydro resources (Ah-You and Leng 1999). With the high fuel prices throughout the NWT, specifically in remote communities, the development of hydroelectric generation could be an opportunity. Advantages of developing hydroelectric power stations may include cost savings to community members and industrial developments. Communities within the NWT that use hydroelectricity have 300 to 500% lower electrical costs than communities using fuel generation (RWED 2004). The cost of electricity for communities using diesel generation ranges between $0.30 per kW - $2.00 per kW, in contrast, the cost of electricity for communities served by hydropower range between $0.10 per kW - $0.20 per kW (RWED 2003a). Hydroelectric power has already been developed or proposed within the NWT, including Bluefish, Taltson, and Great Bear River (Cambridge Strategies Inc. 2004). In addition to reducing fuel costs, large hydropower stations have the potential to be linked to grids to southern Canada, where power can be exported out of the NWT for a monetary gain.

The NWT Energy Strategy (RWED 2003b) indicated the NWT has a vast renewable hydroelectric potential, and plans to assist the acceleration of renewable energy use. In particular, the NWT Energy Strategy outlined programs to evaluate and develop small[6] and mini[7]-hydro developments for small communities and isolated residences. The Small Scale Hydro Task Force (ND) has identified eight technically and economically feasible small hydro developments (between 50 kW – 10 MW) within the NWT. None of which are close to the study area.

The capacity for hydroelectric power within the study area can be crudely estimated for possible future use. Hydroelectric potential of a given watercourse is a function of the amount of water flowing through a portion of a stream or river and the hydraulic head[8]. The hydroelectric potential of the Mountain and Ramparts rivers can be roughly estimated based on the flow data collected at the hydrometric stations (Figure 7). A rough estimate of hydroelectric potential is calculated using flow data that is averaged over the year, and does not represent high flows after snow melt, or low flows during winter months. Flow data for Ontaratue and Hume rivers were unavailable, however Manuel (pers. comm. 2006) indicated Ontaratue River has low flow even during the summer months, and therefore assumed to provide little potential for hydro development.

[6] Small hydro developments are defined as projects that produce several kilowatts (kW) to 25 mega watts (MW) of electricity for a single residence, small community, and industry (Small Scale Hydro Task Force ND).

[7] Mini-hydro developments produce less than 500 kW of power to supply a single residence, or used as a backup to diesel powered (Small Scale Hydro Task Force ND).

[8] Head refers to the vertical distance water falls from upstream to downstream sections.

The hydropower potential of Moutain River can be calculated using a simple formula, assuming a 1 m head and using a hydroelectric constant of (7.85) used in British Columbia (B.C Hydro 2006).

Hydroelectric potential of Mountain River = water flow (m^3/s) x head (m) x 7.85

Hydroelectric potential of Mountain River = 123.0 (m^3/s) x 1 (m) x 7.85

=966 kilowatts (kW)

It is assumed Mountain River has the potential to supply a yearly average of 966kW of power. Typically a 10 kW system can provide enough power for a large home or lodge (Department of Energy 2001). Mountain River could potentially power 96.6 homes or lodges (yearly average). However, flow rates vary throughout the year. In March (the lowest average flow rate), Mountain River could potentially provide enough power to support approximately 10 homes or lodges.

Based on the same calculations, Ramparts River is assumed to provide enough power for 32.8 homes or lodges (yearly average). However, in April when the average flow is the lowest (1.32 m^3/s), the amount of hydroelectric power produced could only support a single home. At most, mini-hydro developments could be used along the Ramparts River at cabins that are utilized throughout the year or on a seasonal basis, however this may not prove cost effective due to the high hydro-electricity development costs and the limited need for electricity within the study area.

If industrial development increases in the study area, camps may be constructed. The Mountain River is assumed to provide sufficient energy to power industrial camps throughout the year. However, Ramparts River may only provide sufficient power during summer months when flow rates are the highest.

No other information exists on other possible hydro development sites within the study area, particularly along the Hume River.

Although there are no communities within the study area that require power, the community of Fort Good Hope is located adjacent to the study area. The proposed Great Bear River hydro development, approximately 230 km southeast from the study area, would provide 126 MW of power and would include 600 km of transmission lines to supply power to as many as ten communities along the line (RWED 2004). These transmission lines would most likely travel along the eastern side of the Mackenzie Valley, and would supply the community of Fort Good Hope with power.

5.2.2.2 Industrial Use

It is assumed water within the study area has been utilized for industrial uses, such as seismic, oil and gas exploration, and camps (Manuel pers. comm. 2006). Based on mapping completed by Auld and Kershaw (2005), seismic lines occur at a density ranging from 0 – 1 km/km^2, and there are approximately ten abandoned well sites in the study area (mostly

adjacent to the Mackenzie River). It is assumed there is sufficient quantity of water within the study area to support a moderate amount of industrial use (Figure 7); however, further confirmation is required.

Future industrial use of water within the study area may increase if oil and gas prices remain high, and the Mackenzie Valley Pipeline is constructed. These economic and logistical factors for supporting further oil and gas development in the regional area have the potential to increase the industrial use of the study area. The majority of the study area is considered to have a moderate hydrocarbon potential (Auld and Kershaw 2005). The highest hydrocarbon potential exists at the extreme southeast portion of the study area near Mountain River (Auld and Kershaw 2005). Future industrial use within the study area is expected to draw water from all major rivers, streams, and lakes. However, future industrial use of water within the study area would be limited to some extent by the remoteness of the study area, lack of infrastructure including road systems, and the location of fossil fuel and mineral deposits. Water resources play a key role in the exploration of oil and gas. However, the economic value of water for industrial use is unknown within the study area since the quantity of water is unknown, there is possibility of various industrial uses (*i.e.* seismic, drilling), and requirements/fees associated with the Sahtu Comprehensive Land Claim Agreement and/ or Water Licenses is undetermined.

Within the study area, the Sahtu Dene and Métis have surface rights near Mountain River and a small portion of subsurface rights along the western limit of the study area (Auld and Kershaw 2005).

5.3 DATA GAP ANALYSIS

5.3.1 Data Gaps in Traditional Knowledge and Use

Aboriginal people who occupied the study area would have used aquatic systems for travel corridors and potable water. Although there is little documented reference of traditional use of aquatic systems within the study area, there are no significant data gaps regarding traditional use of aquatic resources that need determining in order to proceed through the PAS process.

5.3.2 Data Gaps in Scientific Literature and Non-Traditional Use

Hydrological knowledge of a particular area is paramount for water management, planning, and sustainable use. Although some hydrological work has been completed on Mountain and Ramparts rivers, a significant amount of hydrological knowledge is lacking from the remainder of the study area. Little information exists on the amount of water in the study area, as well as water quality for potable use.

Crude estimates of the hydroelectric potential at Mountain and Ramparts rivers have been provided. The hydroelectric potential of the Hume River within the study area is unknown.

In addition, the economic value of the water resources for both potable and industrial use is undetermined.

6.0 VEGETATION

6.1 INTRODUCTION

The study area is located within the boreal forest region, which is characterized by white spruce and poplar plant communities in upland areas, and black spruce and tamarack communities in the lowland and wetland areas (Yamoga Land Corporation 2006). River valleys, streams, and drainage systems are dominated by white birch and willow species (Yamoga Land Corporation 2006). Of special interest are old growth white spruce stands occuring along the Ramparts River (Yamoga Land Corporation 2006). Unfortunately, these old growth areas along Ramparts River have been recently impacted by spruce budworm (Yamoga Land Corporation 2006).

Little vegetation information is available within the study area. However, vegetation types have been mapped and/or described within some portions of the study area, particularly along the Mackenzie River, and a small block near the headwaters of the Hume River (Reid 1974; Forest Management Institute *et al.* 1973). Black spruce – moss habitats are assumed to dominate the study area, however there are small inclusions of sedge fens (particularly within the Ramparts Wetlands), and upland white spruce, paper birch, and balsam poplar throughout the study area (Reid 1974, Forest Management Institute *et al.* 1973).

Fire occurrences have been documented within the study area since the 1970's. Fire regimes have spread throughout the study area, but most commonly within the northern portion near Ontaratue River.

6.2 RENEWABLE RESOURCE USE AND OPPORTUNITIES

Natural Resources Canada has evaluated and mapped forests based on the expected productivity of forestry products including subsistence harvest, and medicinal plant productivities. Productive forests are expected to cover approximately 12.3% of the Peel River Plateau ecoregion, 2.5% of the Mackenzie Mountains ecoregion, 10.4% of the Fort MacPherson Plain ecoregion, and 28.5% of the Mackenzie River Plain ecoregion (Natural Resources Canada 2006).

6.2.1 Traditional Use

Although traditional cultures depended more on wild meat than on wild plants (Murray *et al.* 2005), plants were commonly used for a number of purposes. Traditional use of vegetation and vegetative matter within the Sahtu Settlement Area included subsistence, medicine, arts and crafts, and small-scale tree harvesting for fuel wood and construction material.

Limited information exists regarding plant and plant matter harvesting within the study area, however it is assumed the Sahtu Dene and the Mountain Dene harvested plants from the study area. Although little information exists on plant use and harvest sites within the study area, plant harvesting is assumed to occur.

6.2.1.1 Subsistence

Subsistence harvesting of plant species commonly occurs in localized habitats throughout the study area, such as wetlands. Berry picking historically occurred predominantly along watercourses, and near wetlands, summer fish camps, and cabins (Manuel pers. comm. 2006; Murray 2005), however today, most berry picking occurs near the community of Fort Good Hope and not within the study area (Manuel pers. comm. 2006). Typically, good berry picking sites were passed on through generations (Parlee *et al.* 2005; Murray *et al.* 2005). Murray *et al.* 2005, reported informal property rights of family berry picking sites. Known berry picking sites within the study area are located along the Mackenzie River near Fort Good Hope (Figure 8).

Traditionally, plants such as berries, wild onion, and white birch sap were used for food, and are still used today. Although it is expected plants were harvested from the study area, only a limited number of berry harvest sites were documented within the study area, along the Mackenzie River, however no information is available regarding additional harvest sites and favoured plants within the study area. It is assumed plants were harvested intermittently within the study area, particularly during hunting, fishing, and gathering events in the fall (Manuel pers. comm. 2006; Parlee *et al.* 2005). Manuel (pers. comm. 2006) indicated berries were harvested a long time ago from the study area, particularly near the wetlands and cabins, but today most of the berries are harvested near the community of Fort Good Hope, outside the study area (Manuel pers. comm. 2006).

Many berry-producing plants and paper birch sap were sought for subsistence. Several species of berry-producing plants, such as cranberry, blueberry, cloudberry, crowberry, raspberry, and black and red current were used for subsistence (Johnson and Ruttan 1993; Canadian Forest Service 2004), and are expected to occur throughout the study area in both upland and lowland habitats. Murray *et al.* (2005) completed field surveys to document the location and estimate the quantity of wild berries within the neighbouring Gwich'in Settlement Area. In the Gwich'in Settlement Area, lowland areas dominated by forested peatlands and black spruce supported the greatest cover of berry-producing plants (Table 4) (Murray *et al.* 2005). Upland habitats dominated by white spruce and paper birch had the least cover of berry-producing plants (Table 4) (Murray *et al.* 2005).

TABLE 4. APPROXIMATE NET WEIGHT (WET) (GRAMS/SQUARE METER (G/M^2)) OF BERRIES PRODUCED IN THE GWICH'IN SETTLEMENT AREA FOR 2000 AND 2001[1]

Berry Species	Year	Habitat Types			
		Black Spruce	Forested Peatland	White Spruce	Paper Birch
Cranberry	2000	1.77	1.07	1.71	0.62
	2001	1.76	1.28	0.97	0.52
Blueberry	2000	0.30	0.75	0.28	Trace
	2001	0.06	0.08	0.02	0
Cloudberry	2000	0.27	1.23	0	0
	2001	0	0	0	0
Crowberry	2000	0.65	0.71	0.66	0.04
	2001	1.24	1.15	0.57	0

1. (Murray *et al.* 2005)

According to a telephone survey completed by Murray *et al.* 2005, almost all households located in the neighbouring Gwich'in Settlement Area harvest cloudberry, blueberry, and cranberry. Berries are typically ripe between mid July and mid August. White birch sap would have been sought after predominantly in the spring when sap has the highest flow. White birch can be found along rivers, streams, and drainage areas throughout the study area.

According to Parlee *et al.* (2005), women from Fort McPherson (community with over 950 people) recommend harvesting at least 44 litres (L) of cloudberries, blueberries, and cranberries for each households winter cooking and gifts (this equates to approximately eight ziplock bags of cloudberries and blueberries, and one egg box of cranberries). Murray *et al.* (2005) reported a total of 36 L of berries (cranberry, blueberry, and cloudberry) per household were harvested from Fort McPherson in 2000. The women of Fort Good Hope are assumed to hold similar traditions, beliefs, and practices as the women of Fort McPherson, and likely used the Ramparts River study area for berry picking.

Consultation with Gwich'in women from the community of Fort McPherson indicated berry harvesting is important for individual and family well-being, social connectivity, and spirituality (Parlee *et al* 2005). The monetary value of harvested berries was not considered important to the women of Fort McPherson (Parlee *et al.* 2005). The economic value of berries as a food resource is unknown. Furthermore, a monetary value cannot be determined for the well-being, social connectivity, and spirituality that harvesters experience while picking and eating wild berries.

Although little berry harvesting occurs in the study area today, it is assumed the study area could support additional berry harvests. However, harvest yields can differ annually based on berry abundance and distribution, which change as a result of weather and other ecological factors (Parlee *et al.* 2005). Although Murray *et al.* (2005) indicated there is substantial quantities of berries that could be available for commercial sale (depending on

the year), the sale of berries were not well received by individuals interviewed in the Gwich'in Settlement Area. During interviews, it was reported berry picking was labour intensive, and excess berries should be given away to individuals who are not able to harvest for themselves or as gifts, and people should only harvest what is needed (Murray *et al.* 2005). In addition, the informal property rights may restrict commercialization (Murray *et al.* 2005).

6.2.1.2 Medicinal Use

A vast number of plant species are expected to occur in the study area, many of which are considered to have medicinal properties. Since many of the plant species have at least one medicinal property, only the species considered most important or common in the study area are documented below.

Simmons (1999) collected plant samples throughout the Sahtu Settlement Area and consulted with a medicine person from Yellowknife to describe medicinal uses of each of the plant species. During these consultations, the medicinal qualities and preparation methods were documented for a few of the plant species that occur in the study area, and the medicine person described the four most powerful plant medicines in the world. These four plant species include fireweed, sage, cedar, and sweet grass, however, little information on the medicinal qualities were documented, and only fireweed and sweet grass potentially occur in the study area (Simmons 1999).

Fireweed is not only used for medicine, but also for tobacco, which is offered to the Creator prior to picking any plant (Simmons 1999). Traditionally, fireweed was said to cure rashes, acne, eczema, boils, and tuberculosis (Simmons 1999). Traditional medicinal properties of sweet grass were not documented.

Additional plant species occurring in the study area believed to have medicinal properties include white and black spruce, tamarack, and paper birch. Vegetative parts of white and black spruce are used as cures for sore gums, colds, throat and thyroid problems, fertility problems, asthma, pneumonia, bronchitis, burns, infections, rashes, and as vitamin supplements (Simmons 1999). Tamarack was also used for diabetes and arthritis sufferers (Simmons 1999). The wood and inner bark of paper birch was used for insomnia, kidney disease, skin rashes, liver disease, and cancer (Simmons 1999).

Species of horsetail are boiled as a kidney medicine, or as a poultice or tea for haemorrhages and skin problems. Horsetails were also used as a type of sanding paper to polish arrow shafts, and a tea made from red bearberry was known to control shakiness (Simmons 1999).

Medicinal plants occur throughout the study area in both upland and lowland areas, however specific locations of the most important medicinal plants within the study area are only speculative since vegetation surveys and traditional use areas have not been completed or documented within the study area. In addition, the extent to which people use medicinal plants today and the economic value of medicinal plants is unknown.

6.2.1.3 Arts and Crafts

Traditionally the Sahtu Dene and Métis produced a number of crafts from plant materials, such as baskets, which are now sold in the tourism industry. Traditionally, arts or other items regarded for artistic purposes were not produced (Andrews pers. comm. 2006). Only since the 1950's were items crafted with artistic intentions for the purpose of trade or sale (Andrews pers. comm. 2006).

Today, approximately 18% of the adult population in the NWT produces arts and crafts to supplement their income (RWED 2004); however, this value is overestimated as it includes other non-plant products such as visual arts, performing arts, and other crafts such as painting, sewing, needlecraft, and jewelry.

Crafts important to the local economies for tourism sales include birch bark baskets, birch bark canoes, snowshoes, woodcarvings, dream catchers, and dyes. Most of the artists involved in the arts and crafts industry work out of their homes, and sell their products to local co-operatives or wholesalers (RWED 2004). Since this industry is widespread and small in scale, accurate sales statistics are difficult to determine (RWED 2004), in particular the economic value of specific arts and crafts from plant material.

Traditionally, plant materials would have been harvested throughout the study area for useable crafts such as baskets. Today, it is assumed residents of Fort Good Hope harvest the required plants and plant materials near the community of Fort Good Hope. Plants needed for arts and crafts are available throughout the study area.

Plant species present within the study area that were used for arts and crafts include white birch, willow, spruce, and numerous flowering species. These species are thought to occur throughout the study area, particularly along river, stream, and drainage areas.

Arts and crafts produced from plants and plant materials have the potential to increase with the rise in tourism (both leisure and business travel) to the regional area, particularly Fort Good Hope. A study was completed in 2003 on the arts and crafts purchasing patterns of potential tourists (Zieba 2005). From this study, it was determined tourists tend to purchase products that were locally made, and authentic cultural or community keepsakes (Zieba 2005). It is estimated the average traveller will spend approximately $54 - $65 on souvenirs (RWED 2004). In the summer of 2002, leisure tourists (non-work related travellers) in the NWT spent over $900 on souvenirs, and approximately $2 million on local arts and crafts (Zieba 2005).

6.2.1.4 Small-Scale Harvesting for Fuel Wood and Construction Material

Traditionally, the Sahtu Dene and Métis and Mountain Dene used several tree species throughout the study area for a number of purposes. Trees were cut and used to supply light and heat for warmth and cooking. In addition, trees were de-limbed and used for construction materials for a vast number of items, including tools, boats, tent poles, and cabins. A variety of timber was used including dry wood, rotten wood, and driftwood (Auld and Kershaw 2005). It is assumed timber was harvested predominantly at campsites,

particularly along the rivers, streams, and lakes, including the old growth forest stand along the Ramparts River. Known log timber and firewood harvesting area were recorded on Manitou Island (Koigojeré Du), just outside the study area at the outlet of Ramparts River, as well as along the Mackenzie River, and within Ramparts Wetlands (DIAND 1997 – 2001; Auld and Kershaw 2005). Figure 8 maps known log timber and firewood harvest areas.

Today, it is expected only residents from Fort Good Hope who temporarily reside on the study area conduct small-scale harvesting to construct cabins and collect firewood for use at existing cabins (Manuel pers. comm. 2006). It has been indicated, people permanently residing in Fort Good Hope harvest firewood near the community (Manuel pers. comm. 2006). Consequently, a negligible amount of small-scale timber harvesting is expected within the study area.

Although only negligible amounts of firewood are expected to be collected within the study area, firewood is considered an important resource for the few residents of the study area (individuals occupy the study area particularly during winter and spring months). Ah-You and Leng (1999) indicated in Canada's remote communities an average household utilizes 4 – 5 cords of firewood a year for space heating and hot water. The energy equivalent of 4 – 5 cords of wood is approximately 1,600 – 2,000 litres (L) of heating oil (although this is a crude estimate since each tree species gives off different energy values, such as hardwoods vs. softwoods, and different makes and models of appliances have different fuel efficiencies)(Ah-You and Leng 1999; GNWT 2005). In 2005, the cost of heating fuel at Fort Good Hope was $1.10 per litre, and the cost of a cord of wood was between $150 – 160 in the South Slave and Deh Cho communities (GNWT 2005). By assuming similar pricing for five cords of wood and 2,000 L of heating fuel within the study area, the replacement value of firewood from the study area is approximately $1,400. In 2005, the cost to heat a home in Yellowknife with fuel oil was approximately $4,052 a year, compared with using softwood fuel wood $2,908 a year (a savings of $1144 a year) (GNWT 2005).

Auld and Kershaw (2005), indicate local sawmills, such as the one at Fort Good Hope, offer a substantial economic boost by providing seasonal employment and required local products. However, forest productivity in the north is naturally low due to slow plant growth, frequent fire regimes, open canopy covers, and limited site access. Timber harvested for the local sawmill originates from the Mackenzie River islands and areas surrounding Fort Good Hope (Manuel pers. comm. 2006).

Manitou Island, immediately east of the study area, has been documented as an important source of firewood and construction material for the people of Fort Good Hope (Sahtu Heritage Places and Sites Joint Working Group 1999). It has been estimated that approximately 168 households in Fort Good Hope use wood as a heating source, of these, 21 houses (or 12.5%) use wood as the main heat source (NWT Bureau of Statistics 2004). According to Manuel (pers. comm. 2006), residents of Fort Good Hope collect firewood from the Mackenzie River islands and neighbouring properties around the community.

6.2.2 Non-Traditional Use

6.2.2.1 Commercial Forestry

In the NWT, commercial timber harvests occur mainly in the south (Liard River Valley, Cameron Hills, and the Slave River Lowlands) where large stands of commercially viable trees (mainly white spruce and aspen) occur (RWED 2001). Commercial forestry practices do not occur and have not historically occurred within the study area (Manuel pers. comm. 2006).

The Canadian Forest Inventory Committee (2001) indicated the northern two thirds of the study area has a wood volume between 0 – 50 cubic meters per hectare (m^3/ha), and the southern half has less than 5% forest cover. The study area is considered to have severe limitations, which restrict the growth of commercial forests (Reid 1974). Reid (1974) surveyed habitats along the Hume and Mountain rivers within the study area and reported the majority of the area has severe limitations for commercial forestry. However, low terraces along the Hume River were classified as having only moderate commercial forestry potential (Reid 1974).

The potential economic value of commercially harvesting timber from the study area is unknown; however, it is assumed the economic value of commercial forestry practices is nil to low due to the remoteness of the study area, lack of infrastructure (*i.e.* roads and mills), limited wood volumes, and slow tree growth. A single tree in the NWT may take as long as 200 years to grow to sufficient height and diameter to be considered merchantable (Auld and Kershaw 2005). The feasibility for developing a future commercial forestry practice within the study area is considered nil to low, however the specific volume of wood required to support a viable commercial forestry is unknown. Commercial forestry practices existing in the southern NWT occur in areas that have estimated wood volumes between 50 and 100 m^3/ha (Canadian Forest Inventory Committee 2001).

6.2.2.2 Agriculture

Greenhouses for vegetable production, berry farms, and chicken/egg productions have been successfully developed in the NWT (Economic Strategy Panel 2000); to date, there have not been any agricultural developments in the study area. The potential for agriculture practices within the study area is considered poor due to extensive permafrost, cool summer temperatures, and low annual precipitation. It is also considered impractical to develop agriculture in the study area since existing cabins are only occupied during the winter and spring months, there is limited access to the study area, and agricultural development would limit the available land for traditional hunting and trapping.

6.3 DATA GAP ANALYSIS

6.3.1 Data Gaps in Traditional Knowledge and Use

Limited information exists on traditional knowledge and traditional vegetation use areas within the study area (including for subsistence, medicine, arts and crafts, and small scale harvesting for fuel wood and construction material). No traditional vegetation distribution and abundance knowledge is available. In addition, much of the traditional use information within the study area is reproduced from research conducted at the neighbouring Gwich'in Settlement Area.

6.3.2 Data Gaps in Scientific Literature and Non-Traditional Use

Little information is available to determine the potential for traditional and non-traditional use areas within the study area. Vegetation surveys have not been completed throughout most of the study area to determine the presence, distribution, and abundance of harvest species, such as berry-producing plants and large volume timber. A timber harvest feasibility study has not been completed in the study area.

7.0 FISH

7.1 INTRODUCTION

Fish can be expected to occur in most lakes and rivers within the study area (Figure 9), wherever their life requirements are met. Some of these species are year-round residents residing in the larger bodies of water (*e.g.* lakes), while some water bodies are used only during migration and/or spawning.

Dryden *et al.* 1973 assessed fish resources within the Ramparts River and indicated the most suitable spawning and nursery areas are located in the upper reaches (upstream approximately 180 km from the mouth) where the bottom substrate is dominated by gravel.

Additional fish surveys have been completed in the Hume, Mountain, and Ontaratue rivers. The Mountain River is known to support a diverse assemblage of fish species and is considered to be spawning habitat for Longnose Sucker, Arctic Grayling, Arctic Cisco, and Lake Chub (Dryden *et al.* 1973). Eighteen fish species are known to occur within the study area, (Dryden *et al.* 1973; Stein *et al* 1973; Stewart 1996) these are listed in Table 5. However, there is insufficient information available to determine species distribution and abundance for most of the study area. Although fish surveys have been completed in the Ramparts, Hume, Mountain, and Ontaratue rivers, there is insufficient information to determine the extent of distribution and abundance of fish species occurring throughout the entire study area.

TABLE 5. FISH SPECIES KNOWN TO OCCUR WITHIN THE STUDY AREA[1]

Common Name	Scientific Name
Goldeye	*Hiodon alosoides*
Inconnu	*Stenodus leucichthus*
Lake Whitefish	*Coregonus clupeaformis*
Round Whitefish	*Prosopium cylindraceum*
Lake Cisco	*Coregonus artedii*
Arctic Cisco	*Coregonus autumnalis*
Arctic Grayling	*Thymallus arcticus*
Northern Pike	*Esox lucius*
Flathead Chub	*Platygobio gracilis*
Lake Chub	*Couesius plumbeus*
White Sucker	*Catostomus commersoni*
Longnose Sucker	*Catostomus catostomus*
Trout Perch	*Percopsis omiscomaycus*
Burbot	*Lota lota*
Ninespine Stickleback	*Pungitius pungitius*
Slimy Sculpin	*Cottus cognatus*
Spoonhead Sculpin	*Cottus ricei*
Walleye	*Stizostedion vitreum vitreum*

1. Dryden *et al* 1973; Stein *et al.* 1973; Stewart 1996

7.2 RENEWABLE RESOURCE USE AND OPPORTUNITIES

The majority of people who harvest fish within the study area reside in Fort Good Hope (Manuel pers. comm. 2006). According to the Northwest Territories Bureau of Statistics (2004b), 47.1% of the adult population, including both aboriginals and non-aboriginals of Fort Good Hope, hunted and fished in 2003.

7.2.1 Traditional Use

7.2.1.1 Subsistence Fishing

The Sahtu Heritage Places and Sites Joint Working Group (1999), indicate the Ramparts River and Wetlands CPA is an important fishing area, even though decent fish lakes are considered rare in the wetlands. It is assumed Sahtu Dene and Métis and Mountain Dene traditionally harvested fish from the study area for subsistence. Today, residents of Fort Good Hope are the dominant users.

Between 1998 and 2003, the average number of eligible harvesters[9] in Fort Good Hope was 850 individuals per year (Bayha and Snortland 2002; Bayha and Snortland 2003; Bayha and Snortland 2004).

Although some information exists on specific fish harvest areas, known harvest sites largely occur within the Ramparts Wetlands and along the Mackenzie River (Figure 9). However, it is assumed subsistence fishing traditionally occurred throughout the entire study area. Today, residents from Fort Good Hope net fish during the winter months in lakes within the study area, and in the spring and summer along rivers and streams (Manuel pers. comm. 2006). Stewart (1996) indicated many of the small lakes between the Ramparts and Hume rivers, as well as Hume River itself, were once fished throughout the year for subsistence. Fish species favoured by residents of Fort Good Hope were Whitefish species, Inconnu, and Burbot (Stewart 1996). In addition, residents of Fort Good Hope fish Marion Lake, which is located at the northern limit of the study area, during the fall and winter for Whitefish species, Lake Trout, Northern Pike, and Burbot (Stewart 1996).

The volume of fish required from the study area to support current subsistence needs is unknown. However, in 1961 residents of Fort Good Hope harvested an estimated 157,000 kilograms (kg) of fish throughout the region for subsistence (Stewart 1996). However by 1972, the volume of fish harvested by residents of Fort Good Hope and Colville Lake, combined, was 45,450 kg, much less than in 1961 (Stewart 1996).

The Sahtu Settlement Harvest Study from 1998 to 2003 shows eligible harvesters from Fort Good Hope harvested 12,762 fish within the Sahtu Settlement Area in 1998 and only 170 fish in 2003 (actual volume of fish is unknown)(Bayha and Snortland 2002; Bayha and Snortland 2003; Bayha and Snortland 2004). Since the Sahtu Settlement Harvest Study began in 1998, there has been a steady decline in the number of fish harvested by eligible harvesters (Table 6).

TABLE 6. NUMBER OF FISH HARVESTED BY ELIGIBLE HARVESTERS IN FORT GOOD HOPE FROM 1998 - 2003

	1998	1999	2000	2001	2002	2003	Average
Number of Eligible Harvesters	812	839	844	850	870	885	850
Number of Fish Harvested[1]	12,762	11,632	6,939	6,674	6,149	170	7,387.67

(Bayha and Snortland 2002; Bayha and Snortland 2003; Bayha and Snortland 2004)

1. The number of fish harvested by residents of Fort Good Hope may or may not have been collected from the study area.

[9] An eligible harvester is defined as an individual who is a Sahtu Dene Metis beneficiary, lives in the Sahtu Settlement Area, is 16 years or older, and currently hunts, fishes, and/or traps (Bayha and Snortland 2002; Bayha and Snortland 2003; Bayha and Snortland 2004).

The most common fish species harvested by residents of Fort Good Hope from 1998 to 2003 were Broad Whitefish, Inconnu, Lake Whitefish, Cisco, Northern Pike, and Burbot (Table 7).

TABLE 7. FISH SPECIES HARVESTED BY RESIDENTS OF FORT GOOD HOPE FROM 1998 - 2003

Fish Species	Number of Fish Harvested from 1998 - 2003					
	1998	1999	2000	2001	2002	2003
Broad Whitefish	4998 (39%)	3905 (34%)	3193 (46%)	2703 (41%)	2362 (38%)	0
Inconnu	3423 (27%)	2912 (25%)	1271 (18%)	1336 (20%)	1183 (19%)	0
Lake Whitefish	1075 (8%)	1183 (10%)	1037 (15%)	1264 (19%)	824 (13%)	0
Cisco	2188 (17%)	2495 (21%)	442 (6%)	701 (11%)	962 (16%)	0
Northern Pike	365 (3%)	281 (2%)	204 (3%)	211 (3%)	184 (3%)	0
Burbot	280 (2%)	584 (5%)	502 (7%)	254 (4%)	441 (7%)	170 (100%)
Other Fish Species	433 (3%)	272 (2%)	290 (4%)	205 (3%)	193 (3%)	0

(Bayha and Snortland 2002; Bayha and Snortland 2003; Bayha and Snortland 2004)

Based on Sahtu Harvest data plotted in Figure 9, Whitefish (both Broad and Lake Whitefish) were the most commonly harvested fish species from 1998 to 2003 within the study area. From 1998 to 2003, residents of Fort Good Hope reportedly harvested approximately 1,444 Broad Whitefish, 174 Lake Whitefish, 171 Northern Pike, and 4 Burbot from the Ramparts Wetlands (Figure 9). The majority of fish harvests occurred outside the study area, along the Mackenzie River (Figure 9).

To determine the economic value of fish harvested within the study area, a monetary evaluation was completed to estimate the replacement cost of fish harvested from the study area with Salmon purchased at the local grocery store in Fort Good Hope (frozen Salmon is the only fish species sold at the local grocery contacted) (Table 8). The economic value of fish harvested from the study area is estimated at $6,675.92 a year. Considering each year there were an average of 850 eligible harvesters in Fort Good Hope (Table 6), it is assumed each harvester fishing within the study area saves $7.54 in grocery costs ($6,675.92 / 850).

TABLE 8. EDIBLE WEIGHTS AND REPLACEMENT COST OF FISH HARVESTED FROM THE STUDY AREA

Fish Species	Number Harvested from 1998 - 2003[1]	Average Number Harvested Each Year (Assumed)	Edible Weight per Individual Fish[2] (Assumed) (kg)	Total Edible Weight Harvested Each Year (kg)	Meat Replacement Cost per Fish[3] ($/kg)	Total Meat Replacement Value of Fish Harvested Each Year
Broad Whitefish	1,444	240.7	1.65	397.16	$13.43	$5,333.86
Lake Whitefish	174	29.0	1.25	36.25	$13.43	$486.84
Northern Pike	171	28.5	2.20	62.7	$13.43	$842.06
Burbot	4	0.7	1.40	0.98	$13.43	$13.16
Total Annual Replacement Cost of Fish Harvested from the Study Area						**$6,675.92**

1. Sahtu Renewable Resources Board 2002.
2. Edible weights of fish harvested from the Inuvialuit Region (Ashley 2002).
3. Current market price of frozen fish (Salmon) at Fort Good Hope grocery store.

7.2.2 Non-Traditional Use

7.2.2.1 Commercial Fishing and Outfitting

Commercial fisheries, including sport-fishing operations, have not occurred within the study area. According to the Sahtu Heritage Places and Sites Joint Working Group (1999) adequate fishing lakes are rare in the Ramparts River and Wetlands CPA. It is expected a commercial fishery and sport outfitting operation would not be feasible within the study area. The potential for commercial and outfitted sport-fishing operations within the study area is considered low since lakes adequate for fishing are rare, and assumed to have low fish abundance and slow fish growth. In addition, the potential for developing a sport fishing operation within the study area is restricted due to the proximity of the study area to Great Bear Lake, which is known for trophy sized fish and has already well-established lodges and infrastructure to meet the demands of sport fishing tourists. The abundance of trophy size fish within the study area is unknown.

Non-residents are not known to currently fish in the study area (Manuel pers. comm. 2006).

7.3 DATA GAP ANALYSIS

7.3.1 Data Gaps in Traditional Knowledge and Use

Fish surveys within the study area are limited, and little information exists on fish distribution and abundance within the study area. Although fish are harvested from the study area, there is limited published information with regards to specific fishing areas and the volume of fish annually harvested from within the study area. Information available on

the location of subsistence harvests was limited to the 1998 – 2003 seasons (Sahtu Renewable Resources Board 2002). Most of the available information is restricted to fish harvested by residents of Fort Good Hope throughout the entire Sahtu Settlement Area, and is not specific to the study area. In addition, the volume of fish required to support current subsistence needs is undetermined.

7.3.2 Data Gaps in Scientific Literature and Non-Traditional Use

Limited fish surveys have been completed within the study area. Fish species presence, abundance, distribution, and health throughout the study area are largely unknown. In addition, the abundance and distribution of trophy size fish to support a sport-fishing lodge within the study area has not been determined.

8.0 WILDLIFE

8.1 INTRODUCTION

The Ramparts River and Wetlands CPA is known as important habitat for moose, woodland caribou (both boreal and mountain ecotypes), Dall's sheep, fur-bearers (including beaver and muskrat), and waterfowl (Sahtu Heritage Places and Sites Joint Working Group 1999). Brief species accounts are provided below for species within the study area that have historically been, currently, or have the opportunity to be used as a traditional and non-traditional renewable resource. To determine the amount of resources available, resource distribution, and potential for future resource opportunities, the species accounts are focused on species distributions and abundances within the study area, wherever possible. Limited data exists on species populations and specific species distributions within the study area.

8.1.1 Ungulates

The study area is known to support woodland caribou (both boreal and mountain ecotypes), moose, and Dall's sheep. Unlike moose and boreal woodland caribou, mountain woodland caribou and Dall's sheep have a more restricted distribution within the mountainous regions of the study area.

8.1.1.1 Woodland Caribou (Boreal and Mountain Ecotype)

Two woodland caribou ecotypes occur within the study area: Boreal and Mountain. The Boreal population occurs across the study area throughout the year; however, the Mountain ecotype only occupies the southern reaches of the study area during the fall and winter months (Figure 10). In 2001, woodland caribou (boreal ecotype) population was estimated at 4,000 – 6,400 in the NWT, and woodland caribou (mountain ecotype) population was estimated at 48,000 (ENR 2006b). The number of woodland caribou (both boreal and mountain ecotypes) specifically within the study area are unknown.

The boreal population is considered non-migratory, although movement between different habitats, specific to seasonal needs, are observed. Boreal woodland caribou occupy old growth spruce – lichen woodlands during winter months and open wetlands (bog and fen wetlands) during summer (Yamoga Land Corporation 2006). Winter habitat is limited within the study area to the old growth white spruce habitat along the Ramparts River (which covers approximately 5% of the total study area), and habitat suitable for boreal ecotype caribou during summer months is considered to cover approximately 25% of the study area (Yamoga Land Corporation 2006). In addition, habitat analysis based on radio-collared cows indicated 25% of the study area is considered good quality year round habitat (Yamoga Corporation 2006). The boreal population calves within the study area, however, specific locations or habitat types are generally unknown. Elsewhere in the Mackenzie Bison Sanctuary, woodland caribou (boreal ecotype) are known to calve on small prairie habitats, and it is probable that caribou occupying the study area use similar areas for calving (Gray and Panegyuk 1989). The density of woodland caribou (boreal ecotype) within the study area is unknown.

The mountain ecotype occurs in the southern mountainous regions, particularly in the southwestern corner of the study area. The mountain ecotype occurs within the study area from fall to late winter. This ecotype exhibits directional seasonal movements from low elevations during the winter to alpine/subalpine habitat from June to November. During the winter months, the mountain population occupies mature forests with a high density of lichens. Local knowledge indicates caribou migrate out of the mountains and along the Ramparts and Arctic Red rivers in the winter (Olsen *et al.* 2001; Gray and Panegyuk 1989). Calving is not expected to occur within the study area (Gray and Panegyuk 1989).

8.1.1.2 Moose

Moose mainly occur within the boreal forested zone of the NWT, including the entire study area (Figure 11). Although moose are known to occur throughout the study area in low densities (Auld and Kershaw 2005), moose densities have been investigated for only a small portion of the study area. Based on aerial moose surveys completed in November 1992 along the lower reaches of the Ramparts, Hume, and Mountain rivers, moose densities varied from low to moderate (MacLean 1994). However, moose densities were considered high in a small area along the Mountain River within the Ramparts River and Wetlands CPA boundaries (MacLean 1994). The majority of the lower reaches of Ramparts River, including the Ramparts wetland area had low moose densities (MacLean 1994). Medium moose densities were observed along the Hume River, and at the lower reaches of Mountain River (MacLean 1994). Moose densities within the Fort Good Hope area were estimated at approximately 0.17 moose per square kilometre (km^2); which is considered high for the NWT (MacLean 1994).

Although moose occur throughout the study area, it has been suggested moose occur at varying densities depending on habitat quality. For example, islands in the Mackenzie River, adjacent to the study area, are considered important moose wintering grounds (Ruttan

1972). These islands provide a source of security cover with large trees and thick bushes, and highly nutritional browse material, most notably willow species. Moose tend to occupy these islands from December to February (Ruttan 1972). During moose surveys in 1992, moose were typically associated with old burns (15 – 20 year old burns) and riparian river drainages (MacLean 1994).

Moose are expected to calve throughout the study area in areas with high security cover. Typically a single calf is born, although twins are known to occur, between mid-May to the first part of June (Johnson and Ruttan 1993).

8.1.1.3 Dall's Sheep

Dall's sheep occur in the mountainous regions in the southern portion of the study area (Figure 12). Unlike the mountain ecotype of woodland caribou, Dall's sheep do not complete large migrations and confine most of their movements to a particular mountain block (Simmons 1982). However, dispersal to new ranges has also been documented (Simmons 1982). Winter and summer ranges are used each year and from generation to generation. Winter ranges are encompassed within the summer range, and are typically confined to an area 30 – 90% of the total summer range (Simmons 1982). Winter ranges are occupied from October to May and favoured winter habitat includes slopes with shallow snow (*i.e.* areas blown free of snow) and timberline areas where food plants (*i.e.* grasses, sedges, and shrub leaves and stems) are abundant, snow crusting is reduced, and shelter from wind is available (Simmons 1982). Known Dall's sheep winter ranges are located within the southeast corner of the study area, between Mountain and Gayna rivers, as well as in the south western corner of the study area (Simmons 1982). No known winter ranges occur within the designated Ramparts River and Wetlands CPA boundaries.

Summer ranges are merely an expansion of the winter range and includes alpine tundra habitat close to rugged escape terrain (Simmons 1982). In addition, favoured summer range is closely related to the close proximity of mineral licks, particularly for ewe groups (Simmons 1982). Known summer ranges have been reported within the most rugged alpine terrain occurring within the southern portion of the study area (Simmons 1982). Limited amount of known Dall's sheep summer range occur within the CPA boundaries.

Population densities within the study area are largely unknown; however, an aerial survey was completed in 1988 in the extreme southwestern portion of the study area (Latour 1992). In 1988, the density of Dall's sheep within the extreme southwestern portion of the study area was 0.79 sheep per km^2 (Latour 1992). This density was considered lower than compared to areas surveyed further south (Latour 1992). Total Dall's sheep density within the study area is unknown.

8.1.2 Fur-bearers

In this report, the term fur-bearer applies to those mammalian species that have been trapped or hunted for their fur, or are species important for the local economy. Fur-bearers are widely distributed across the study area, occupying most terrestrial habitat types throughout the boreal forest zone.

8.1.2.1 Grizzly and Black Bear

Both grizzly and black bears occur throughout the study area (Figure 13). Grizzly bear habitat use, outside the denning season, is a function of the availability of food such as young plant shoots, ripe berries, and the location of mammalian prey. In spring, grizzly bears graze on roots and new grasses and sedges as they emerge, particularly in low lying and wetland areas. During late summer and fall they feed primarily on berries, however grizzly bears also eat many lemmings and ground squirrels whenever available. With respect to large animals, bears are opportunistic scavengers and predators, and will kill caribou and moose (adults and calves).

Yamoga Land Corporation (2006) indicated a special grizzly bear habitat along the Gayna River, near the confluence with Mountain River (southeastern portion of the study area). However, no further information with regards to specific habitat or a rationale for the significance was provided. Although grizzly bear densities within the study area are unknown, it is assumed densities are higher in the mountainous regions of the study area. Grizzly bears have large home ranges; in particular, a male's range can extend over 2000 km^2 while a female's range is about half that size (RWED 2002). Based on the size of the study area (18,376 km^2), approximately 18.4 female grizzlies could potentially occupy the study area. Grizzly bear denning habitat is expected to occur within the study area, particularly along rivers, eskers, and other areas of appropriate glacial deposits, particularly within the mountainous regions of the study area.

Similarly to grizzly bears, black bear distribution is a function of food availability. In addition, black bear distribution is also a function of escape habitat, such as large diameter trees. Black bear distribution is restricted to the relative abundance of grizzly bears and wolves. Based on available habitat within the study area, it is assumed black bears would occur throughout the study area and neighbouring properties.

Black bears are omnivores. In general, their diet is dominated in all seasons (excluding denning period) by vegetation, but black bears will also scavenge and hunt. Following den emergence, bears gravitate towards areas with early-emerging vegetation such as wetlands dominated by sedges, cottongrass, horsetails, grasses, and over-wintering berries, such as bog cranberry. In addition to vegetation matter, winter-killed ungulate carcasses can be important after spring emergence, but are usually scarce and may not be predictably available to bears in the boreal forest.

In summer, bears consume a variety of species of grasses, sedges, horsetails, forbs, ants, bees, and wasps, and by fall bears consume ripe berries, such as blueberry, crowberry, bearberry, and cloudberry.

Preferred denning areas vary and can include natural cavities, such as in a hollow under an upturned tree root, or excavated in the side of an esker, or stream bank. Denning habitat is expected to occur within the study area. Black bear densities within the study area are unknown. However, Wooley and Ruttan (1974) indicated that the Ramparts, Hume, and Ontaratue river valleys contained the highest black bear population in the proposed pipeline route in the Mackenzie Valley.

8.1.2.2 Wolf and Wolverine

Although the density of wolves within the study area is unknown, wolves are expected to be present throughout the entire study area (Figure 13), most especially habitats occupied by their prey (mainly moose and caribou). Wolves also consume hare, small rodents, birds, beaver, muskrat, and vegetation matter. It is assumed wolves occupying the southern mountain regions of the study area follow woodland caribou (mountain ecotype only) from the summer alpine/subalpine areas to the winter valley habitat. Wolves are expected within the study area throughout the year.

Wolves have very specific requirements for denning habitat and a den may be reused in subsequent years (ENR 2006b). Preferred denning habitat includes glaciofluvial material that can be found on eskers, river and stream banks, or other glacial deposits (ENR 2006b).

Wolverines also occur within the study area throughout the year, however population densities within the study area are unknown (Figure 13). Wolverines lead a largely solitary lifestyle, and have large home ranges. Wolverines typically live at low densities even under optimal conditions (Banci 1994).

Wolverines rely on a variety of food items and typically scavenge and prey on birds, small mammals, and caribou. There appears to be a correlation between wolverine numbers, ungulate populations, and the presence of more (successful) efficient predators such as wolves (Van Zyll de Jong 1975).

The denning habitats of wolverines are also poorly understood. There is evidence that adult females show fidelity towards maternal den sites. Dens may be constructed in areas of rocky slopes or deadfall (ENR 2006b).

8.1.2.3 Red Fox

Red foxes are thought to be common within the study area (Auld and Kershaw 2005). This species occupies many diverse habitats throughout the study area, wherever suitable prey items occur (Figure 13). Mice, muskrats, squirrels, hares, grouse, insects, eggs, vegetative matter, and carrion dominate the diets of red foxes (ENR 2006b). Red foxes den in glaciofluvial and glacial till material near rivers and lakes, or in elevated areas where

permafrost is not present at the surface (ENR 2006b). Dens are typically re-used in following years. Appropriate denning habitat is expected to occur within the study area.

8.1.2.4 Marten

Marten favour mature or late-successional coniferous forests with a complex woody debris understory and a distinct shrub and forb cover to support prey populations (*i.e.* voles) (Clark *et al.* 1987). However, marten have been documented in late successional burn areas (Latour *et al.* 1992). Fur-bearer surveys completed by Wooley and Ruttan in 1971 indicated a small marten population in mature spruce forests in the Ramparts River area, however local trappers reported the highest marten densities were located in the hilly forests east of the upper Ramparts River (Wooley and Ruttan 1974). Martens are expected to occupy the entire study area, expect alpine tundra in the extreme southern portion of the study area (Figure 13).

8.1.2.5 Beaver and Muskrat

Beaver and muskrat are an important economic resource throughout the year for residents of Fort Good Hope. Beaver and muskrat were traditionally harvested during winter months for their fur, however, spring and summer harvests commonly occur today. The study area includes numerous wetlands, rivers, and streams that provide habitat for both species, most notably the Ramparts Wetlands (Figure 13).

Beaver surveys have been completed in the Ramparts Wetlands in 1972, 1989, and 2001 (Ruttan and Wooley 1974; Wooley 1974; Poole and Croft 1990; Popko *et al.* 2002). In 1972, aerial beaver surveys were completed in an area encompassing the Ramparts and Ontaratue rivers, and Ramparts wetlands (Wooley 1974). Based on aerial surveys, this area was considered the best beaver habitat north of Fort Simpson (Wooley 1974). During the 1972 aerial surveys, it was reported the largest population of beavers were located in streams (Wooley 1974). Many of the lakes were considered too shallow to be suitable beaver habitat (Wooley 1974). Stream densities averaged 0.25 occupied colonies per stream (Wooley 1974). Willow was considered the most common winter food for beavers occupying stream habitat within the study area (Wooley 1974). Ruttan and Wooley (1974) indicated beaver habitat outside the Ramparts and Ontaratue river systems are marginal.

In 1989, Poole and Croft (1990) surveyed beaver lodges throughout the western NWT, including the Ramparts Wetlands. Poole and Croft (1990) reported 0.58 active lodges per square kilometre within the Ramparts Wetlands area; the highest density surveyed in western NWT during the 1989 event. In addition, 0.29 abandoned lodges per square kilometre were recorded (Poole and Croft 1990). Results from the 1989 beaver lodge survey indicated beaver populations within the Ramparts Wetlands could support additional harvesting (Poole and Croft 1990). Poole and Croft (1990) recommended additional beaver harvests within the Ramparts Wetlands should be promoted. During the 2001 aerial beaver survey within the Ramparts Wetlands, a high density of active beaver lodges were recorded (0.82 active lodges per kilometre) (Popko *et al.* 2002). In addition, the number of inactive

lodges increased since 1997 results (Popko *et al.* 2002). Little information exists on muskrat populations within the study area. In 1971, muskrats were reported to be commonly occurring in the lakes of the Ramparts wetlands; however, population estimates were not completed (Wooley and Ruttan 1974). Muskrats are expected to occur in streams, lakes, wetlands, and rivers. Like beavers, muskrats construct houses (conical houses from vegetative matter) and bank burrows.

8.1.2.6 Snowshoe Hare

Snowshoe hares prefer deciduous, mixed wood, and lowland black spruce-tamarack forest communities. The snowshoe hare is an important prey species within the study area, and many carnivore populations are closely tied to the snowshoe hare population cycle. Snowshoe hare populations oscillate every 9 to 10 years (Poole 1994; Best and Henry 1994), and consequently carnivore populations such as wolf, red fox, and mink who prey upon hares also fluctuate. Snowshoe hares are expected to be common throughout the study area in all habitat types and in all seasons (Figure 13). However, population density is highly variable and dependent upon a number of environmental factors, most notably being food resources and predation. Population densities within the study area have not been recorded.

8.1.3 Birds

8.1.3.1 General Waterfowl

Few surveys have documented waterfowl distribution and use within the Ramparts wetlands (Davis 1974); however, surveys have not encompassed the entire study area. Based on aerial surveys and local knowledge, Ramparts Wetlands has been reported as significant waterfowl habitat.

Aerial surveys were completed in 1972 within the Ramparts Wetlands and area (Davis 1974). Three aerial surveys were completed during spring migration (late May – early June), breeding/nesting (mid July), and fall migration (late September – early October). Overall waterfowl (excluding loons and grebes) densities recorded in the Ramparts Wetlands during the spring migration survey was 58.43 /km^2, and 19.24 /km^2 during the breeding/nesting period (Davis 1974). However, data collected during the fall migration was not reported since migration was mostly completed by the time of the third survey (Davis 1974). Fourteen waterfowl species staged in the Ramparts Wetlands during spring migration, and 12 species were recorded during the breeding/nesting survey period (Davis 1974).

Three additional surveys were completed in the study area in conjunction with the Ramparts Wetlands; two areas to the north of Ramparts Wetlands (both 32.4 km^2 in size), and one area to the south near the Mountain River confluence (14.9 km^2 in size) (Davis 1974). Waterfowl densities during the spring migration reported at the survey areas north of Ramparts Wetlands were 16.37 waterfowl per km^2 and 29.22 waterfowl per km^2, respectively (Davis 1974). However, during the breeding/nesting survey, waterfowl

densities at the northern survey areas were 0.81 and 16.58 waterfowl per km^2, respectively (Davis 1974). Near the Mountain River confluence, waterfowl densities were 25.23 and 3.63 waterfowl per km^2 during the spring migration and breeding/nesting survey periods, respectively (Davis 1974).

As a result of the waterfowl surveys, Davis (1974) indicated the Ramparts Wetlands appeared to posses significant waterfowl habitat and classified this area as an important waterfowl area. In addition, Davis (1974) goes on to report the Ramparts River area is one of the most important waterfowl areas in the Mackenzie Valley between Great Slave Lake and the Mackenzie Delta.

Lakes and wetlands within the study area are expected to host numerous staging, breeding, and molting waterfowl. Many of the lakes and wetlands that contain emergent and submergent vegetation within the study area are expected to be important feeding areas, particularly Ramparts Wetlands. Waterfowl habitat is common throughout the study area, and waterfowl are expected to occur throughout the study area where lakes, wetlands, streams, and rivers occur (Figure 14).

8.1.3.2 Grouse and Ptarmigan

Spruce Grouse, Sharp-tailed Grouse, Willow Ptarmigan, and Rock Ptarmigan are expected to occur throughout the study area. Willow Ptarmigan, and Spruce and Sharp-tailed Grouse are assumed to remain in the study area throughout the year (Sibley 2003). Rock Ptarmigan occur in the mountainous regions of the study area throughout the year, however they will move to lower elevations near the Mackenzie River during winter months (Sibley 2003).

Grouse and Ptarmigan species prefer dense spruce forests, open grasslands, shrublands, and alpine tundra (particularly Rock Ptarmigan), where they feed on buds and leaves of deciduous and coniferous trees/shrubs, insects, fruit, and seeds during summer months (Sibley 2003). In the winter, grouse and ptarmigan browse on twigs, buds, and seeds (Sibley 2003). Grouse and Ptarmigan distributions within the study area are mapped in Figure 15. Grouse and ptarmigan were recorded as incidental species during the 1972 waterfowl surveys within the study area (Davis 1974). A total of five Spruce Grouse and four Sharp-tailed Grouse were observed in the Ramparts Wetlands during the surveys. No other upland bird surveys reported grouse/ptarmigan within the study area.

8.2 RENEWABLE RESOURCE USE AND OPPORTUNITIES

Diverse assemblages of wildlife species occur within the study area. All of these species can be considered a renewable resource and are used for subsistence, economic/commercial, or aesthetic purposes. Although no communities occur within the study area, residents of Fort Good Hope harvest wildlife throughout the study area. The economy of Fort Good Hope is based primarily on hunting and trapping (INAC 2005).

8.2.1 Traditional Use

Traditionally, people harvested wildlife for subsistence, survival materials, and trade. This not only provided basic life requisites, but also helped maintain their cultural identity and tied them to the land and their heritage (Hall 1989). Traditional based hunting for subsistence (principally for food and clothing) and trapping continues today.

According to Northwest Territories Bureau of Statistics (2004b), 47.1% of the residents of Fort Good Hope hunted and fished in 2003 (approximately 259 individuals, based on 2001 Statistics Canada census). In addition, 9.8% of the Fort Good Hope residents took part in trapping (approximately 54 individuals, based on 2001 Statistics Canada census)(Northwest Territories Bureau of Statistics 2004b).

8.2.1.1 Subsistence Hunting

The Ramparts, Hume, and Mountain rivers, in particular, were critical travel routes to important wildlife harvest sites. Mountain Dene were known to travel up the Ramparts, Hume, and Mountain rivers to hunt moose, woodland caribou (both mountain and boreal ecotypes), and Dall's sheep. Harvest camps were constructed along these important travel routes, principally during winter months (Johnson and Ruttan 1993). In particular, Mountain River area is considered an important moose hunting area (Sahtu Heritage Places and Sites Joint Working Group 1999). Spring hunting camps were also erected along the Ramparts River to hunt woodland caribou (both ecotypes), moose, fish, waterfowl, beaver, and muskrat (Johnson and Ruttan 1993). Animals harvested were utilized for food, clothing, and other survival materials.

In 2003, a total of 35.7 households in Fort Good Hope reported consuming country foods such as caribou, moose, waterfowl, grouse/ptarmigan, and fish (Northwest Territories Bureau of Statistics 2004b). From 1999 to 2004, the average number of big and small game licenses issued to non-aboriginal residents of Fort Good Hope was 5.8 and 5.4, respectively (Table 9) (ENR 2005).

TABLE 9. NUMBER OF BIG AND SMALL GAME LICENSES PURCHASED BY NON-ABORIGINAL RESIDENTS OF FORT GOOD HOPE FROM 1999 – 2004[1]

Year	Number of Big Game Licenses	Number of Small Game Licenses
1999 – 2000 Season	7	6
2000 – 2001 Season	7	6
2001 – 2002 Season	4	4
2002 – 2003 Season	6	6
2003 – 2004 Season	5	5
Average	**5.8**	**5.4**

1. ENR 2005.

The Department of Environment and Natural Resources (ENR) completes an annual survey of the number of hunting licenses purchased by resident non-aboriginals and game harvested in the regional area (ENR 2005). Based on the number of hunting licenses and

the number of game harvested annually, hunting success rates were calculated. Using the calculated hunting success rate, the number of game animals harvested by non-aboriginal residents of Fort Good Hope could be estimated (Table 10). It is estimated an average of 1.189 big game animals will be harvested a year by non-aboriginal residents of Fort Good Hope (Table 10), however this does not assume the animals will be harvested from the study area.

TABLE 10. ESTIMATED NUMBER OF BIG GAME HARVESTED FROM THE STUDY AREA FROM 1999 TO 2004

Harvest Season	Big Game[1] Licenses Purchased by Non-aboriginal Residents of Fort Good Hope	Estimated Big Game Hunting Success Rate of Non-Aboriginals in the Inuvik Region[2]	Estimated Number of Big Game Harvested by Non-Aboriginal Residents of Fort Good Hope[3]
1999 – 2000	7	0.205	1.435
2000 – 2001	7	0.205	1.435
2001 – 2002	4	0.205	0.82
2002 – 2003	6	0.205	1.23
2003 – 2004	5	0.205	1.025
Average			**1.189**

1. Big game species include woodland caribou (both mountain and boreal ecotypes), moose, black bear, and Dall's sheep (ENR 2005).
2. Big game hunting success rate was calculated based on ENR (2005) big game license and harvest data for the Inuvik region, which included the community of Fort Good Hope.
3. The estimated number of big game harvested by non-aboriginal residents of Fort Good Hope does not suggest the animals were harvested within the study area.

It is assumed the number of big game harvested by non-aboriginal residents within the study area is low. The number of small game harvested within the study area is unknown. Aboriginal residents of Fort Good Hope also harvest big and small game for subsistence. Data collected by the Sahtu Renewable Resources Board (2002), estimated the number of big and small game harvested within the study area (refer to Figures 10 – 15) (Table 11). According to the Sahtu Renewable Resources Board (2002) harvest data, goose species were the most sought harvest species within the study area from 1998 – 2003, followed by scoter species, grouse species, and moose (Table 11). Based on the Sahtu Renewable Resources Board (2002) harvest data, the number of woodland caribou and Dall's sheep harvested within the study area is considered low. Latour (1992) substantiated Dall's sheep subsistence harvest by aboriginal and non-aboriginal residents in Outfitter Zone G/OT/01 (Figure 12) are negligible. From the Sahtu Renewable Resources Board (2002) harvest data, the majority of subsistence harvesting occurs within the Ramparts Wetlands area (Figures 10 – 15).

TABLE 11. APPROXIMATE NUMBER OF BIG AND SMALL GAME HARVESTED WITHIN THE STUDY AREA FOR SUBSISTENCE[1]

Species	Approximate Number Harvested Within the Study Area Between 1998 - 2003[2]
Woodland Caribou	22
Moose	175
Dall's Sheep	5
Goose Species	1934
Duck Species, excluding scoter	147
Scoter Species	1061
Swan Species	71
Grouse Species	201
Ptarmigan Species	2

1. Some fur-bearers were also harvested for subsistence (*e.g.* hare). These species are discussed in Section 8.2.1.3 Trapping.
2. (Sahtu Renewable Resources Board 2002).

The economic value of subsistence wildlife harvested within the study area was calculated to estimate the replacement cost of wildlife harvested from the study area to frozen beef and chicken purchased at the local grocery store in Fort Good Hope (Table 12). The economic value of wildlife harvested from the study area is estimated at $13,095.49 a year. In 2003, a total of 35.7 households in Fort Good Hope reported consuming country foods. Therefore, assuming each of these households obtain foods solely from the study area, each household would save approximately $366.82 a year ($13,095.49 / 35.7).

TABLE 12. EDIBLE WEIGHTS AND REPLACEMENT COST OF FISH HARVESTED FROM THE STUDY AREA

Wildlife Species	Number Harvested from 1998 - 2003[1]	Average Number Harvested Each Year (Assumed)	Edible Weight per Individual[2] (Assumed) (kg)	Total Edible Weight Harvested Each Year (kg)	Estimated Meat Replacement Cost per Animal[3] ($/kg)	Total Meat Replacement Value of Wildlife Harvested Each Year
Woodland Caribou	22	3.67	50	183.50	$12.54	$2,301.09
Moose	175	29.17	180	209.17	$12.54	$2,622.99
Dall's Sheep	5	0.83	32[4]	32.83	$12.54	$411.69
Goose Species	1934	322.33	1.6	323.93	$13.43	$4,350.38
Duck Species, excluding Scoter	147	24.50	0.77	25.27	$13.43	$339.38
Scoter Species	1061	176.83	0.65	177.48	$13.43	$2,383.56
Swan Species	71	11.83	4.75	16.58	$13.43	$222.67
Grouse Species	201	33.5	0.3	33.80	$13.43	$453.93
Ptarmigan Species	2	0.33	0.4	0.73	$13.43	$9.80
Total Annual Replacement Cost of Wildlife Harvested from the Study Area						**$13,095.49**

1. Sahtu Renewable Resources Board 2002.
2. Edible weights of wildlife harvested from the Sahtu Settlement Area and the Mackenzie Valley (Ashley 2002).
3. Current market price of frozen beef and chicken at Fort Good Hope. Grocery store.
4. Edible weight of Dall's sheep from the Mackenzie Mountains (Ashley 2002).

8.2.1.2 Trapping

Trapping was historically a major economic resource for the Sahtu Dene and Métis and Mountain Dene. Wildlife species were trapped for subsistence (for example hare, beaver, and muskrat), and/ or pelts were sold or traded. Trapping continues today, for both subsistence and fur trade purposes. In 2005, approximately 40 residents from Fort Good Hope trapped (Rossouw pers. comm. 2006) (Table 13).

TABLE 13. NUMBER OF FORT GOOD HOPE TRAPPERS FROM 2000 - 2005[1]

Year	Number of Trappers
2000	40
2001	43
2002	40
2003	29
2004	33
2005	40
Average	**37.5**

1 (Rossouw pers. comm. 2006).

In the study area, marten is the most commonly harvested fur-bearer species, followed by beaver, snowshoe hare, and black bear (Table 14) (Popko *et al.* 2002; Sahtu Renewable Resources Board 2002). Additional fur-bearer harvests, such as muskrat, mink, weasel, wolverine, fox, wolf, lynx, and grizzly bear have not been documented within the study area, however, it is assumed these species are harvested opportunistically.

Marten are trapped along traplines throughout the study area, particularly within the Ramparts Wetlands, and near the Hume and Mountain rivers (Figure 13)(Sahtu Renewable Resources Board 2002). Based on the Sahtu Renewable Resources Board (2002) harvest data, residents from Fort Good Hope trap a significant number of marten near the community and east of the Mackenzie River. However, a considerable number of marten were also harvested from the study area, particularly within the Ramparts Wetlands. According to the Sahtu Renewable Resources Board (2002) harvest data, approximately 944 marten have been harvested from the study area between 1998 and 2003 (Table 14). This accounts for 43.3% (944 marten) of the total fur-bearers harvested from the study area from 1998 to 2003 (Table 14). It is unknown if marten populations within the study area could support additional trapping. Further evaluation is required.

Beaver harvests accounted for 42.8% (933 beavers) of the fur-bearers trapped from the study area (Table 14). Eighty-seven percent of known beaver harvests within the study area occurred within the Ramparts Wetlands (Figure 13). Remaining beaver harvest locations were along the Mackenzie River (Figure 13). Wooley (1974) reported over half of the beaver harvested by Fort Good Hope trappers were taken from the Ontaratue – Ramparts area. In addition, Popko *et al.* (2002) indicated a large portion of beavers harvested by residents of Fort Good Hope were removed from Ramparts Wetlands or adjacent areas in late winter and summer months (March and June). This is supported by the Sahtu Renewable Resources Board (2002) harvest data (Figure 13).

Popko *et al.* (2002) recommended a sustainable annual beaver harvest rate between 0.5 to 2 beavers per lodge depending on the habitat type and colony size. Beaver populations within the Sahtu Settlement Area, including the study area, were considered under-harvested (Popko *et al.* 2002). Approximately 933 beavers have been harvested from the study area between 1998 to 2003 by residents of Fort Good Hope (Sahtu Renewable Resources Board 2002). It is assumed there is opportunity for additional beaver harvests within the study area.

Beaver pelts harvested during winter months (mid-December to mid-March) average higher value than compared to pelts harvested during open water seasons (Poole and Croft 1990). Beaver pelts from the Sahtu Settlement Area are considered by fur buyers to be of high quality (Popko *et al.* 2002). The average beaver pelt price received by local trappers is 12% above the NWT average for the species (Popko et al 2002). Forecasted trade prices for beaver pelts were considered good for 2006 (Pappas 2005).

Fur-bearers, such as black bear and snowshoe hare were also harvested from the study area from 1998 – 2003 (Sahtu Renewable Resources Board 2002). Eight-four percent of the harvested black bears were located within the Ramparts Wetlands, the remaining harvest sites were near the Mackenzie River (Figure 14) (Sahtu Renewable Resources Board 2002). Black bear harvests accounted for 0.9% of the total fur-bearer harvests within the study area from 1998 to 2003 (Table 14). It is unknown if the black bear population can support additional harvests. Trade prices for black bear pelts were forecasted as fair for the 2006 season (Pappas 2005).

Snowshoe hares were commonly trapped within the Ramparts Wetlands and along the Ramparts River and its tributaries (Figure 14). Snowshoe hares accounted for 13.1% of the total known fur-bearers harvested within the study area from 1998 – 2003 (Table 14). Hare populations cycle every 9 – 10 years (Poole 1994; Best and Henry 1994). It is unknown if current snowshoe hare population could support additional harvests.

TABLE 14. NUMBER OF FUR-BEARER SPECIES HARVESTED BY RESIDENTS OF FORT GOOD HOPE BETWEEN 1998 - 2003[1]

Common Name	Number of Fur-bearers Harvested from the Study Area (1998 – 2003)	Number of Fur-bearers Harvested by Residents of Fort Good Hope[2] (1998 – 2003)	2006 Fur Trade Price Forecast[3]
Marten	944	4029	Fair
Beaver	933	1241	Good
Muskrat	None known	1411	Good
Mink	None known	35	Fair
Weasel	None known	4	Fair
Hare Species	285	7126	NA
Wolverine	None known	24	Good
Fox Species	None known	65	Good (Red Fox)
Wolf	None known	21	Good
Lynx	None known	6	Good
Black Bear	19	36	Fair
Grizzly Bear	None known	1	Excellent

1 (Sahtu Renewable Resources Board 2002)
2 Trapped fur-bearers may not have been harvested within the study area.
3 (Pappas 2005)
None Known – No muskrat, mink, weasel, wolverine, fox, wolf, lynx, and grizzly bear harvests have been documented within the study area, however, it is assumed these species are trapped opportunistically.
NA = Not available

The Department of Industry, Tourism and Investment surveys the number of fur-bear pelts sold each year, and the selling price. Based on known pelt prices obtained by residents of Fort Good Hope an estimated economic value of the fur-bearers harvested from the study area can be calculated. This economic value is an estimation because selling prices of pelts vary according to pelt size and quality. The total economic value of fur-bearer pelts harvested from the study area from 1998 – 2003 was approximately $84,674.97 (Table 15). Therefore, the economic value of harvesting marten, beaver, and black bear within the study area is approximately $14,112.50 annually (Table 15). Subsequently, it is assumed each trapper from Fort Good Hope receives approximately $376.33 annually from harvesting fur-bearers within study area (assuming an average of 37.5 trappers). However, it must be noted that it is expected additional fur-bearers were harvested from the study area, but no further information with regards to all fur-bearer harvests and average selling prices were available. It is assumed the estimated economic value of trapping within the study area is higher than documented in this report.

TABLE 15. ECONOMIC VALUE OF FUR-BEARERS TRAPPED WIHTIN THE STUDY AREA BY RESIDENTS OF FORT GOOD HOPE

Species	Number of Fur-bearers Harvested from the Study Area (1998 – 2003)	Average Selling Price from 2000 – 2005 for a Single Pelt[1]	Estimated Economic Value of Trapped Fur-bearers Within the Study Area from 1998 - 2003
Marten	944	$65.73	$62,045.88
Beaver	933	$21.32	$19,891.07
Snowshoe Hare	285	NA	-
Black Bear	19	$144.11	$2,738.02
Total	**2,181**		**$84,674.97 from 1998 – 2003 (or $14,112.50 a year)**

1 (Rossouw pers. comm. 2006).
NA = Not Available

The potential for future trapping opportunities within the study area is relatively unknown since little information exists on fur-bearer populations within the study area. However, beaver populations have been documented as under-harvested within the study area (Popko *et al.* 2002), and therefore, populations could support additional trapping.

8.2.1.3 Arts, Crafts, and Religion

Traditionally, arts or other items regarded for artistic purposes were not produced (Andrews pers. comm. 2006). Only since the 1950's were items crafted with artistic intentions for the purpose of trade or sale (Andrews pers. comm. 2006). However, wildlife and wildlife parts were sources of tools, crafts, stories, and legends. For this report, the term "crafts" refers to tools, construction material, and other non-subsistence material. Since a number of wildlife species or their parts (*i.e.* bones, hide, sinew, stomach, etc) were used for a number of purposes, only the most common uses or those documented in available literature are documented in this report. Moose and caribou antler, bone, and sinew were fashioned into tools, weapons, and ornaments, and pelts were used for tents and bedding (Hall 1989).

Hall (1989) documented caribou and caribou parts were traditionally utilized and devised into numerous purposes and products including antler arrow points, bone hide scraper, bone knife, bone needle, sinew thread, babiche, tents, clothes, hoof rattle, and drums. Hall (1989) estimates approximately 20 caribou were needed to clothe one individual for a year. Today, traditional crafts (*e.g.* rattles, needles, knives) and art are sold in the tourism industry.

Today, approximately 18% of the adult population in the NWT produces arts and crafts to supplement their income (RWED 2004). Therefore based on 2001 Statistics Canada census, it is assumed approximately 100 residents of Fort Good Hope produce arts and crafts. However, this value is overestimated as it includes other non-wildlife products such as plant/ plant materials, visual arts, performing arts, and other crafts such as painting,

sewing, needlecraft, and jewelry. The number of wildlife harvested from the study area for the purposes of arts, crafts, and religion is unknown.

When harvested, all parts of the animal were utilized for subsistence, crafts, and trade goods. It is generally assumed, wildlife were harvested primarily for human survival, and secondarily for arts and craft material. Wildlife would have been harvested throughout the entire study area.

Arts and crafts produced from wildlife and wildlife parts have the potential to rise as tourism (including leisure and business related travellers) increases in the NWT, particularly at Fort Good Hope. Tourists commonly purchase products that were locally made, depict authentic cultural, or community keepsakes (Zieba 2005). It is estimated the average travel party will spend approximately $199 on local arts and crafts (RWED 2002c). The economic value of wildlife utilized within the study area for arts and crafts is difficult to quantify since little information exists on historic and current art and craft use in the study area. This industry is widespread and small in scale; therefore accurate sales statistics are difficult to determine (RWED 2004), as the number of visitors travelling through Fort Good Hope is unknown. However, as the Mackenzie Valley Pipeline and possible all-weather road is developed, tourism at Fort Good Hope is anticipated to rise, which would subsequently increase the sale of arts and crafts.

In addition, wildlife, in particular caribou were important figures in religion and mythology (Hall 1989). Predictably, the economic value of wildlife in the study area for religion and beliefs cannot be determined.

8.2.2 Non-Traditional Use

8.2.2.1 Outfitting and Recreational Hunting

There are eight outfitting zones within the Mackenzie Mountains. Two outfitting zones overlie the southern portion of the study area, including the Arctic Red River (G/OT/01) and Gayna River (S/OT/01) zones. Non-resident hunters (including non-resident[10] and non-resident alien[11]) within the Mackenzie Mountains must use the services of an outfitter and must be accompanied at all times by a guide (ENR 2006; Larter and Allaire 2005). Big game species harvested by non-resident and non-resident aliens include: Dall's sheep (males only with at least ¾ horn curl), woodland caribou (mountain ecotype) (both sexes), moose (both sexes), wolf (both sexes), wolverine (both sexes), and black bear (only adults not accompanied by a cub). Based on the number of game licenses issued in the area, woodland caribou (mountain ecotype), Dall's sheep, and wolf are the three big game species most

[10] Non-resident is defined as a Canadian citizen or landed immigrant who resides outside the NWT or has not lived in the NWT for two consecutive years prior to the hunting license application.

[11] Non-resident alien is defined as a person who is not a Canadian citizen or landed immigrant.

sought after by non-resident hunters. The number of game harvested from the outfitted zones within the study area is unknown. Grizzly bear harvest licenses have not been issued for non-resident and non-resident aliens in the Mackenzie Mountains since 1982 after concerns of over-harvesting (Larter and Allaire 2005).

According to Larter and Allaire (2005), of the 229 non-resident hunters (includes non-resident and non-resident alien) surveyed from outfitting lodges in the Mackenzie Mountains in 2004, 59% indicated they would like to return to the Mackenzie Mountains in the future, and 27% were repeat clients. Many of the hunters surveyed indicated a strong interest in hunting grizzly bears if licenses were available (Larter and Allaire 2005).

It is estimated $1.8 million annually is generated from non-resident and non-resident alien outfitted hunts in the Mackenzie Mountains alone (Larter and Allaire 2005). In addition, the outfitted hunting industry in the NWT provides employment for approximately 100 - 120 individuals in various occupations (including guides, camp cooks and camp helpers, horse wranglers, and pilots) throughout the year (non-resident hunting license year runs from July 1 to June 30) (Larter and Allaire 2005). In addition, meat from harvested animals is distributed to elders, residents, and long-term health centres of local communities, including Fort Good Hope (Larter and Allaire 2005). In 2004, it was estimated approximately 4,575 kg of wild meat (including caribou, Dall's sheep, mountain goat, and moose) was distributed to local communities, which was expected to cost approximately $91,500 to purchase from retail outlets (Larter and Allaire 2005). The economic value of outfitted hunts within the study area is undetermined since the number of animals harvested, number of local employees, and the amount of meat distributed to Fort Good Hope is unknown.

Only two outfitting zones occur within the study area, which means two outfitting companies have exclusive use of this zone. Since only a single outfitter has the right to provide hunting services in each zone, no further outfitters could develop in the study area. However, there is a potential for increased harvest from each of the zones, particularly for Dall's sheep. In 2004, an estimated 0.8 to 1.5% of the total Dall's sheep population (estimated around 14,000 to 26,000 individuals) were harvested from the Mackenzie Mountain outfitting zones by non-resident hunters. Resident hunters harvested approximately ten Dall's sheep in 2004 (Manuel pers. comm. 2006). Although there is no quota on the total number of Dall's sheep harvested in each outfitter zone (ENR 2006), Larter and Allaire (2005) indicated harvest levels from non-residents were well within sustainable harvest levels. However, further investigation on woodland caribou (mountain ecotype), moose, wolf, and black bear populations and population compositions are required to evaluate possible harvest level increases.

8.2.2.2 Ecotourism

In 2002, the dominant tourists visiting the Sahtu Settlement Area were Canadian in origin (84%) (RWED 2002b). Travellers surveyed in 2002 suggested the attraction to the NWT as a travel destination were general interest in the north, visiting family/friends, specific event or natural phenomenon, and fishing (RWED 2002b). Tourists were principally interested in both physical and non-physical outdoor experiences including camping, canoeing, photography, hiking, and sightseeing/ wildlife viewing, but museum visits and town tours were also desired (RWED 2002b; 2002c). Adventure tourism is the fastest growing travel tourism market in the world (RWED ND). In 2002, 58% of the outdoor adventure tourists were repeat visitors to the NWT (RWED 2002c). In addition, "cultural tourism" is a growing tourist market (RWED ND).

To date, it is assumed little or no ecotourists (defined as non-consumptive tourists, such as hunting and fishing) visit the study area. However, the study area is considered to have a number of characteristics that has the potential to draw tourists, particularly adventure travelers, including a remote location, proximity to the Mackenzie River and the community of Fort Good Hope, aboriginal culture attractions, and scenic landscapes. Ramparts Wetlands has attributes which would be considered a good tourist attraction including its: cultural importance, unique scenery, abundant wildlife, and its accessibility from Fort Good Hope. The Mountain and Hume Rivers may also provide tourism opportunities, as well as the mountainous regions in the southern portion of the study area. The study area has the potential to attract tourists interested in camping, canoeing and boat trips, hiking, wildlife viewing, sightseeing, aboriginal culture, and photography.

The potential economic value of ecotourism within the study area is unknown. However, the potential to increase ecotourism in the area is restricted by high transportation costs (both into the NWT, Fort Good Hope, and to the study area), and low marketing and trained workforce. "Auto touring" is currently the largest single source of visitors in the NWT (RWED ND). Therefore, a permanent road to Fort Good Hope would presumably increase the number of tourists to the area.

8.3 DATA GAP ANALYSIS

8.3.1 Data Gaps in Traditional Knowledge and Use

Wildlife traditional knowledge and traditional use areas within the study area are a large component of the known information available on the study area. Although many hunting and trapping areas have been documented and mapped within the study area, it is expected additional harvest areas exist, particularly within the southern portion of the study area. Although information exists on harvest areas, the actual distribution and abundance of wildlife within the study area are generally unknown. In addition, the number of big and small game harvested within the study area is unknown prior to 1998 (Sahtu Renewable Resources Boards 2002). The potential to increase traditional wildlife use within the study area is unknown.

8.3.2 Data Gaps in Scientific Literature and Non-Traditional Use

Information regarding wildlife species distributions were mainly extrapolated from traditional harvest areas, known wildlife habitat requirements, and known vegetation/ habitat within the study area. Specific wildlife distribution and abundances within the study area were limited, however, moose and waterfowl surveys have been completed within the study area, and Dall's sheep wintering and summering habitat was delineated. In addition to limited wildlife distribution and abundance information, the number of game harvested from the study area, particularly within the outfitting zones were known, as well as the economic value of outfitting within the study area, possible increase in harvest levels for the most sough sport species (*e.g.* Dall's sheep, woodland caribou, and grizzly bear), and the economic feasibility and value of ecotourism within the study area.

9.0 SUMMARY OF RENEWABLE RESOURCE SIGNIFICANCE

One of the mandates of the Sahtu Land Use Planning Board is to protect and promote the cultural, social, and economic well being of local residents (Sahtu Land Use Planning Board 2002). To support this mandate, the Sahtu Land Use Planning Board has outlined the Ramparts River and Wetlands area, which encompass many special traditional and historical places, includes a sustainable biological environment, and supports the economic well being of local residents (both historically and today).

To promote the Ramparts River and Wetlands area into a Protected Area, the renewable resources of the area were identified and evaluated following the PAS guidelines. Both traditional and non-traditional use of renewable resources, including climate, carving rocks, aquatics, vegetation, fish, and wildlife were discussed.

9.1 SUMMARY OF RENEWABLE RESOURCE SIGNIFICANCE FOR TRADITIONAL USE

Information on the traditional use of renewable resources (characterized by living off the land, local consumptive use of resources, or inherited cultural lifestyles) are limited, however, some important harvest areas have been mapped within the study area. Traditional use of aquatic resources, vegetation, fish, and wildlife within the study area has historically played an important role in the lives of the Sahtu Dene and Métis and Mountain Dene ancestors. Although wind and solar energy was harnessed for daily tasks, such as food preservation, light, and heat, this energy supply is not unique to the study area.

Available literature places most significance on aquatics, vegetation, fish, and wildlife present at the Ramparts River and Wetlands CPA. Dominant rivers, particularly the Ramparts, Hume, and Mountain rivers were important travel routes for both the Sahtu Dene and Métis and Mountain Dene. Rivers were important access corridors to key hunting and fishing areas, and were used especially by the Mountain Dene to sell and trade goods at the Fort Good Hope trading post. Water resources were also used for potable water; however, available information sets little significance of potable water within the study area. Potable water is considered common throughout the region.

Known timber and berry harvest sites were also documented within the study area, particularly within the Ramparts Wetlands. Today, timber harvested for the Fort Good Hope sawmill originates from the Mackenzie River islands and areas immediately surrounding Fort Good Hope (Manuel pers. comm. 2006). In addition, current berry harvest sites are located near the community of Fort Good Hope, outside the study area (Manuel pers. comm. 2006). The economic value of timber and berry harvests from the study area is unknown since historical and current harvest levels are not known. Known firewood harvests sites were located immediately outside the study area, along the Mountain and Mackenzie rivers, however firewood harvest sites within the study area is expected, particularly adjacent to camps and cabins. Although only negligible amounts of firewood is expected to be collected within the study area today, firewood is considered an important resource for the few residents of the study area (individuals who occupy cabins in the study area during winter and spring months). The estimated replacement value of firewood from the study area is approximately $1,400 a year. Historical and current harvest sites for medicinal plants and plants used for arts and crafts were not documented within the study area, however, it is expected plants were harvested intermittently throughout the entire study area.

People also traditionally fished and hunted throughout the study area, and continue to do so today. Although fish are harvested throughout the year from the study area, good fishing lakes are rare within the Ramparts Wetlands. In addition, wildlife species hunted for subsistence (*i.e.* food, clothing, shelter) were available, including woodland caribou (both boreal and mountain ecotypes), moose, Dall's sheep, waterfowl, and grouse/ptarmigan. Today it is estimated the replacement value of big and small game harvested from the study area for subsistence is approximately $13,095 a year. In addition, the replacement value of fish harvested from the study area is approximately $6,676 a year.

In addition to subsistence hunting, known harvest areas for beaver, marten, black bear, and snowshoe hare were located throughout the study area, particularly within the Ramparts Wetlands. Although harvest sites for other fur-bearers, such as mink, muskrat, weasel, wolf, fox, and lynx were not documented, it is assumed these species were trapped opportunistically throughout the study area. Historically, fur-bearers played an important role in the fur trade, and continue to be an important part of the local economy. Some fur-bearers were also harvested for subsistence, such as hares. Today it is estimated beaver, marten, black bear, and snowshoe hare harvested from the study area provide economic support of approximately $14,113 annually to residents of Fort Good Hope.

9.2 SUMMARY OF RENEWABLE RESOURCE SIGNIFICANCE FOR NON-TRADITIONAL USE

Non-traditional renewable resource use (such as large-scale commercial and industrial resource development) is limited within the study area, and includes some industrial water use and outfitted hunting. Although additional renewable resources are available within the study area (such as solar, wind, vegetation, and fish), limiting factors reduce the feasibility of future exploitation or use.

Solar energy within the study area is reduced during winter months. The daily annual average solar radiation received by the study area would provide a sufficient solar resource essentially during summer months. In addition, wind speeds expected within the study area are less than the required threshold for a wind-powered energy source.

Future commercial forestry practices, agricultural development, and commercial/outfitted sport-fishing operations are considered low potential within the study area due to environmental limiting factors, logistical constraints, and limited demand.

It is assumed water has been used from the study area to support seismic and oil/gas drilling in the southeast corner of the study area. However, the amount of water used from the study area is unknown. With the development of the Mackenzie Gas Pipeline, it is expected additional oil/gas exploration (including seismic and wells) may increase in the study area, and the amount of water use (both potable and industrial water use) will rise. Water resources play a key role in the exploration of oil and gas. Although water is required during oil and gas exploration, the economic value of both potable and industrial use water is undetermined. In addition, the aquatic resources available within the study area could be harnessed for hydropower. The hydrologic power of Mountain River is assumed to provide sufficient energy to power industrial camps throughout the year. However, Ramparts River may only provide sufficient power during summer months when flow rates are the highest. Both rivers could supply a single cabin with sufficient power throughout the year.

Two outfitting zones occupy the southern portion of the proposed Ramparts River and Wetlands CPA. Within these outfitting zones, key sport hunting species are harvested, principally woodland caribou, Dall's sheep, moose, wolf, and black bear. It is estimated $1.8 million annually is generated from non-resident and non-resident alien outfitted hunts in the Mackenzie Mountains alone (Larter and Allaire 2005); however, the economic value of outfitting within the study area is unknown. Further investigation on woodland caribou (mountain ecotype), moose, wolf, and black bear populations and population compositions are required to evaluate increased harvest levels.

In addition to industrial development, there is potential for ecotourism development within the study area. The study area includes tourist attractions such as its cultural importance and history, pleasing scenery, abundant wildlife, and remoteness. The study area has the potential to attract tourists interested in camping, canoeing and boat trips, hiking, wildlife viewing, sightseeing, aboriginal culture, and photography. However, the potential economic value of ecotourism within the study area is unknown.

10.0 RECOMMENDATIONS

The main objective of this Renewable Resource Assessment is to collect published renewable resource information of the study area, evaluate existing data and knowledge, and report data gaps. Based on these data gaps, additional studies are recommended to fill in valuable knowledge of the local resources. This is required to support and manage the renewable resources in the study area. These recommendations are then rated based on priority. A table documenting the data gaps, recommendations, and priority ratings is provided in Table 16.

Besides recommending additional studies and knowledge gathering programs, miscellaneous recommendations are provided in Section 10.1.

TABLE 16. RECOMMENDATIONS AND PRIORITY RATINGS FORVALUABLE RENEWABLE RESOURCE COMPONENTS

Valuable Renewable Resource Component	Data Gaps	Recommendations	Priority Rating	Rationale for Priority Rating
Climate (including solar and wind)	• Potential for solar and wind energy available at the study area. • Feasibility of solar and wind energy development in the study area.	• Collect baseline wind speed, wind direction, and incoming solar radiation data specific to the study area. • Conduct a feasibility study for use of solar and wind powered generation for cabins and exploration camps.	• Very Low • Very Low	• Gathering baseline climate data at the study area is considered a very low priority because historical and current long-term meteorological data are available from Fort Good Hope, and modeling estimates are sufficient for the PAS needs. • There is a limited need for solar and wind energy development within the study area since current use of cabins within the study area is infrequent. The feasibility of solar and wind energy generation for large-scale industrial developments is limited since large battery or grid-systems are necessary to supply energy through winter months. It is recommended each development (small and large scale developments) should complete a feasibility study (cursory or comprehensive) depending on the energy requirements of the development, and season and duration of use.
Geology	• Abundance and distribution of culturally significant geological material (*i.e.* carving stones). • The extent of historic and current resource use. • Quantity and quality of peat available for horticultural peat harvests. • Economic value of carving stones and peat.	• Conduct baseline geological survey to document abundance and distribution of culturally significant stones. • Survey residents of Fort Good Hope to identify historic and current use of culturally significant stones from the study area. • Complete a peat survey to document the quality and quantity of peat available in the study area for horticultural use. • Conduct a feasibility study for peat harvesting in the study area.	• Very Low • Very Low • Very Low • Very Low	• Existing geological information is sufficient to expect possible locations of important stones. • Documenting the historic and current use of carving stone in the study area is very low priority since stones are not likely harvested from the study area for carving. • Conducting a peat survey and a feasibility study for peat harvesting within the study area are considered very low since the study area is remote and has limited access, and peat harvesting would hinder traditional hunting, fishing, and trapping within the study area.
Aquatics	• Water quality and quantity of major rivers, streams, wetlands, and lakes (for both potable and industrial use). • Accurate estimate of the hydroelectric potential of Ramparts, Mountain, and Hume rivers. • Economic value of water resources for both potable and industrial use (including hydro-power and oil and gas development).	• Complete baseline water quantity and quality of Ramparts, Mountain, Hume, and Ontaratue rivers, tributaries, and Ramparts Wetlands for local potable and industrial use. • Conduct a feasibility study for mini and small hydro projects on Ramparts, Mountain, and Hume rivers. • Determine the potential economic value of the water resources within the study area.	• Medium • Low • Very Low	• Collecting baseline water quantity and quality data is considered a medium priority since industrial development (predominantly seismic and oil and gas exploration) has occurred within the study area, and is expected to increase in the future. • Completing a feasibility study for mini and small hydro developments is considered low priority since little energy demand is currently required at the study area. • Determining the potential economic value of water resources within the study area is considered very low priority since existing water resource use is limited, too large an area to quantify the amount of water available, and currently low user demand.
Vegetation	• Abundance and distribution of traditional use plants within the study area. • Extent of historical and current traditional use of	• Complete a baseline survey to document the abundance and distribution of traditional use plants (such as those used for subsistence, medicine, arts and crafts, firewood, and log	• Low - Medium	• A baseline survey to document abundance and distribution of traditional use plants is considered a low - medium priority. Areas used the most (both historically and today), particularly the Ramparts Wetlands are considered a more

Valuable Renewable Resource Component	Data Gaps	Recommendations	Priority Rating	Rationale for Priority Rating
Vegetation (continued)	vegetation within the study area. • Quantity and quality of timber for commercial harvest (both for local sawmills and commercial export).	timber). • Extent of historical and current traditional use should be documented from all historical and current users of the study area including Sahtu Dene and Métis and Mountain Dene people. Procedures to document traditional use should follow prescribed methods, such as those described by Hart (1995). • Conduct a timber harvest evaluation (including quantity and quality of available timber) for local sawmills and commercial export.	• Low • Very Low	priority than opposed to areas with limited access, such as the northwestern corner of the study area. • Extent of historical and current vegetation use within the study area is considered a low priority since some literature has already documented traditional and current use sites, and traditionally important areas. In addition, species distribution can be speculated based on known ecosystems and environmental conditions, and existing field data. Extent of berry harvests from the study area would depend on the berry crop, which varies each year depending on weather conditions. Existing plant harvests from the study area is considered low. • A timber harvest evaluation is considered very low priority since forestry potential is expected to be negligible.
Fish	• Distribution and abundance of fish (including trophy size fish to support a sport-fishing lodge) within the study area. • Specific traditional fishing areas and volume of fish annually harvested for subsistence. • The volume of fish required to support current subsistence needs is undetermined. • Exact economic benefit of fish harvested within the study area for subsistence.	• Complete a baseline fish distribution and abundance survey within major rivers, tributaries, lakes, and wetlands within the study area. Trophy sized fish should also be documented to determine the feasibility for a sport-fishing lodge within the study area. • Document specific traditional fishing areas within the study area and the volume of fish harvested from all historical and current users of the study area including Sahtu Dene and Métis and Mountain Dene people. Procedures to document traditional use areas and knowledge should follow prescribed methods, such as those described by Hart (1995). • Survey residents of Fort Good Hope who rely on wild meat to determine the volume of fish required to support current subsistence needs. • Estimate the economic benefit of fish from the study area.	• Medium - Low • Low • Low • Low	• A baseline fish survey is considered a medium - low priority since limited fish surveys have been completed within the study area. Fish distribution and abundance data is important to evaluate the traditional and non-traditional resource potential of the study area. However, it is considered low priority to determine the abundance and distribution of trophy sized fish since the potential for a fishing lodge within the study area is considered low. • Some traditional and current fishing areas have been already documented within the study area. Some areas have been reported as poor fishing areas (*i.e.* Ramparts Wetlands), therefore it is assumed only a limited volume of fish was historically and currently harvested from the study area. Current fish harvest areas have been documented by the Sahtu Renewable Resources Board (2002). • A survey to determine the volume of fish required to support current subsistence needs is considered low priority since it is expected residents of Fort Good Hope rely on the Mackenzie River and other waterbodies outside the study area to supply the majority of subsistence needs. • It is considered low priority to estimate the economic benefit of fish from the study area since it is assumed only limited amounts of fish are harvested in comparison to the Mackenzie River and other waterbodies closer to Fort Good Hope.
Wildlife	• Distribution and abundance of wildlife within the study area. • Comprehensive data regarding the number of big and small game harvested within the study area by residents and non-residents.	• Conduct baseline wildlife surveys to document distribution and abundance of big and small game species. • Survey Fort Good Hope residents and document the number of big and small game harvested from the study area. • Monitor populations of big and small game species to	• Low - Medium • Very Low • Low - Medium	• Baseline wildlife surveys have been completed in portions of the study area, particularly within the Ramparts Wetlands. Areas with poor survey coverage have a medium priority. • The Sahtu Renewable Resources Board has begun mapping the number of big and small game harvested

Valuable Renewable Resource Component	Data Gaps	Recommendations	Priority Rating	Rationale for Priority Rating
Wildlife (continued)	• Potential to increase traditional wildlife use within the study area. • Possible increase of outfitted hunts for woodland caribou, moose, Dall's sheep, wolf, and black bear within the outfitting zones. • Grizzly bear population within the outfitting zones to support sustainable outfitted hunts.	determine possible increase in traditional and non-traditional use. • Evaluate grizzly bear populations within the outfitting zone to support sustainable outfitted hunts.	• Low	from the Sahtu Settlement Area, including the study area. • Monitoring populations of species used for traditional and non-traditional use, including grizzly bears is considered a low - medium priority since the Department of Environment and Natural Resources (ENR) already monitors some wildlife populations, including woodland caribou, moose, beaver, marten, Dall's sheep, and grizzly bear. Medium priority is given to species not already monitored by ENR. • Evaluating grizzly bear populations within the outfitting zones is considered a low-medium priority since ENR already monitors grizzly populations and determines if populations could support outfitted hunts.

10.1 MISCELLANEOUS RECOMMENDATIONS

Based on scientific and traditional knowledge from this area, the Ramparts River and Wetlands CPA was classified as a priority area of interest, and subsequent protected area boundaries were delineated. As stated in the NWT-PAS guidelines, protected areas should ideally include a large enough area to:

- Contain numerous habitat types in various stages of succession.
- Accommodate natural disturbances, such as fire.
- Preserve areas that are biologically diverse and productive.
- Allow the natural renewal of healthy land and water systems.
- Guard sensitive species and their life requirements (*i.e.* key habitats).

The present boundaries of the Ramparts River and Wetlands CPA appear appropriate to meet most of the NWT-PAS guidelines. Present boundaries guard key habitats for most sensitive species, however alteration to proposed boundaries are recommended to further protect fur-bearers, moose, and Dall's sheep habitats and harvest areas.

Fur-bearers occur throughout many of the habitat types within the study area. Fur-bearers were once important for subsistence and trapping, and are still an important economic commodity today. Fur-bearers are currently harvested mainly within the Ramparts Wetlands and along the Hume and Mackenzie river systems. It is recommended the northeastern boundary of the Ramparts River and Wetlands CPA be shifted against the Mackenzie River to protect important fur-bearer harvest areas.

Moose are known to occur throughout the study area. However, based on previous moose surveys completed in the study area, river systems, particularly Mountain River, appear to support higher moose densities than compared to upland areas. Moose densities along Mountain River were found to support moderate to high moose densities. Moose are considered an important subsistence species that is available to the residents of Fort Good Hope during all seasons. The Sahtu Heritage Places and Sites Joint Working Group (1999) consider the Mountain River area as an important moose hunting area. It is recommended the Ramparts River and Wetlands CPA boundary be shifted to include Mountain River in order to protect important moose habitat and subsistence hunting areas. Figure 16 depicts suggested boundary shifts. In addition, Mountain River has traditionally been an important hunting corridor for both Mountain and Sahtu Dene and Métis people.

Known Dall's sheep winter and summer ranges occur along the Mountain River and the Gayna River headwaters within the study area. It is recommended the Ramparts River and Wetlands CPA boundary be shifted further south to encompass a greater portion of Dall's sheep summer and winter range (Figure 16). Although current subsistence harvest levels of Dall's sheep by Fort Good Hope residents are low, Dall's sheep was once traditionally

important, particularly for the Mountain Dene. In addition, Dall's sheep are key sport-hunting species for existing outfitters.

The recommended adjustments to the Ramparts River and Wetlands CPA boundary is considered sufficient to preserve existing traditional based economies and cultures, and existing outfitting operations, as well as protect areas biologically diverse and productive, and guard sensitive species and their habitats.

REFERENCES

Ah-You, K., and G. Leng. 1999. Renewable Energy in Canada's Remote Communities. Renewable Energy for Remote Communities Program, Natural Resources Canada. Web access: http://cetc-carennes.nrcan.gc.ca/fichier.php/codectec/En/1999-26-27/1999-27e.pdf

Andrews, Tom. 2006. Personal Communication. Prince of Wales Northern Heritage Centre, Yellowknife, NT. [April 19, 2006].

Ashley, B. 2002. Edible Weights of Wildlife Species used for Country Food in the Northwest Territories and Nunavut. Manuscript Report No. 138. Department of Resources, Wildlife and Economic Development, Yellowknife, NWT. 78 pp.

Auld, J., and R. Kershaw. 2005. The Sahtu Atlas. Sahtu GIS Project 2005. 68 pp.

Aurora Research Institute. 2003. Pre-Feasibility Analysis of Wind Energy for Inuvialuit Region in Northwest Territories. Final Report. Submitted to Department of Resources, Wildlife and Economic Development and Northwest Territories Power Corporation. 68 pp.

Banci, V. 1994. Wolverine. Pages 99-127 *In:* Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, L.J. Lyon and W.J. Zielinski, eds. The scientific basis for conserving forest carnivores: American marten, fisher, lynx and wolverine in the western United States. General Technical Report RM-254, U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. Ft. Collins, CO.

Beanlands, G.E. and P.N. Duinker. 1983. An ecological framework for environmental impact assessment in Canada. Institute for Resource and Environmental Studies, Dalhousie Univ., Halifax. 132 pp.

Best, T.L., and T.H. Henry. 1994. *Lepus arcticus*. The American Society of Mammalogists 457: 1-9. *In:* Haysson, V. (editor). Mammalian Species online reference. Web access: http://www.science.smith.edu/departments/Biology/VHAYSSEN/msi/msi_intro.html (March 2006).

British Columbia Hydro. 2006. Exploring for Hydroelectric Energy. Web access: www.bchydro.com/rx_files/community2283.pdf (March 2006).

Cambridge Strategies Inc. 2004. Northern Powerhouse: The Untapped Energy of the Northwest Territories' Rivers. Background paper prepared for Northwest Territories Power Corportation. Edmonton, Alberta. 20 pp.

Canadian Forest Inventory Committee. 2001. Canada's National Forest Inventory – Wood Volume Map. Web access: www.nfi.cfs.nrcan.gc.ca/nfi_e.html (March 2006).

Centre for Land and Biological Resources Research (CLBRR). 1996. Soil Landscapes of Canada, v.2.2, Research Branch, Agriculture and Agri-Food Canada. Ottawa.

Clark, T.W., E. Anderson, C. Douglas, and M. Strickland. 1987. *Martes americana.* The American Society of Mammalogists 289: 1- 8. *In:* Haysson, V. (editor). Mammalian Species online reference. Web access: http://www.science.smith.edu/departments/Biology/VHAYSSEN/msi/msi_intro.html (March 2006).Daigle, J.V, and H. Gautreau - Daigle. 2001. Canadian Peat Harvesting and the Environment. Second Edition. Issue Paper, No 2001-1. North American Wetlands Conservation Council Committee, Ottawa, Ontario. 45 pp. Web access: http://www.peatmoss.com/pdf/Issuepap2.pdf (March 2006).

Davis, R.A. 1974. Chapter I: Aerial Surveys of Bird Populations Along the Route of the Proposed Gas Pipeline in the Mackenzie District, Northwest Territories, Summer, 1972. *In:* Bird Distribution and Populations Ascertained Through Aerial Survey Techniques, 1972. Arctic Gas Biological Report Series Volume 11. 156 pp.

Department of Energy, United States. 2001. Energy Efficiency and Renewable Energy Clearinghouse – Small Hydropower Systems. Web access: www.nrel.gov/docs/fy01osti/29065.pdf

Department of Indian Affairs and Northern Development (DIAND). 1997-2001. Community Mapping Project. GIS shape files obtained from James Auld, Sahtu GIS office, March 2006.

Dignard-Bailey, L., and A. Filion. 1998. Canada PV Technology Status and Prospects 1998. Natural Resources Canada. Web access: http://cetc-varenes.nrcan.gc.ca/fichier.php/codectec/En/1998-58-1999-38/1998-58_1999-38e.pdf

Dryden, R.L., B.G. Sutherland, and J.N. Stein. 1973. An Evaluation of the Fish Resources of the Mackenzie River Valley as Related to Pipeline Development – Volume II. Prepared for the Environmental-Social Program Northern Pipelines. 176 pp.

Dyke L.D., and G.R. Brooks. 2000. The Physical Environment of the Mackenzie Valley, Northwest Territories: A Base Line for the Assessment of Environmental Change. Geological Survey of Canada Bulletin 547. Ottawa, Ontario. 208 pp.

Economic Strategy Panel. 2000. Common Ground: NWT Economic Strategy. 91 pp. Web access: http://www.iti.gov.nt.ca/iea/pdf/reports/common_ground.pdf (April 2006).

Environment Canada. 2004. National Climate Data and Information Archive. Climate Data Online – Fort Good Hope. Web access: www.climate.weatheroffice.ec.gc.ca/climateData/canada_e.html (March 2006).

Environment Canada. 2004b. Canadian Wind Energy Atlas. Web access: http://www.windatlas.ca/en/index.php (March 2006).

Environment Canada. 2005. National Climate Data and Information Archive. Climate Data Online – Customized Search Ramparts River. Web access: www.climate.weatheroffice.ec.gc.ca/climateData/canada_e.html (March 2006).

Environment Canada. 2006. Archived hydrometric Data. Web access http://www.wsc.ec.gc.ca/hydat/H2O/ (March 2006).

Environment and Natural Resources (ENR). 2005. Resident Harvest Survey. Database obtained March 29, 2006, from Joanna Wilson, PAS Biologist, Environment and Natural Resources, Yellowknife, NT.

Environment and Natural Resources (ENR). 2005b. Northwest Territories Summary of Hunting Regulations July 1, 2005 to June 30, 2006. Government of Northwest Territories. Yellowknife, NT. 28 pp.

Environment and Natural Resources (ENR). 2006. Dall's Sheep in the NWT. Species Accounts. Web access: http://www.nwtwildlife.com/NWTwildlife/dallsSheep.htm (June 2006).

Environment and Natural Resources (ENR). 2006b. NWT Wildlife Species Accounts. Web access: http://www.nwtwildlife.com/NWTwildlife (February 2006).

Forest Management Institute, Canadian Forestry Service, and the Department of the Environment. Vegetation Types of the Mackenzie Valley 1973 – Appendix 7 to Vegetation Types of the Mackenzie Corridor. Prepared for the Environmental – Social Program of the Task Force on Northern Oil Development.

Government of the Northwest Territories (GNWT). 2005. The Rising Cost of Energy in the NWT – Presentation. Web access: www.iti.gov.nt.ca/energy/pdf/energypres_nov21_2005.pdf

Gray, P and P. Panegyuk. 1989. Woodland Caribou. *In:* People and caribou in the Northwest Territories. Pages 159 – 163. E. Hall, Ed. Department of Renewable Resources. Yellowknife, NWT. 190 pp.

Hart, Elisa. 1995. Getting Started in Oral Traditions Research. Occasional Papers of the Prince of Wales Northern Heritage Centre, No. 4, Government of the Northwest Territories, Yellowknife, NT. Web access: http://pwnhc.learnnet.nt.ca/research/otm/otrman.htm#TABLE (April 2006).

Hall, E. 1989. People & Caribou in the Northwest Territories. Department of Renewable Resources. Yellowknife, NWT. 190 pp.

Heritage Sites and Places Working Group. 1999. Routes and Sites shapefiles. Created by the Sahtu GIS Project. Files obtained from James Auld, Sahtu GIS project.

Indian and Northern Affairs Canada. 2004. Fort Good Hope. Web access: http://www.ainc-inac.gc.ca/nin/pro/nwt/fortgoodhope_e.html (April 2006).

Indian and Northern Affairs Canada. 2005. SID Viewer Online. Web access http://nwt-tno.inac-ainc.gc.ca/ism-sid/index_e.asp (March 2006).

Johnson, M., and R.A. Ruttan. 1993. Traditional Dene Environmental Knowledge: A Pilot Project Conducted in Ft. Good Hope and Colville Lake, NWT (1989 – 1993). Prepared for Dene Cultural Institute. 309 pp.

Kokelj, S.A. 2001. Hydrologic Overview of the Gwich'in and Sahtu Settlement Areas. Water Resources Division, Indian and Northern Affairs Canada. Yellowknife, NWT. 39 pp.

Larter, N.C., and D.G. Allaire. 2005. Mackenzie Mountain Non-Resident and Non-Resident Alien Hunter Harvest Summary 2004. Manuscript Report No. 165. Department of Environment and Natural Resources, Government of Northwest Territories. Fort Simpson, NWT. 51 pp.

Latour, P. 1992. A Survey of Dall's Sheep in Zone E/1-1, Northern Mackenzie Mountains. Manuscript Report No. 44. Department of Renewable Resources, Government of Northwest Territories, Norman Wells, NWT. 19 pp.

Latour, P, and N. MacLean. 1994. An Analysis of Data Returned by Outfitted Hunters from the Mackenzie Mountains, NWT 1979 – 1990. File Report No. 110. Department of Renewable Resources, Government of Northwest Territories, Norman Wells, NWT. 41 pp.

Latour, P, N. MacLean, and K. Poole. 1992. Progress Report on the Study of Movements of Marten in the Mackenzie Valley – Sahtu District. Manuscript Report No. 57. Department of Renewable Resources, Government of Northwest Territories, Norman Wells, NWT. 24 pp.

Mackenzie River Basin Board. 2004. Mackenzie River Basin: State of the Aquatic Ecosystem Report 2003. Mackenzie River Basin Board. Fort Smith, NT. 208 pp.

MacLean, N. 1994. Population Size and Composition of Moose in the Fort Good Hope Area, NWT, November 1992. Manuscript Report No. 78. Department of Renewable Resources, GNWT, Norman Wells, NWT. 18 pp.

Manuel, Isadore. 2006. Personal Communication. Project Manager, Sahtu Renewable Resource Board, Fort Good Hope. [May 2006].

Minister of Indian Affairs and Northern Development, NWT Government Leader, Chiefs and Métis Presidents, and Sahtu Tribal Council. 1993. Sahtu Dene and Métis Comprehensive Land Claim Agreement. Minister of Public Works and Government Services Canada, Ottawa, Ontario.

Murray, G., P.C. Boxall, and R.W. Wein. 2005. Distribution, Abundance, and Utilization of Wild Berries by the Gwich'in People in the Mackenzie River Delta Region. Economic Botany 59(2): 174 – 184.

Natural Resources Canada. 2006. The Atlas of Canada: Productive Forests Land Use Map. Web access: http://atlas.gc.ca/site/english/index.html (March 2006).

Northwest Territories Bureau of Statistics. 2001. 2001 Census Data. Web access: http://www.stats.gov.nt.ca/Statinfo/Census/census%2001/Labour%20Force.xls (March 2006).

Northwest Territories Bureau of Statistics. 2004. 2004 NWT Community Survey: Heating Source – Wood. Database obtained March 2006, from Joanna Wilson, PAS Biologist, Environment and Natural Resources, Yellowknife, NT.

Northwest Territories Bureau of Statistics. 2004b. Fort Good Hope Statistical Profile. Web access: http://www.stats.gov.nt.ca/Profile/Profile%20PDF/Fort%20Good%20Hope.pdf (March 2006). Parlee, B., F. Berkes, and the Teetl'it Gwich'in Renewable Resources Council. 2005. Health of the Land, Health of the People: A Case Study on Gwich'in Berry Harvesting in Northern Canada. EcoHealth Journal Consortium 2: 127-137.

Pappas, T. 2005. Canadian Forecast 2006: Information letter from Western Canadian Raw Fur Auction Sales Ltd. Web access: www.westcanfurauction.com (March 2006).

Poole, K.G. 1994. Characteristics of an unharvested lynx population during a snowshoe hare decline. J. Wildl. Manage. 58(4): 608-618.

Poole, K.G, and B. Croft. 1990. Beaver Surveys in the Western NWT, September – October 1989. Manuscript Report No. 34. Department of Renewable Resources, Government of the Northwest Territories, Yellowknife, NWT. 15 pp.

Popko, R.A., A.M. Veitch, M.C. Promislow. 2002. An Aerial Survey for Beaver Lodges in the Sahtu Settlement Area – September 2001. Manuscript Report No. 144. Department of Resources, Wildlife and Economic Development, Sahtu Government of Northwest Territories, Norman Wells. 29 pp.

PorslidA.E., and W.J. Cody. 1980. Vascular Plants of Continental Northwest Territories, Canada. National Museum of Canada. 667 pp.

Reid, D.E. 1974. Vegetation of the Mackenzie Valley – Part One. Biological Report Series Volume Three. Prepared by Northern Engineering Services Company Limited. 155 pp.

Resources, Wildlife and Economic Development (RWED). ND. Industry Profile An integrated approach to nurturing industry development and NWT wealth: Travel and Tourism. Web access: www.iti.gov.nt.ca/parks/tourism/pdf/2004_Travel_Tourism_Industry_Profile.pdf (July 2006).

Resources, Wildlife and Economic Development (RWED). 2001. Renewable Resource Values - Wildlife and Fisheries 2001/2002. Government of Northwest Territories. Web access: www.iti.gov.nt.ca/iea/pdf/fact_sheets/renewable_resources2001.pdf (March 2006).

Resources, Wildlife and Economic Development (RWED). 2002. Population status reports. Government of the Northwest Territories (GNWT), RWED, Yellowknife NT. Web access: http://www.nwtwildlife.rwed.gov.nt.ca/Publications/populationstatusreports/populationrpts.htm

Resources, Wildlife and Economic Development (RWED). 2002b. 2002 Visitor Exit Survey: Report on the General Touring Segment of Visitors to the Northwest Territories. Department of Investments and Economic Analysis. 90 pp. Web access:

www.iti.gov.nt.ca/parks/tourism/pdf/2002_Visitor_Exit_Survey_General_Touring.pdf (July 2006).

Resources, Wildlife and Economic Development (RWED). 2002c. 2002 Visitor Exit Survey: Report on the Outdoor Adventure Segment of Visitors to the Northwest Territories. Department of Investments and Economic Analysis. 56 pp. Web access: www.iti.gov.nt.ca/parks/tourism/pdf/2002_Visitor_Exit_Survey_Outdoor_Adventure.pdf (July 2006).

Resources, Wildlife and Economic Development (RWED). 2003a. Towards an Energy Strategy for the NWT: A Discussion Paper. RWED Energy Secretariat. 82 pp. Web access: http://www.enr.gov.nt.ca/library/pdf/energystrategy_discussion.pdf (February 2006).

Resources, Wildlife and Economic Development (RWED). 2003b. NWT Energy Strategy. Government of Northwest Territories. Web access: http://www.gov.nt.ca/RWED/library/publications.htm (February 2006).

Resources, Wildlife and Economic Development (RWED). 2004. Economic Diversification Equitable Access: Strong Communities and Self Reliant People. Edition 1. Government of Northwest Territories. 276 pp. Web access: www.iti.gov.nt.ca/iea/pdf/documents/frameworksweb.pdf (March 2006).

Robinson, J and D. Irwin. 2003. Mineral Deposits and Petroleum Resources of the Northwest Territories – map. Minerals, Oil and Gas Division, GNWT, Yellowknife, NT. Map. Web access: www.enr.gov.nt.ca/maps/pdf/min_pet_resources2.pdf (June 2006).

Rocky Mountain Institute. ND. Passive Solar Design, Photovoltaics, and Wind Power. Web access: www.rmi.org (March 2006).

Rossouw, F. 2006. Personal communication. Fur Marketing/ Traditional Economy, Industry, Tourism and Investment, GNWT. [April 7, 2006]. Ruttan, R.A. 1972. Observations of Moose in the Northern Yukon Territory and Mackenzie River Valley, 1972. *In:* Studies of Furbearers associated with Proposed Pipeline Routes in the Yukon and Northwest Territories. Arctic Gas Biological Report Series Volume Nine.

Ruttan, R.A., and D.R. Wooley. 1974. A Study of Furbearers Associated with Proposed Pipeline Routes in the Yukon Territory and Mackenzie River Valley, 1971. Arctic Gas Biological Report Series Volume Eight. 118 + pp.

Sahtu Heritage Places and Sites Joint Working Group. 1999. Rakekée Gok'é Godi: Places We Take Care Of. Prince of Wales Northern Heritage Centre, Yellowknife, NWT. 114 pp.

Sahtu Land Use Planning Board. 2002. Sahtu Preliminary Draft Land Use Plan. Fort Good Hope, NT. 96 pp.

Sahtu Land Use Planning Board and the Sahtu GIS Project. 2005. Sahtu Land Use Plan (Draft Only) – Land Use Designation Map, July 2005. Norman Wells, NT. 1 map.

Sahtu Renewable Resources Board. 2002. Sahtu Settlement Harvest Study Data Report 1998 – 1999. Sahtu Renewable Resources Board, Tulita, NT. Database obtained from Joanna Wilson, PAS Biologist, Environment and Natural Resources, Yellowknife, NT.

Sibley, D.A. 2003. The Sibley guide to birds. National Audubon Society. Alfred A. Knopf, New York. 545 pp.

Simmons, N. 1982. Seasonal Distribution of Dall's Sheep in the Mackenzie Mountains, Northwest Territories. File Report No. 21. N.W.T Wildlife Service, Yellowknife, NWT. 47 pp.

Small Scale Hydro Task Force. ND. International Small Hydro Atlas. Web access: www.small-hydro.com (March 2006).

Solar Energy Society of Canada Inc. 1997. Renewable Resource Pamphlets. Web access: http://www.newenergy.org/sesci/sesci_e.html (March 2006).

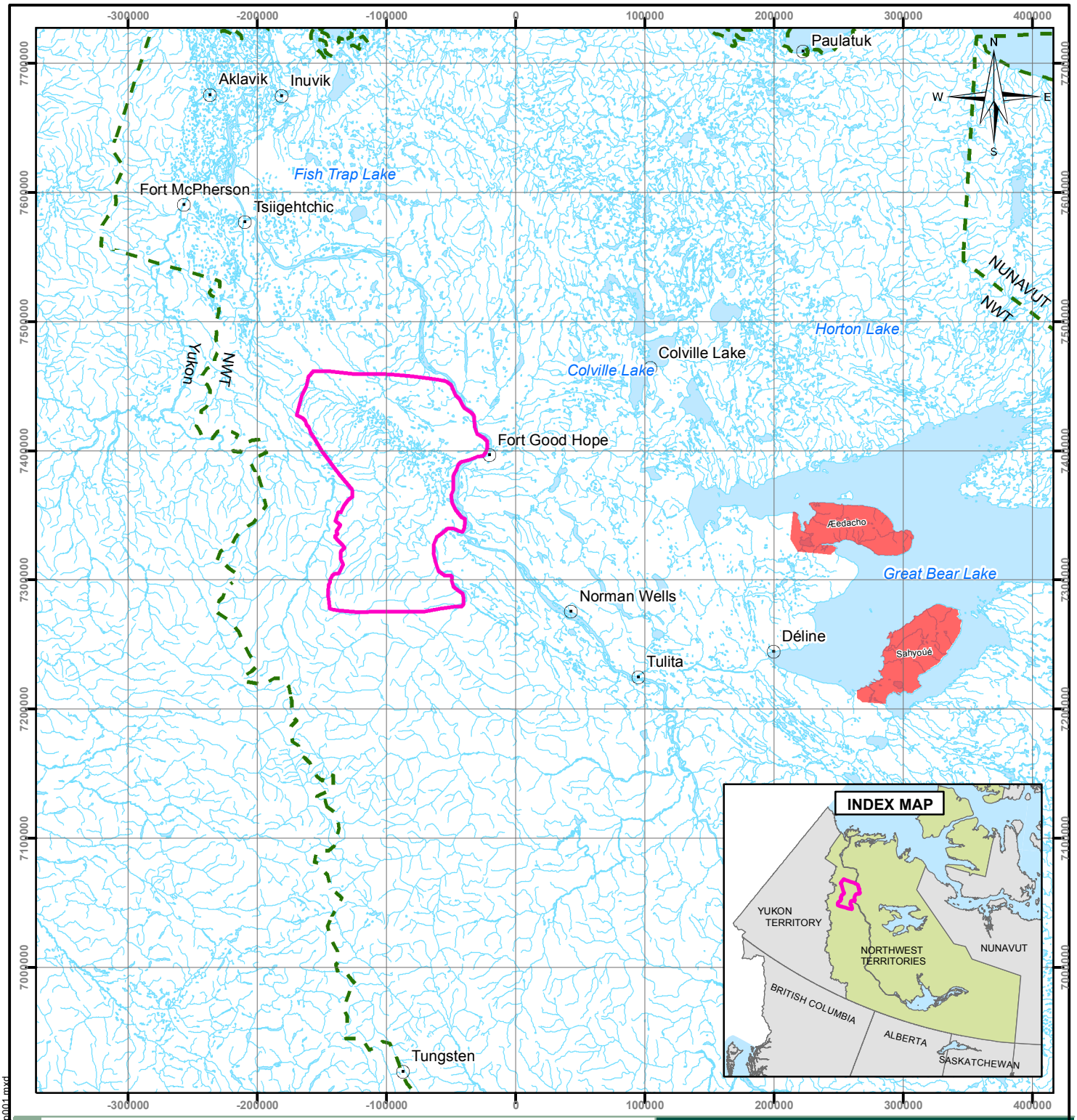
Stewart, D.B. 1996. A Review of the Status and Harvests of Fish Stocks in the Sahtu Dene and Métis Settlement Area, including Great Bear Lake. Canadian Manuscript Report of Fisheries and Aquatic Sciences. 2337: iv + 64 pp.

Van Zyll de Jong, C.G. 1975. The distribution and abundance of the wolverine (*Gulo gulo*) in Canada. Can Field-Nat. 89:431-437.

Yamoga Land Corporation. 2006. Interim Land Withdrawal Proposal: Culture, Wildlife, Vegetation/Water/Geology. Fort Good Hope, NWT.

Zieba, R. 2005. Arts and Crafts Purchasing Patterns of Potential Tourists to the Northwest Territories: Results of the 2003 Survey. Department of Renewable Resources, Wildlife and Economic Development, Government of Northwest Territories. 46 pp. Web access: http://www.iti.gov.nt.ca/iea/pdf/documents/arts%20crafts%20survey%20report.pdf (March 2006).

FIGURES



LEGEND

- Community
- Watercourse
- Waterbody
- Existing NWT Protected Area
- Study Area
- Territorial Boundary

NOTES

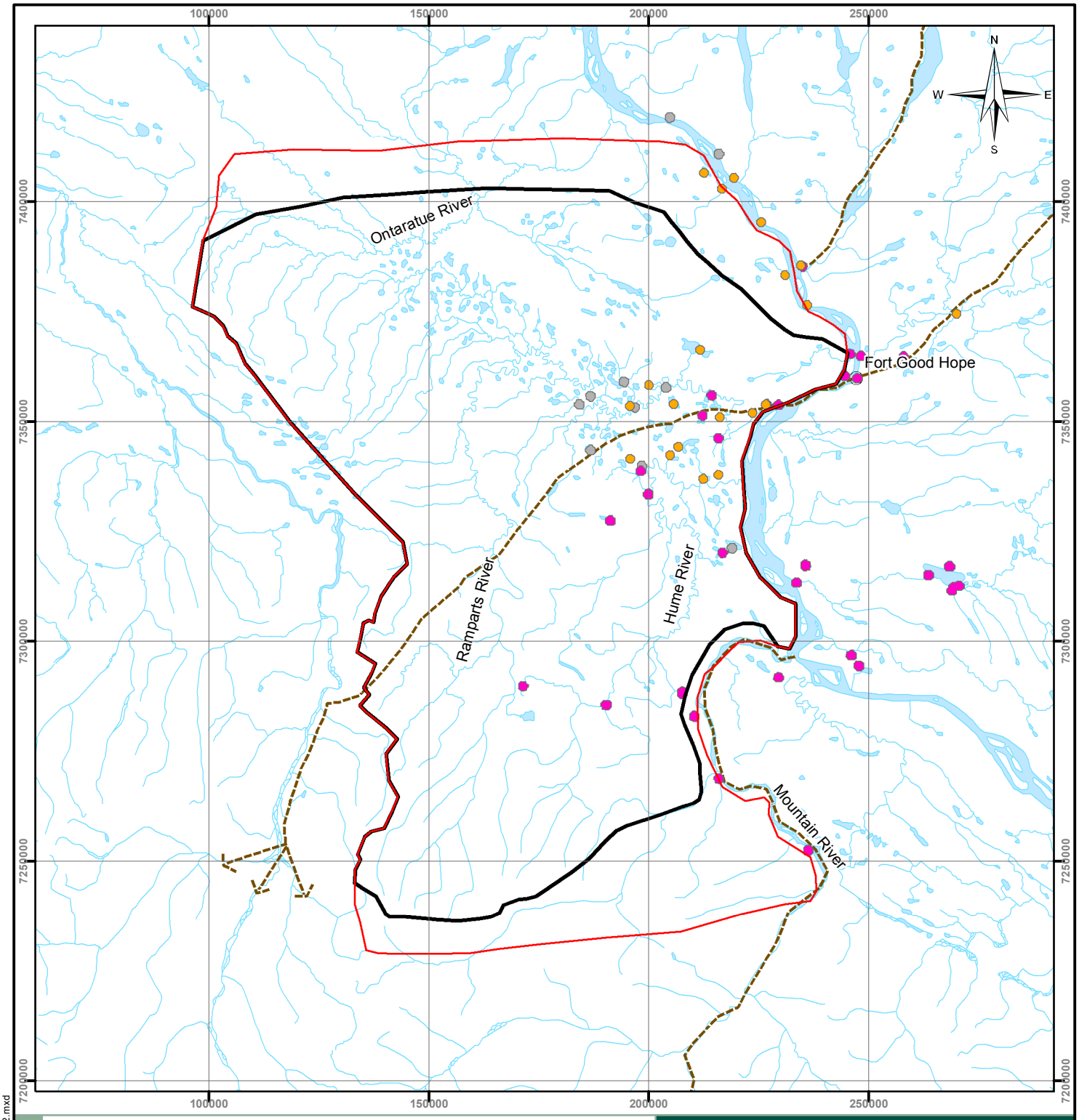
Base data source: The Atlas of Canada

RAMPARTS PHASE I ECOLOGICAL AND RENEWABLE RESOURCES ASSESSMENT

Site Location Map

PROJECTION: UTM Zone 11	DATUM: NAD83	
Scale: 1:4,250,000 (50 25 0 50 100 Kilometres)		EBA Engineering Consultants Ltd.
FILE No: 1740176_Map001		DATE: June 9, 2006
JOB NO: 1740174	REVISION NO: 1	
OFFICE: EBA-VANC	DRAWN: KMW / CHECK: XX	Figure 1

O:\Vancouver\GIS\0701_YEL\1Z40174_Caribou_PointMaps\1Z40174_Map001.mxd



LEGEND

- Community
- Watercourse
- Waterbody
- Travel Routes
- Cabins
- Cultural
- Graves
- Study Area
- Ramparts River and Wetlands Candidate Protected Area

NOTES

Base data source: The Atlas of Canada

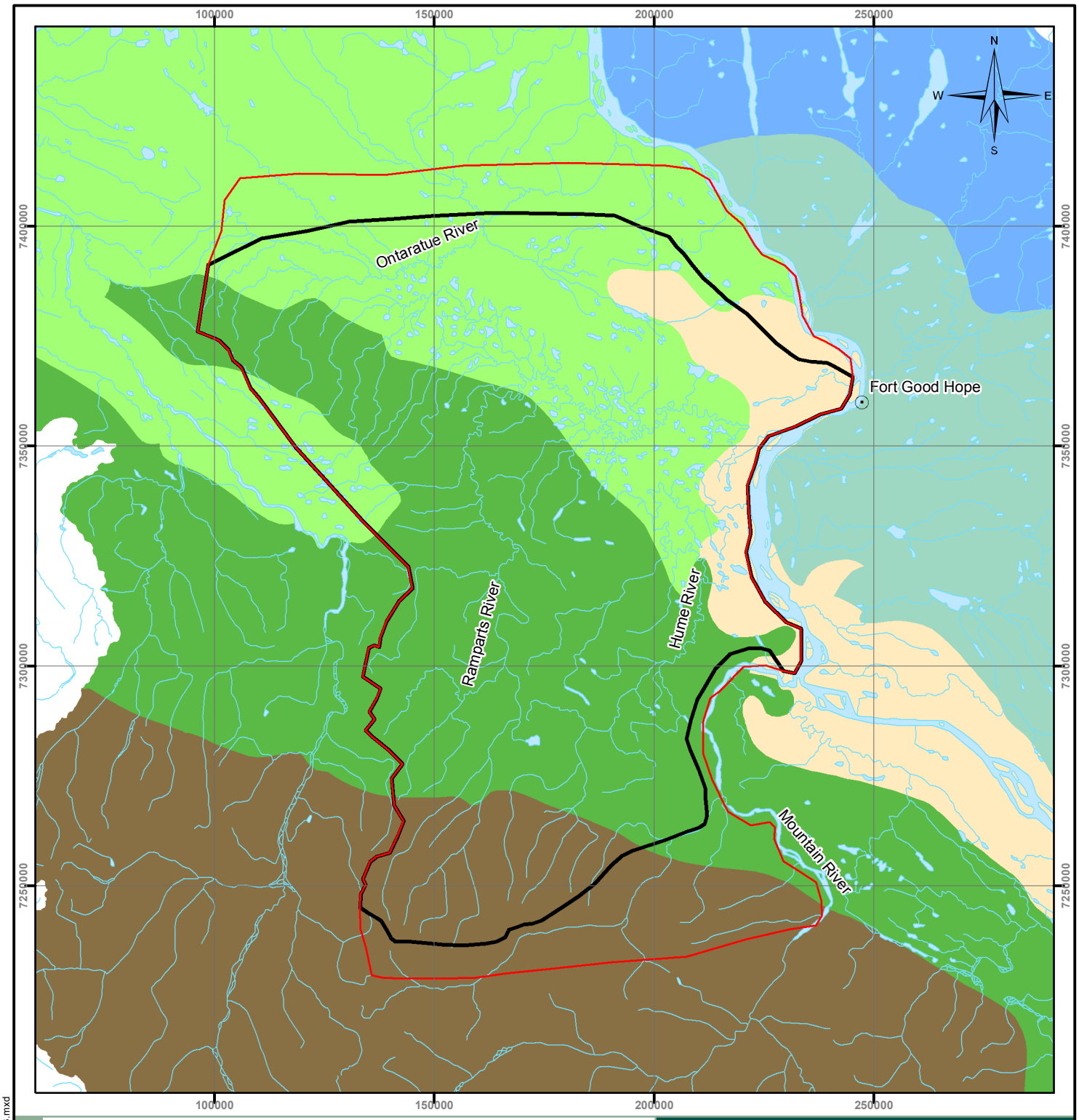
Reference: DIAND 1997 - 2001; Heritage Sites and Places Working Group 1999

RAMPARTS RIVER AND WETLANDS RENEWABLE RESOURCES ASSESSMENT

Study Area Map

PROJECTION: UTM Zone 10	DATUM: NAD83	
Scale: 1:1,250,000 (25 12.5 0 25 Kilometres)		EBA Engineering Consultants Ltd.
FILE No: 1740176_Map002.mxd		DATE: June 22, 2006
JOB NO: 1740176	REVISION NO: 3	
OFFICE: EBA-VANC	DRAWN: YL / CHECK: XX	Figure 2

Q:\Vancouver\GIS\0701_YEL\1740176_Ramparts\Maps\1740176_Map002.mxd



LEGEND

- Community
- Watercourse
- Waterbody
- Study Area
- Ramparts River and Wetlands Candidate Protected Area

Ecoregions

- Peel River Plateau
- Great Bear Lake Plain
- Fort MacPherson Plain
- Norman Range
- Mackenzie River Plain
- Mackenzie Mountains

NOTES

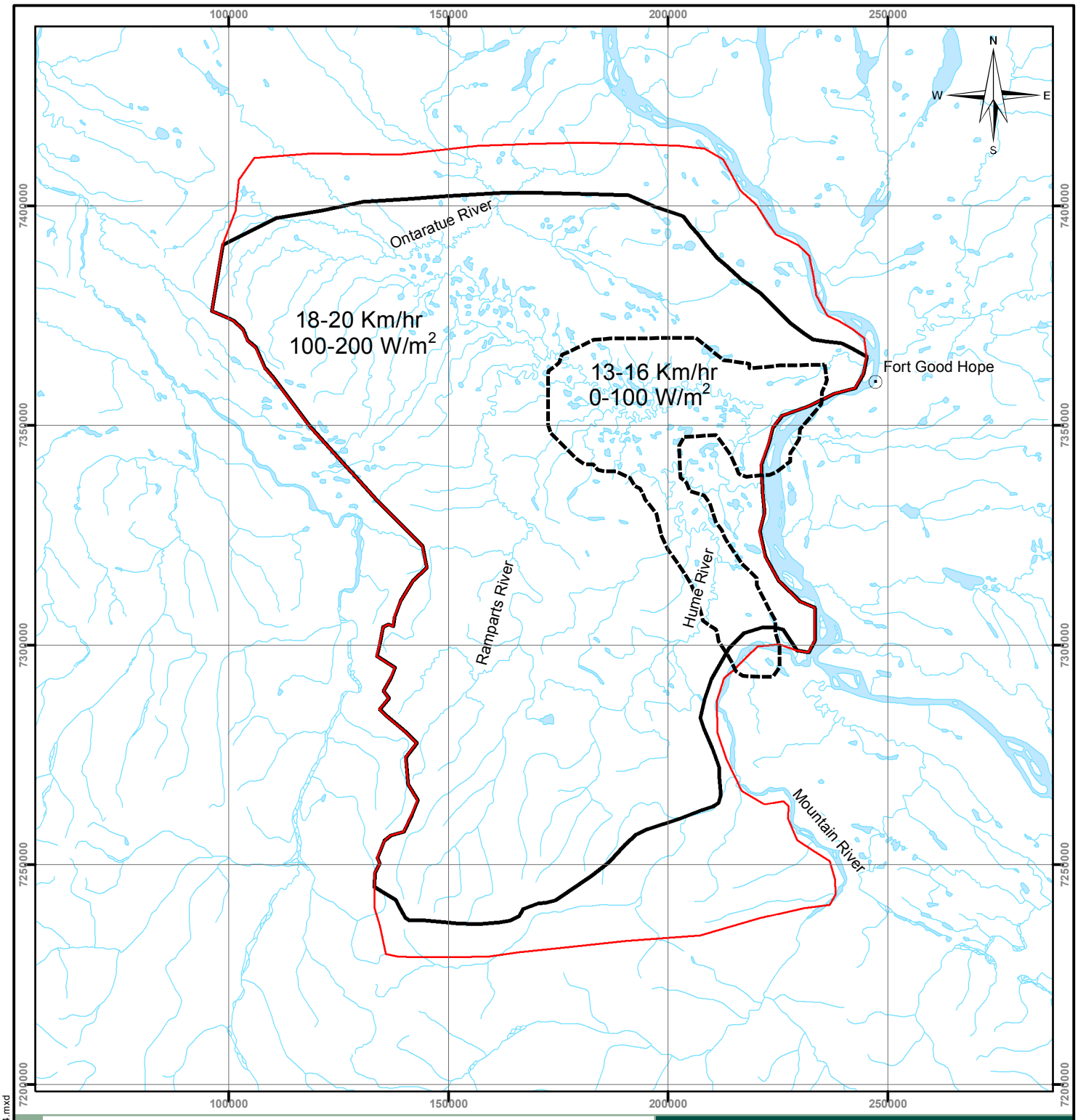
Base data source: The Atlas of Canada

RAMPARTS RIVER AND WETLANDS RENEWABLE RESOURCES ASSESSMENT

Ecoregions in the Study Area

PROJECTION: UTM Zone 10	DATUM: NAD83	EBA Engineering Consultants Ltd.
Scale: 1:1,250,000 — 25 12.5 0 25 Kilometres		
FILE No: 1740176_Map003.mxd		DATE: June 22, 2006
JOB NO: 1740176	REVISION NO: 3	
OFFICE: EBA-VANC	DRAWN: MZ / CHECK: XX	Figure 3

Q:\Vancouver\GIS\0701_YEL\1740176_Ramparts\Maps\1740176_Map003.mxd



LEGEND

- Community
- Watercourse
- Waterbody
- Study Area
- Ramparts River and Wetlands Candidate Protected Area
- Estimated Wind Speeds (Km/h)*
- Estimated Wind Energy (W/sq.m)*

NOTES

* = wind speed and wind energy estimates from 30m above ground
Base data source: The Atlas of Canada

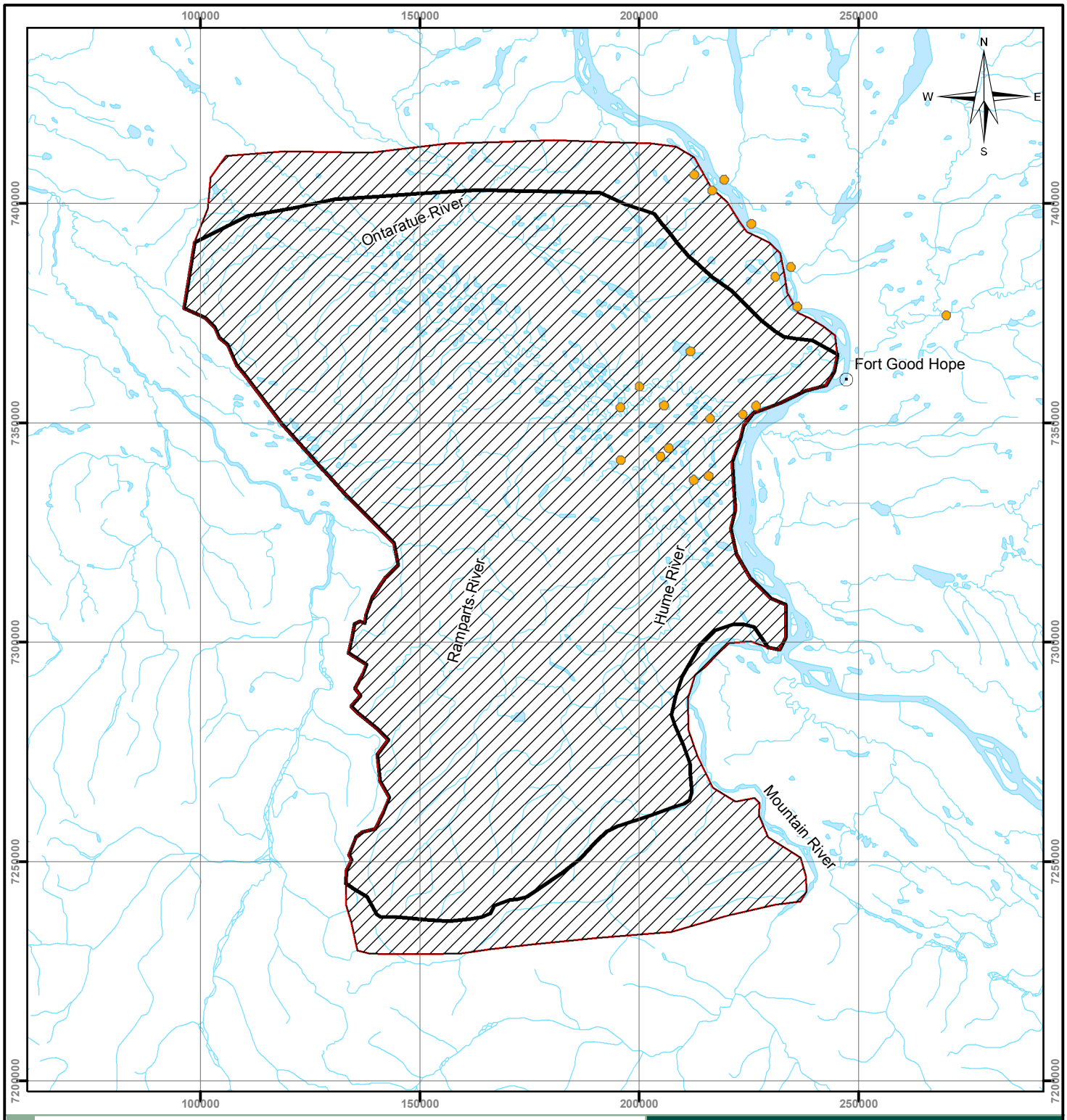
Reference: Environment Canada 2004b

RAMPARTS RIVER AND WETLANDS RENEWABLE RESOURCES ASSESSMENT

Estimated Wind Speeds and Wind Energy in the Study Area

PROJECTION: UTM Zone 10	DATUM: NAD83	
Scale: 1:1,250,000 25 12.5 0 25 Kilometres		EBA Engineering Consultants Ltd.
FILE No: 1740176_Map004.mxd		DATE: June 09, 2006
JOB NO: 1740176	REVISION NO: 1	
OFFICE: EBA-VANC	DRAWN: MZ / CHECK: XX	Figure 4

Q:\Vancouver\GIS\0701_YEL\1740176_Ramparts\Maps\1740176_Map004.mxd



LEGEND

- Community
- Watercourse
- Waterbody
- Study Area
- Ramparts River and Wetlands Candidate Protected Area
- Potential Passive/Active Solar and Passive Wind Energy Use Areas
- Existing Developments that have the Potential for Active Solar Resource Use

NOTES

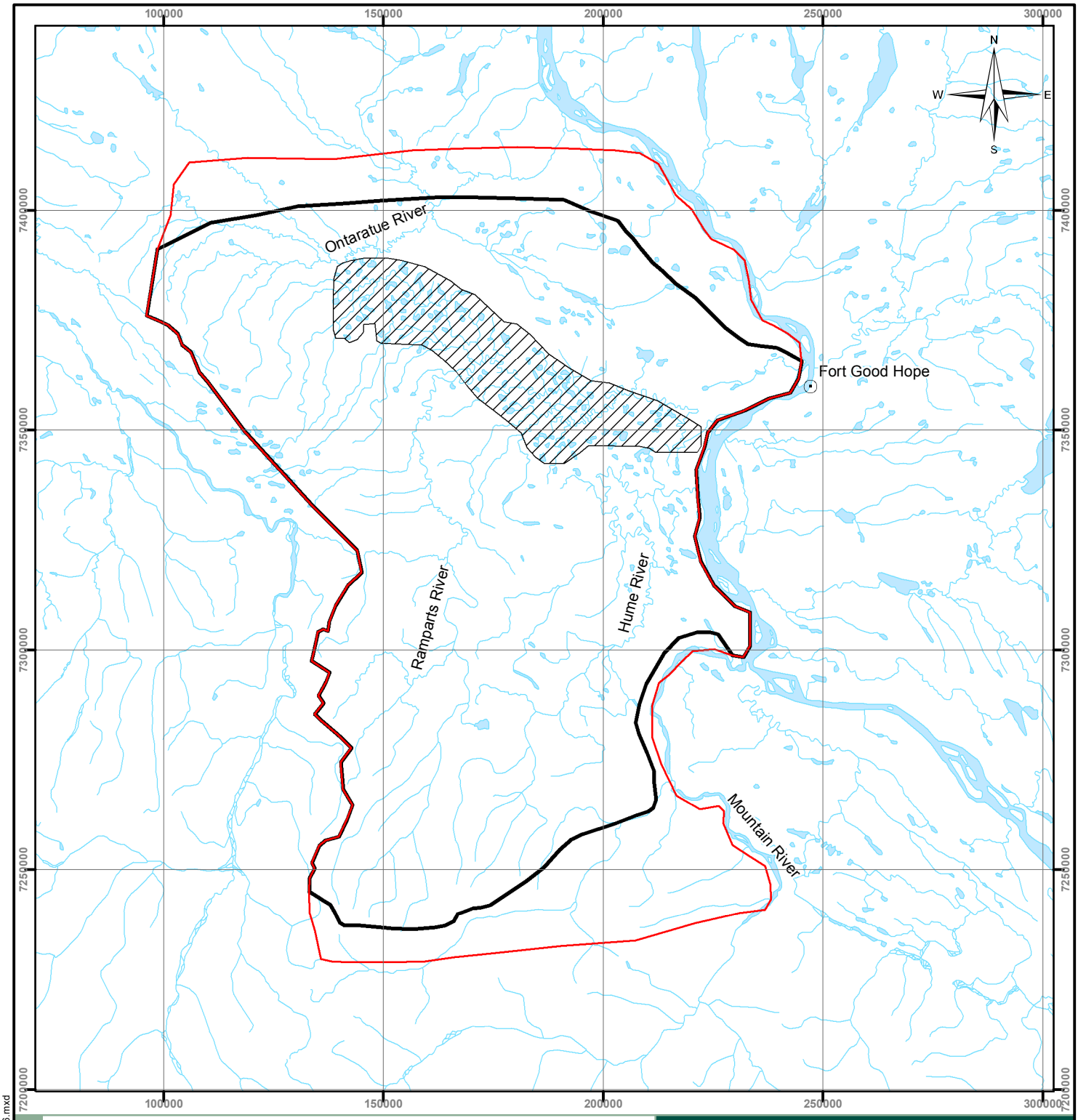
[1] = Active Wind energy development areas are not expected within the study area
Base data source: The Atlas of Canada

RAMPARTS RIVER AND WETLANDS RENEWABLE RESOURCES ASSESSMENT

Potential Solar and Wind Energy[1] Development Areas

PROJECTION: UTM Zone 10	DATUM: NAD83	
Scale: 1:1,250,000 (25 12.5 0 25 Kilometres)		EBA Engineering Consultants Ltd.
FILE No: 1740176_Map005.mxd		DATE: June 22, 2006
JOB NO: 1740176	REVISION NO: 2	
OFFICE: EBA-VANC	DRAWN: MZ / CHECK: XX	Figure 5

Q:\Vancouver\GIS\0701_YEL\1740176_Ramparts\Maps\1740176_Map005.mxd



LEGEND

- Community
- Watercourse
- Waterbody
- Study Area
- Ramparts River and Wetlands Candidate Protected Area
- Potential Horticultural Peat Extraction Area

NOTES

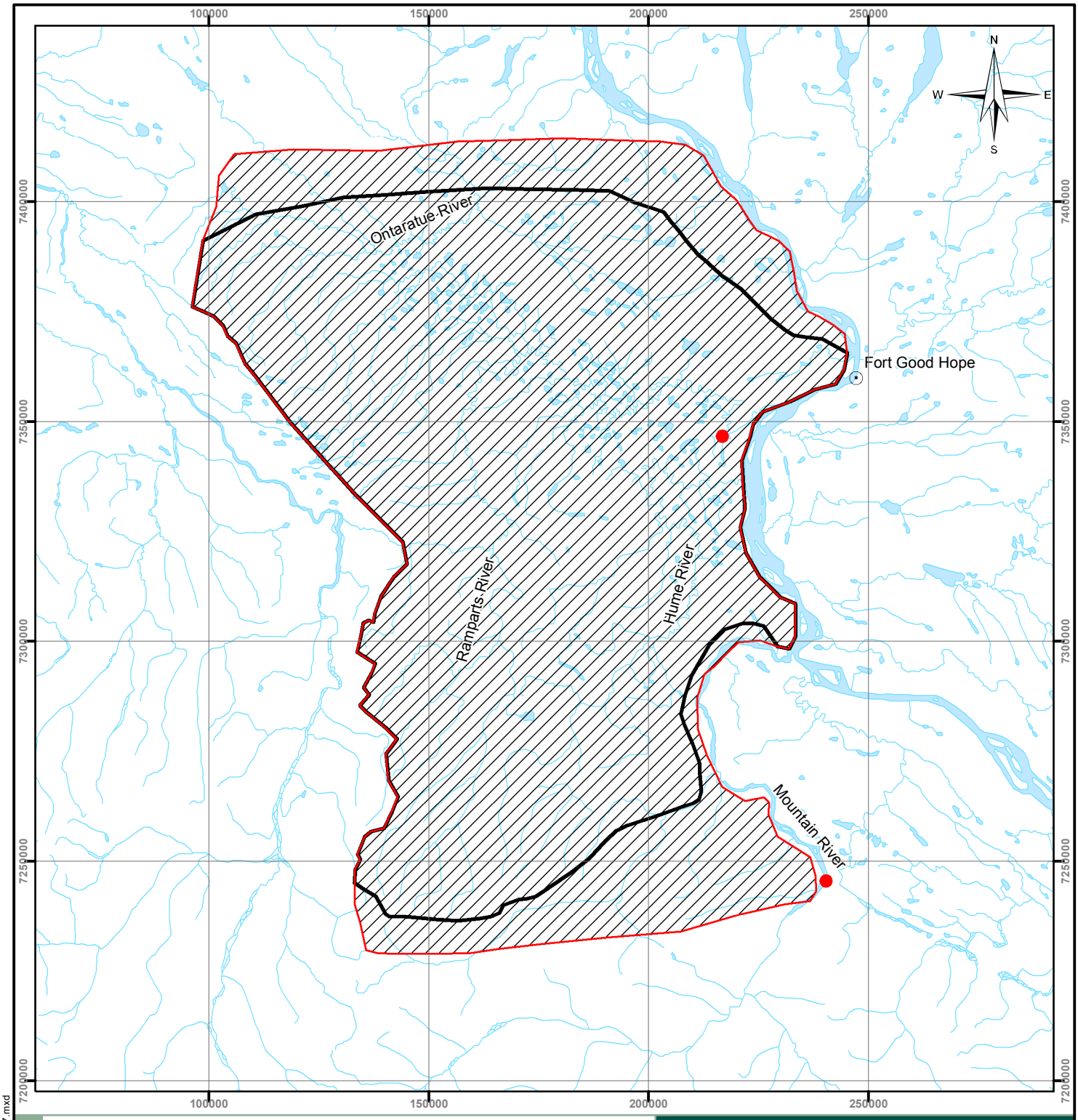
Base data source: The Atlas of Canada

RAMPARTS RIVER AND WETLANDS RENEWABLE RESOURCES ASSESSMENT

Potential Horticultural Peat Extraction Area

PROJECTION: UTM Zone 10	DATUM: NAD83	
Scale: 1:1,250,000		
25 12.5 0 25 Kilometres		EBA Engineering Consultants Ltd.
FILE No: 1740176_Map006.mxd		DATE: June 09, 2006
JOB NO: 1740176	REVISION NO: 1	
OFFICE: EBA-VANC	DRAWN: MZ / CHECK: XX	Figure 6

Q:\Vancouver\GIS\0701_YEL\1740176_Ramparts\Maps\1740176_Map006.mxd



LEGEND

- Community
- Watercourse
- Waterbody
- Study Area
- Ramparts River and Wetlands Candidate Protected Area
- Potential Traditional and Non-traditional Water Use Areas
- Hydrometric Station

NOTES

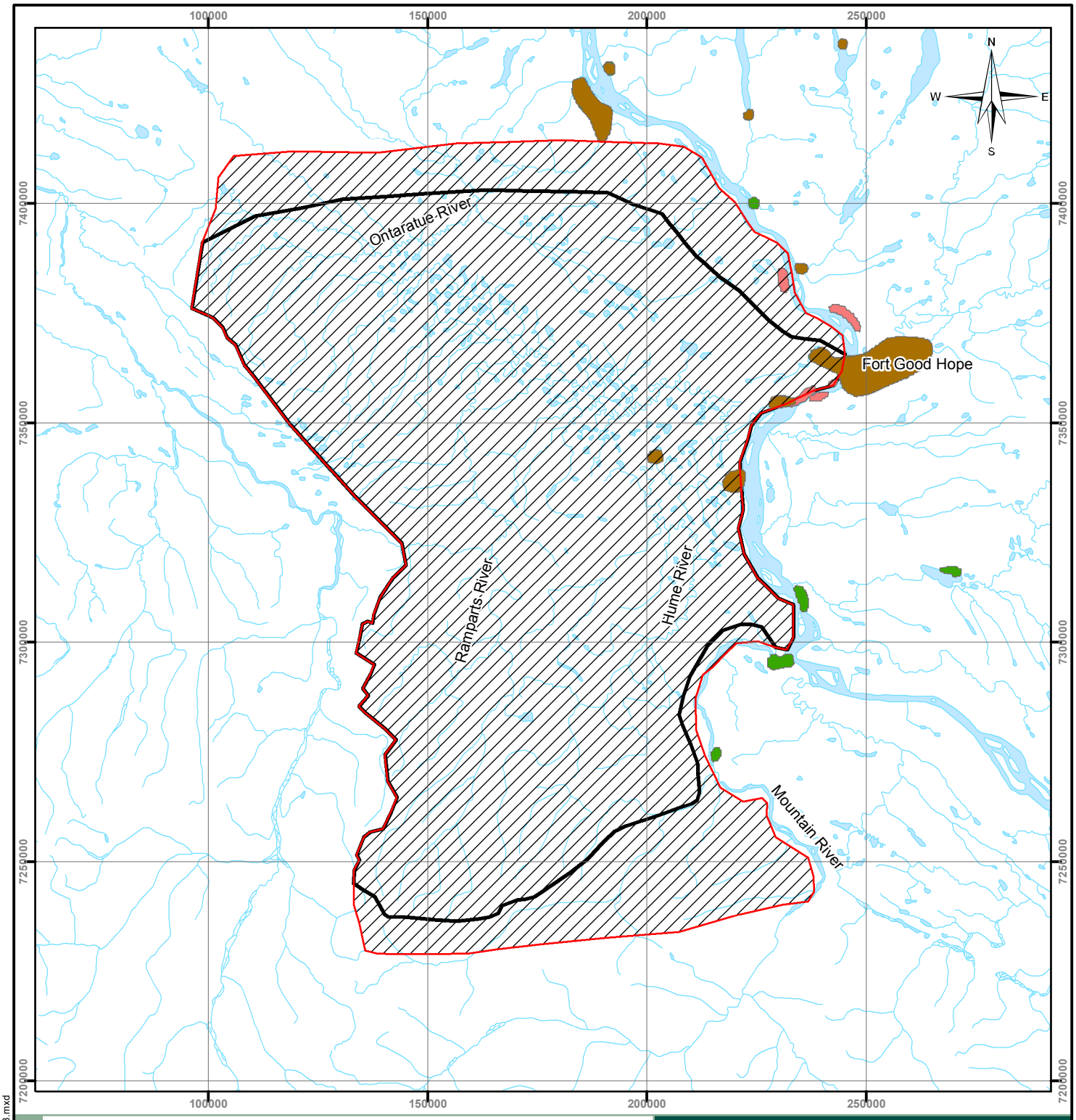
Base data source: The Atlas of Canada

RAMPARTS RIVER AND WETLANDS RENEWABLE RESOURCES ASSESSMENT

Potential Areas of Traditional and Non-Traditional Use of Aquatic Resources within the Study Area

PROJECTION: UTM Zone 10	DATUM: NAD83	
Scale: 1:1,250,000		
25 12.5 0 25 Kilometres		EBA Engineering Consultants Ltd.
FILE No: 1740176_Map007.mxd		DATE: June 22, 2006
JOB NO: 1740176	REVISION NO: 2	
OFFICE: EBA-VANC	DRAWN: MZ / CHECK: XX	Figure 7

Q:\Vancouver\GIS\0701_YEL\1740176_Ramparts\Maps\1740176_Map007.mxd



LEGEND

- Community
- Watercourse
- Waterbody
- Study Area
- Ramparts River and Wetlands Candidate Protected Area
- Potential Traditional Plant use Areas
- Known Firewood Harvest Area
- Known Berry Harvest Area
- Known Log Timber Harvest Area

NOTES

[1] = There is no potential for commercial forestry and agriculture developments within the study area
Base data source: The Atlas of Canada

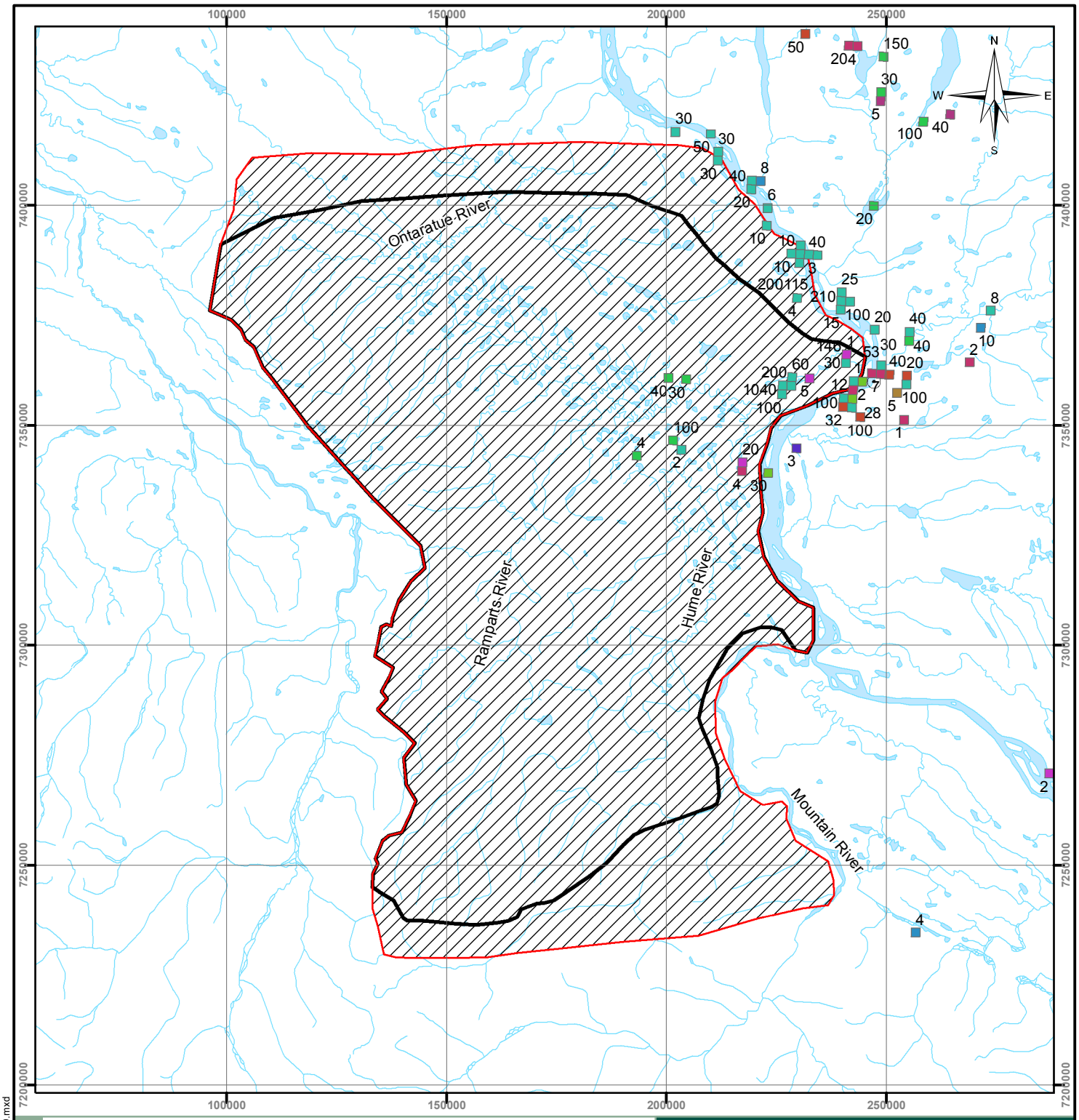
Reference: DIAND 1997 - 2001; Heritage Sites and Places Working Group 1999

RAMPARTS RIVER AND WETLANDS RENEWABLE RESOURCES ASSESSMENT

Potential Plant Harvest Areas [1] within the Study Area

PROJECTION: UTM Zone 10	DATUM: NAD83	EBA Engineering Consultants Ltd.
Scale: 1:1,250,000		
25 12.5 0 25 Kilometres		
FILE No: 1740176_Map008.mxd		DATE: June 22, 2006
JOB NO: 1740176	REVISION NO: 2	
OFFICE: EBA-VANC	DRAWN: MZ / CHECK: XX	Figure 8

Q:\Vancouver\GIS\0701_YEL\1740176_Ramparts\Maps\1740176_Map008.mxd



LEGEND

- Community
- Watercourse
- Waterbody
- Study Area
- Ramparts River and Wetlands Candidate Protected Area
- Fish Distribution

Fish Harvest Areas

- Arctic Grayling (Bluefish)
- Broad Whitefish
- Burbot (Loche)
- Chum Salmon
- Cisco (Herring)
- Inconnu (Coney)
- Lake Trout
- Lake Whitefish (Crookedback)
- Northern Pike (Jackfish)
- Walleye (Pickerel)

NOTES

[1]No known commercial fisheries and sport fishing within the study area
Base data source: The Atlas of Canada

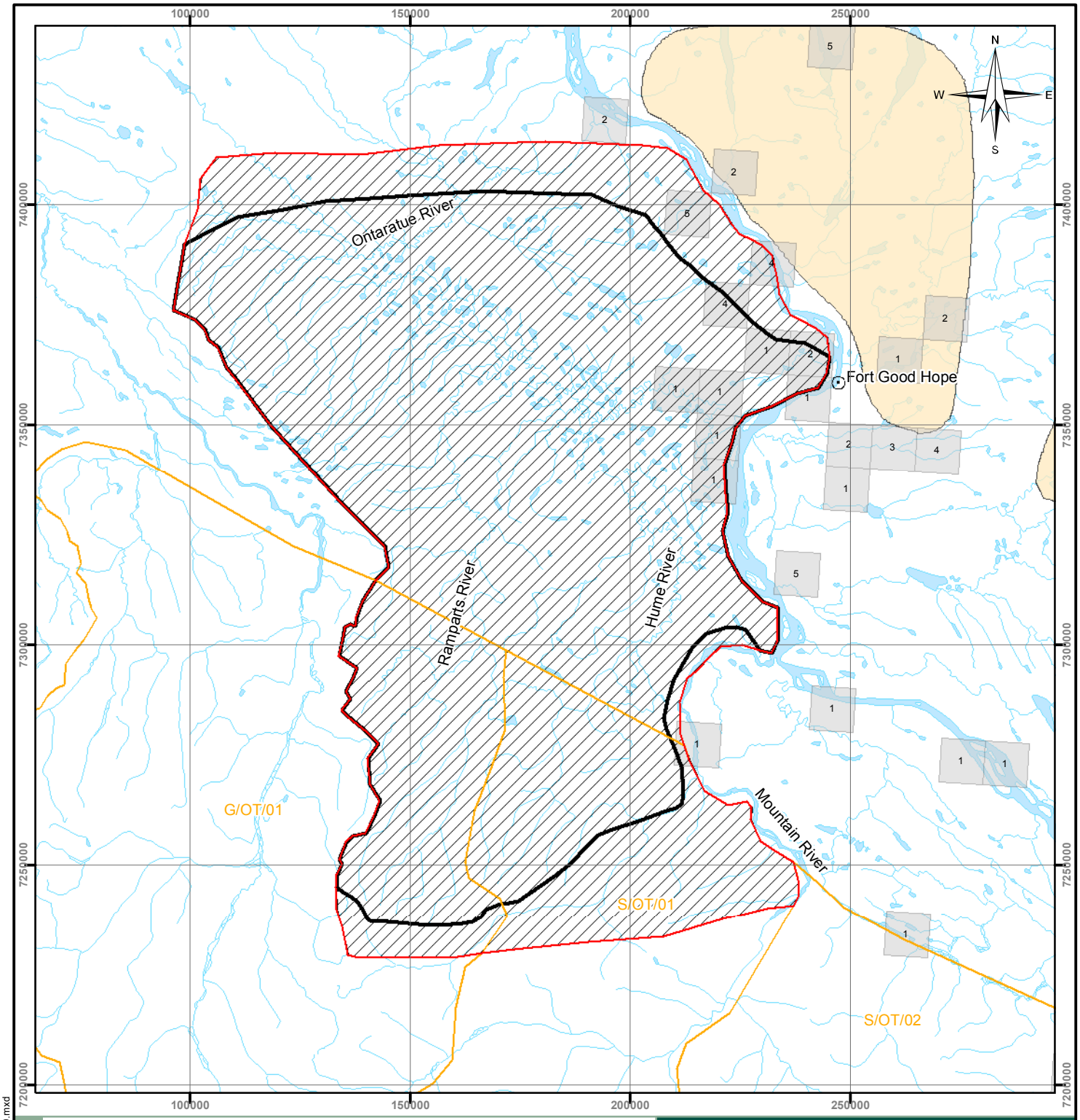
Reference: DIAND 1997 - 2001; Sahtu Renewable Resources Board 2002

RAMPARTS RIVER AND WETLANDS RENEWABLE RESOURCES ASSESSMENT

Fish Distribution and Known Fish Harvesting[1] Sites within the Study Area

PROJECTION: UTM Zone 10	DATUM: NAD83	
Scale: 1:1,250,000 (25 12.5 0 25 Kilometres)		EBA Engineering Consultants Ltd.
FILE No: 1740176_Map009.mxd		DATE: June 09, 2006
JOB NO: 1740176	REVISION NO: 1	
OFFICE: EBA-VANC	DRAWN: MZ / CHECK: XX	Figure 9

Q:\Vancouver\GIS\0701_YEL\1740176_Ramparts\Maps\1740176_Map009.mxd



LEGEND

- Community
- Watercourse
- Waterbody
- Study Area
- Ramparts River and Wetlands Candidate Protected Area
- Woodland Caribou Distribtion (boreal and mountain ecotypes) [1]
- Outfitter Zones

Known Woodland Caribou Harvest Areas*

- 2 Woodland Caribou
- Other Known Woodland Caribou (boreal ecotype) Harvest Areas

NOTES

[1] Woodland caribou (mountain ecotype) are harvested within the Outfitter Zones

Base data source: The Atlas of Canada

* Numbers in the boxes indicate the number of Woodland Caribou harvested from the area.

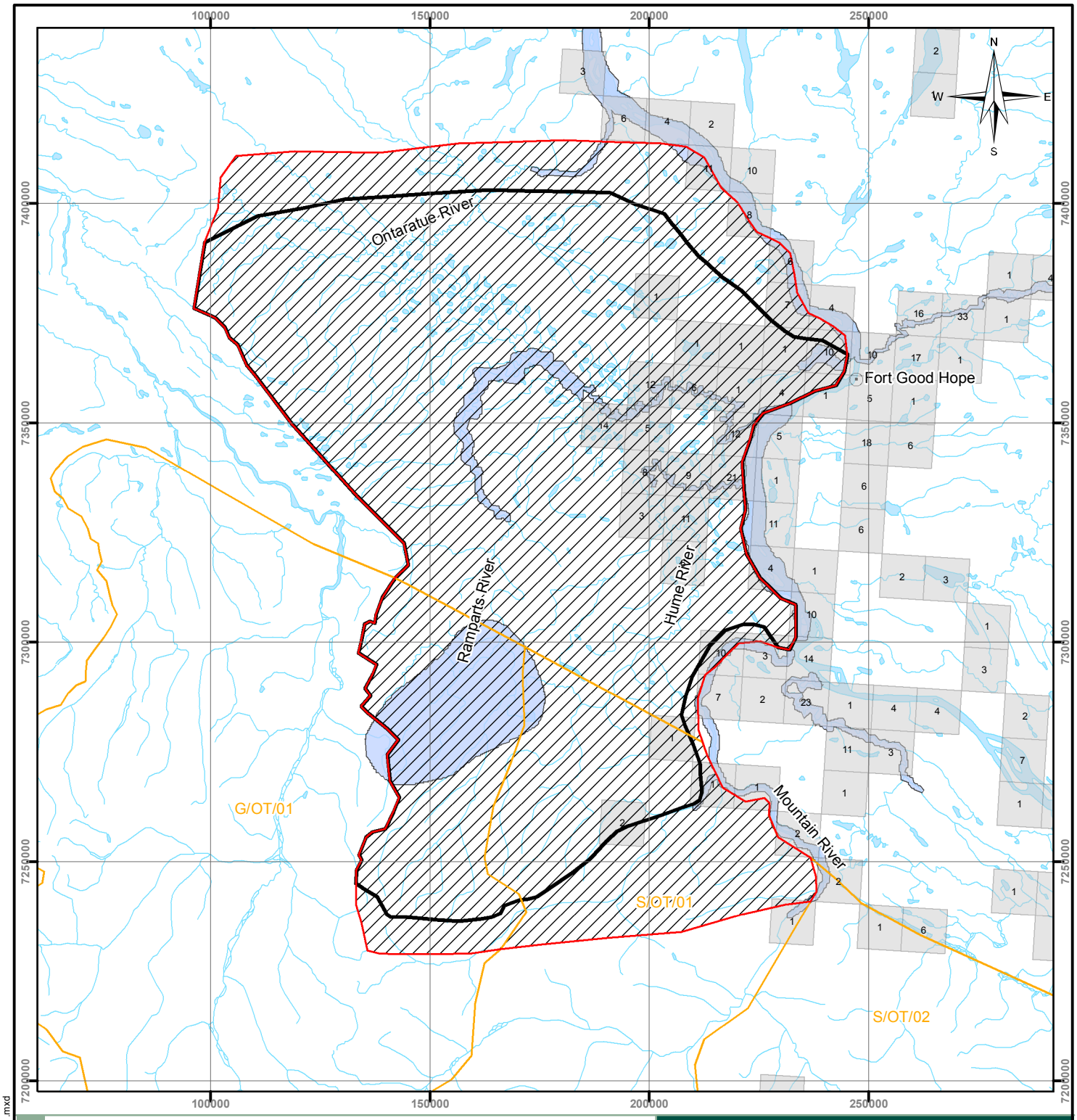
Reference: DIAND 1997 - 2001; ENR 2005b; Sahtu Renewable Resources Board 2002

RAMPARTS RIVER AND WETLANDS RENEWABLE RESOURCES ASSESSMENT

Woodland Caribou Distribution and Known Harvest Areas [1] within the Study Area

PROJECTION: UTM Zone 10	DATUM: NAD83	
Scale: 1:1,250,000		
25 12.5 0 25 Kilometres		EBA Engineering Consultants Ltd.
FILE No: 1740176_Map010.mxd		DATE: August 10, 2006
JOB NO: 1740176	REVISION NO: 5	
OFFICE: EBA-VANC	DRAWN: MZ / CHECK: XX	Figure 10

Q:\Vancouver\GIS\0701_YEL\1740176_Ramparts\Maps\1740176_Map010.mxd



LEGEND

- Community
- Watercourse
- Waterbody
- Study Area
- Ramparts River and Wetlands Candidate Protected Area
- Moose Distribution
- Outfitter Zones

Other Known Moose Harvest Areas*

- 2 Moose
- Other Known Moose Harvest Areas

NOTES

Base data source: The Atlas of Canada

* Numbers in the boxes indicate the number of moose harvested from the area

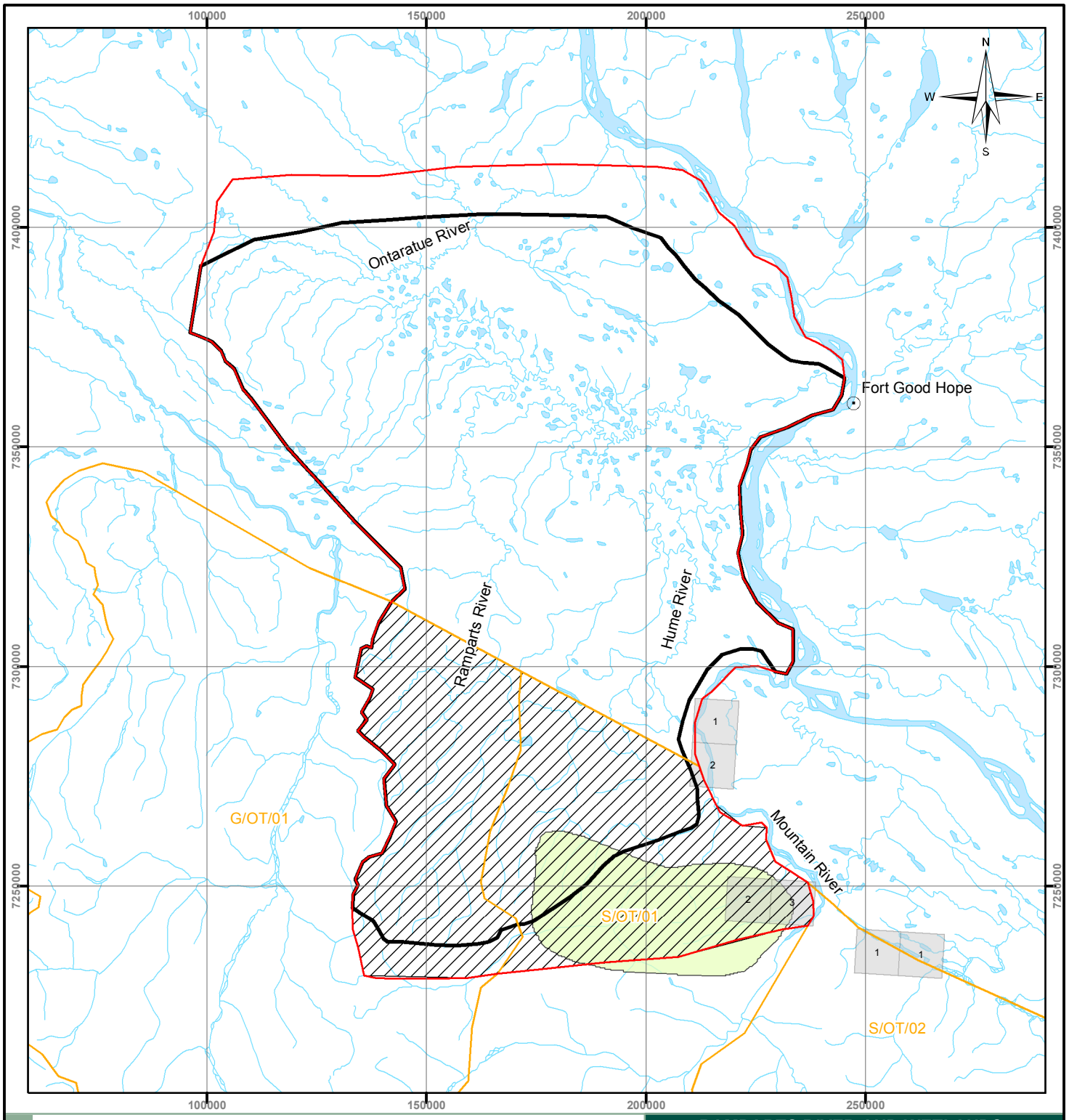
Reference: DIAND 1997 - 2001; ENR 2005b; Sahtu Renewable Resources Board 2002

RAMPARTS RIVER AND WETLANDS RENEWABLE RESOURCES ASSESSMENT

Moose Distribution and Known Harvest Sites Within the Study Area

PROJECTION: UTM Zone 10	DATUM: NAD83	
Scale: 1:1,250,000		
25 12.5 0 25 Kilometres		EBA Engineering Consultants Ltd.
FILE No: 1740176_Map011.mxd		DATE: June 30, 2006
JOB NO: 1740176	REVISION NO: 3	
OFFICE: EBA-VANC	DRAWN: MZ / CHECK: XX	Figure 11

Q:\Vancouver\GIS\0701_YEL\1740176_Ramparts\Maps\1740176_Map011.mxd



LEGEND

- Community
- Watercourse
- Waterbody
- Study Area
- Ramparts River and Wetlands Candidate Protected Area
- Dall's Sheep Distribution
- Outfitter Zones

Known Dall's Sheep Harvest Areas *

- 2 Dall's Sheep
- Other Known Dall's Sheep Harvest Sites

NOTES

Base data source: The Atlas of Canada

* Numbers in the boxes indicate the number of Dall's Sheep harvested from the area.

Reference: DIAND 1997 - 2001; ENR 2005b; ENR 2006; Sahtu Renewable Resources Board 2002

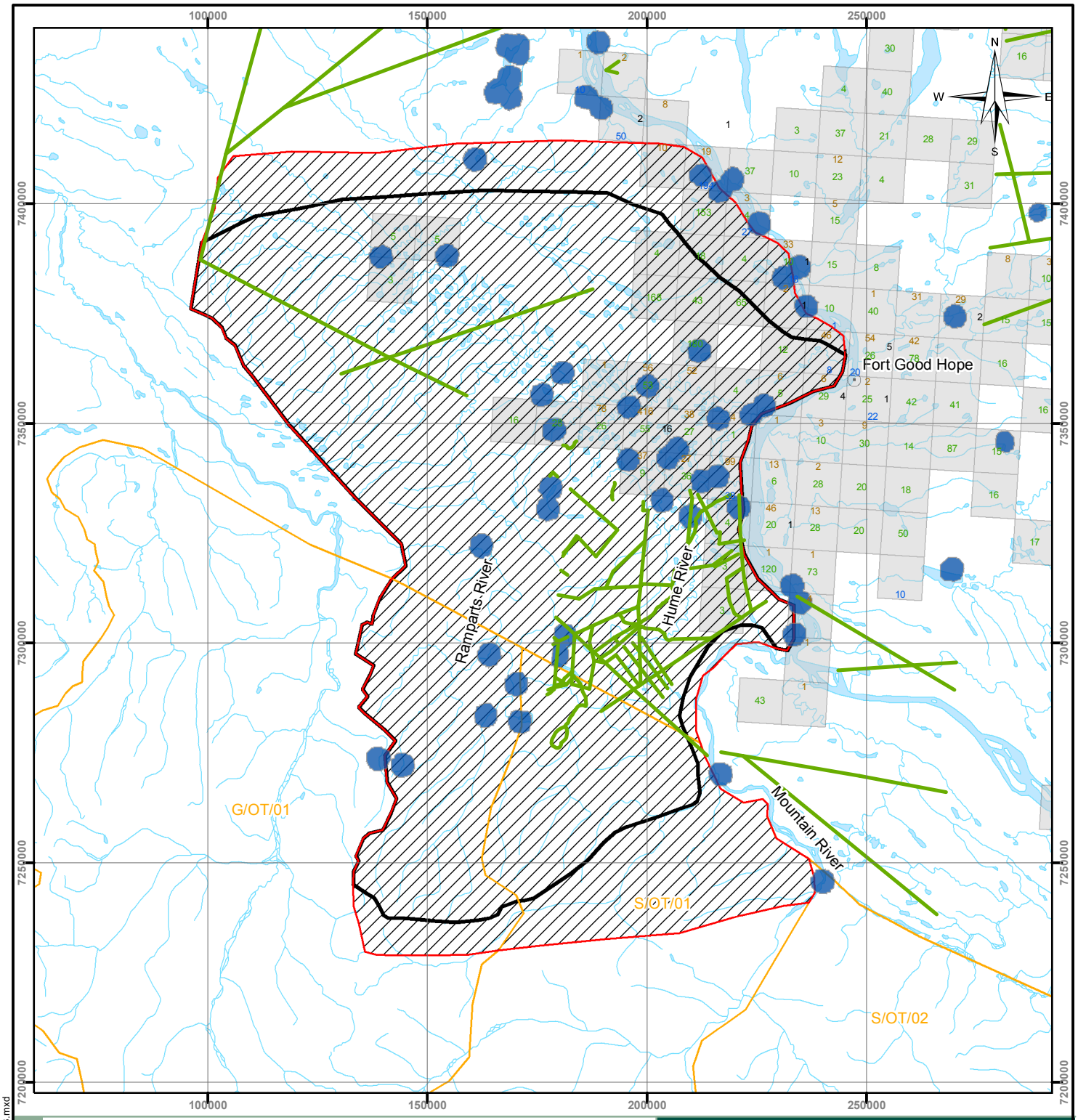
RAMPARTS RIVER AND WETLANDS RENEWABLE RESOURCES ASSESSMENT

Dall's Sheep Distribution and Known Harvest Sites Within the Study Area

PROJECTION: UTM Zone 10	DATUM: NAD83	
Scale: 1:1,250,000 (25 12.5 0 25 Kilometres)		EBA Engineering Consultants Ltd.
FILE No: 1740176_Map012.mxd		DATE: June 30, 2006
JOB NO: 1740176	REVISION NO: 3	
OFFICE: EBA-VANC	DRAWN: MZ	CHECK: XX

Figure 12

Q:\Vancouver\GIS\0701_YEL\1740176_Ramparts\Maps\1740176_Map012.mxd



LEGEND

- Community
- Watercourse
- Waterbody
- Study Area
- Ramparts River and Wetlands Candidate Protected Area
- Furbearer Distribution [2]
- Outfitter Zone
- Known Mink/Wolverine/Marten Harvest Sites
- Known Snowshoe Hare Harvest Sites
- Known Harvest Areas *
  - 1 Beaver
  - 2 Marten
  - 1 Snowshoe Hare
  - 2 Black Bear

NOTES

[1]No known grizzly bear, black bear, wolf, muskrat, and weasel traditional harvesting areas
[2]Furbearers include: grizzly bear, black bear, wolf, red fox, wolverine, marten, mink, beaver, muskrat, weasel, and snowshoe hare
Base data source: The Atlas of Canada
* Numbers in boxes indicate the number of animals harvested in the areas.

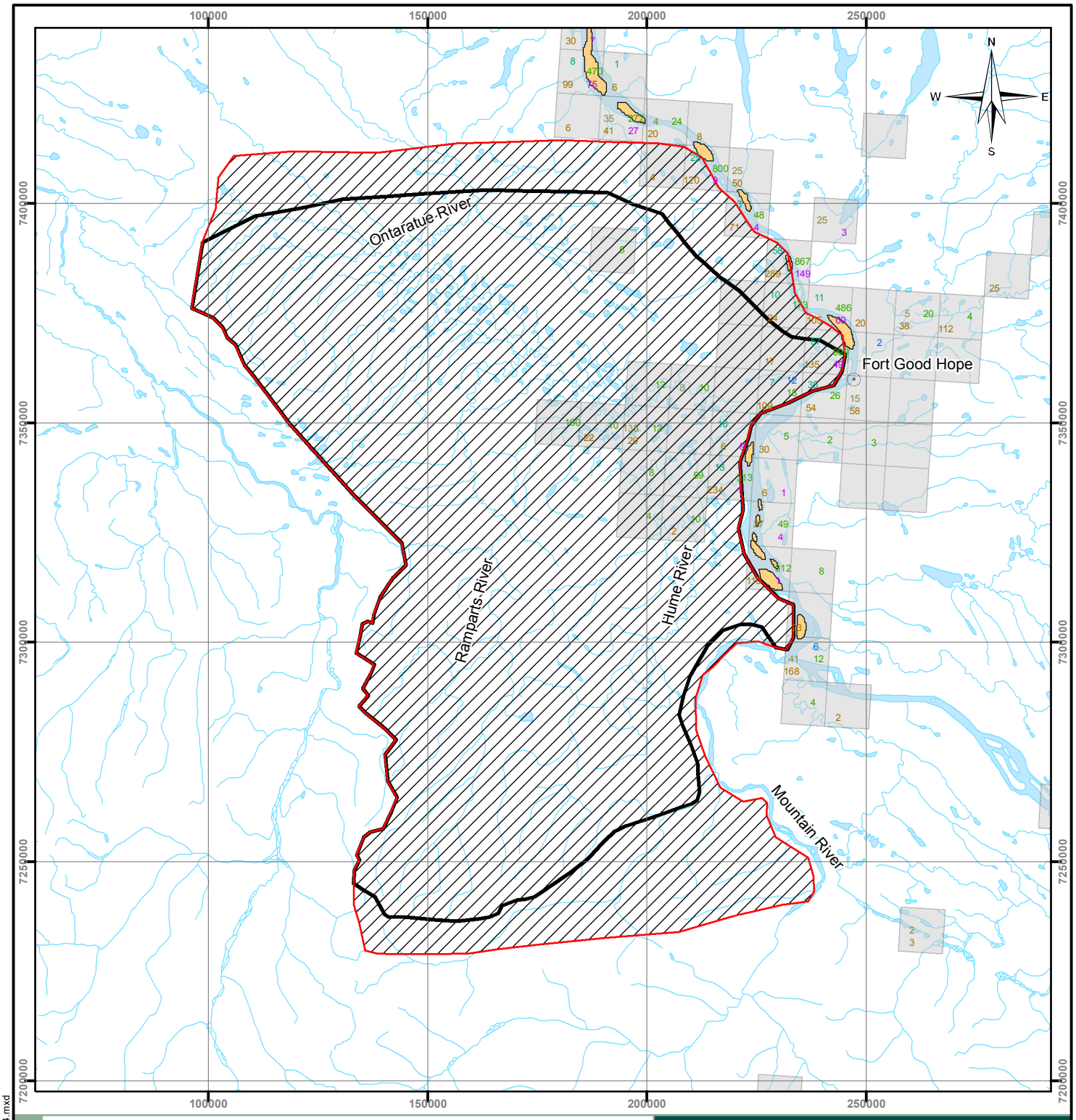
Reference: DIAND 1997 - 2001; Sahtu Renewable Resources Board 2002

RAMPARTS RIVER AND WETLANDS RENEWABLE RESOURCES ASSESSMENT

Furbearer Distribution and Known Harvest[1] Sites within the Study Area

PROJECTION: UTM Zone 10	DATUM: NAD83	
Scale: 1:1,250,000 (25 12.5 0 25 Kilometres)		EBA Engineering Consultants Ltd.
FILE No: 1740176_Map013.mxd		DATE: June 22, 2006
JOB NO: 1740176	REVISION NO: 2	
OFFICE: EBA-VANC	DRAWN: YL / CHECK: XX	Figure 13

Q:\Vancouver\GIS\0701_YEL\1740176_Ramparts\Maps\1740176_Map013.mxd



LEGEND

- Community
- Watercourse
- Waterbody
- Study Area
- Ramparts River and Wetlands Candidate Protected Area
- Waterfowl Distribution

Waterfowl Harvest Areas *

- 1 Canada Goose
- 2 Canvasback
- 1 Duck Species
- 2 Goose Species
- 1 Scoter (Black Duck) Species
- 2 Swan Species
- Other Known Waterfowl Harvest Sites

NOTES

Base data source: The Atlas of Canada

* Numbers in boxes indicate the number of waterfowl harvested in the area.

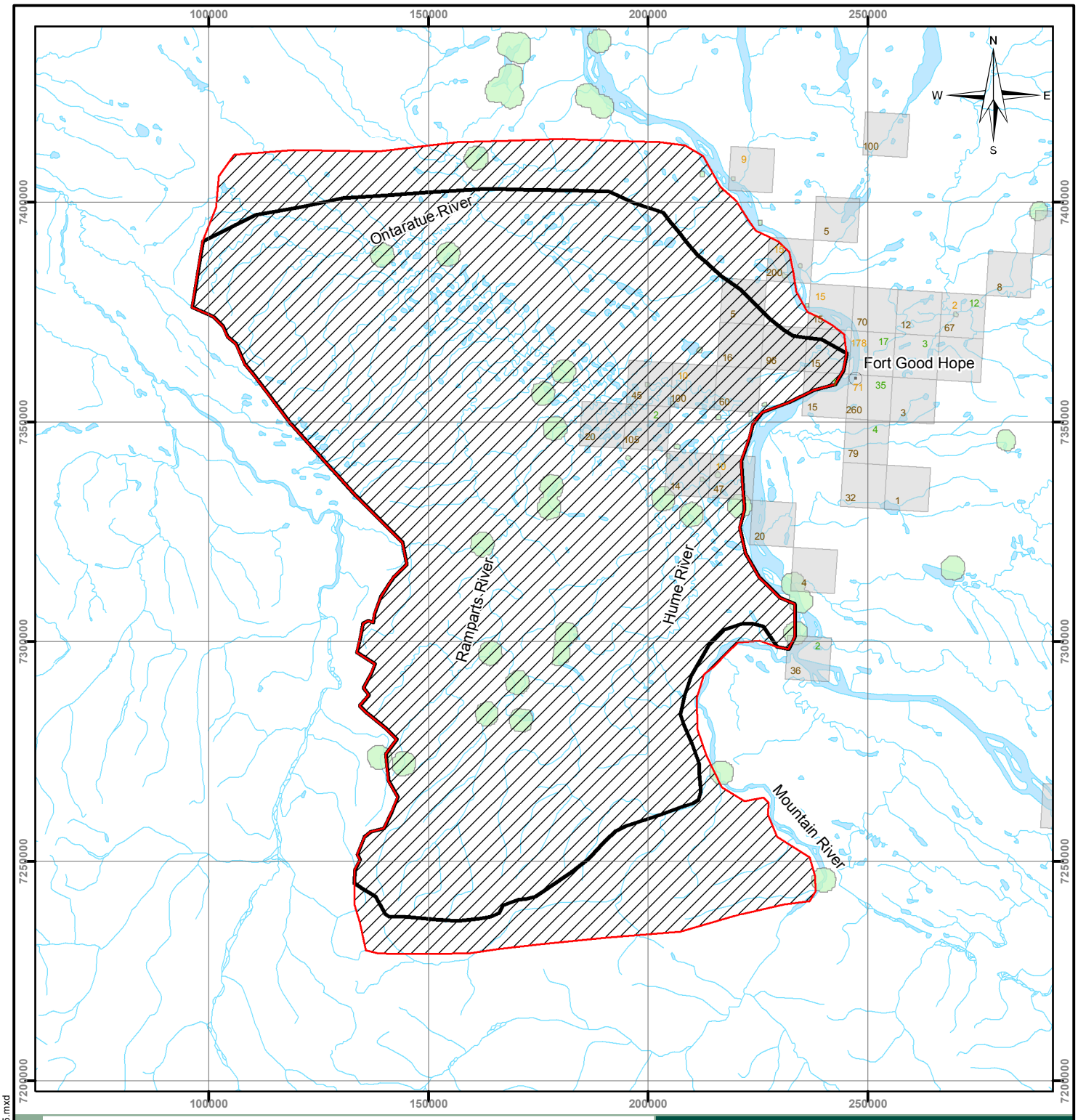
Reference: DIAND 1997 - 2001;
Sahtu Renewable Resources Board 2002

RAMPARTS RIVER AND WETLANDS RENEWABLE RESOURCES ASSESSMENT

Waterfowl Distribution and Known Harvest Sites within the Study Area

PROJECTION: UTM Zone 10	DATUM: NAD83	
Scale: 1:1,250,000 (25 12.5 0 25 Kilometres)		EBA Engineering Consultants Ltd.
FILE No: 1740176_Map014.mxd		DATE: June 22, 2006
JOB NO: 1740176	REVISION NO: 3	
OFFICE: EBA-VANC	DRAWN: MZ / CHECK: XX	Figure 14

Q:\Vancouver\GIS\0701_YEL\1740176_Ramparts\Maps\1740176_Map014.mxd



LEGEND

- Community
- Watercourse
- Waterbody
- Study Area
- Ramparts River and Wetlands Candidate Protected Area
- Grouse/Ptarmigan Distribution
- Other Known Grouse/Ptarmigan Harvest Sites

Grouse/Ptarmigan Harvest Sites *

- 1 Grouse (Chicken) Species
- 2 Spruce Grouse
- 1 Ptarmigan Species
- 2 Rock Ptarmigan

NOTES

Base data source: The Atlas of Canada

* Numbers in boxes indicate the number of grouse harvested in the area.

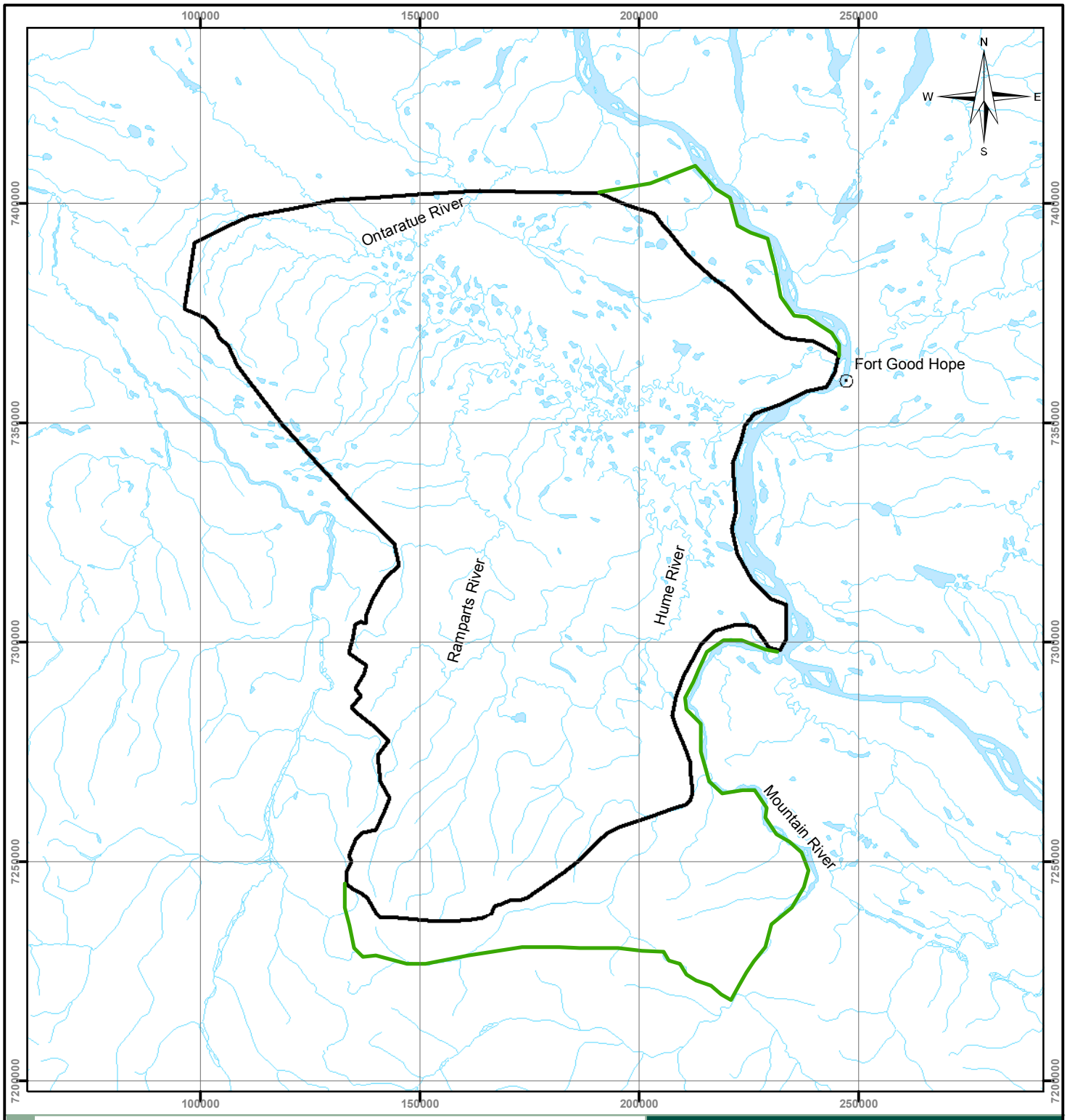
Reference: DIAND 1997 - 2001;
Sahtu Renewable Resources Board 2002

RAMPARTS RIVER AND WETLANDS RENEWABLE RESOURCES ASSESSMENT

Grouse and Ptarmigan Distribution and Known Harvest Sites within the Study Area

PROJECTION: UTM Zone 10	DATUM: NAD83	
Scale: 1:1,250,000 (25 12.5 0 25 Kilometres)		EBA Engineering Consultants Ltd.
FILE No: 1740176_Map015.mxd		DATE: June 22, 2006
JOB NO: 1740176	REVISION NO: 3	
OFFICE: EBA-VANC	DRAWN: MZ / CHECK: XX	Figure 15

Q:\Vancouver\GIS\0701_YEL\1740176_Ramparts\Maps\1740176_Map015.mxd



LEGEND

- Community
- Watercourse
- Waterbody
- Existing Ramparts River and Wetlands Candidate Protected Area (CPA)Boundary
- Recommended CPA Boundary Extensions

NOTES

Base data source: The Atlas of Canada

RAMPARTS RIVER AND WETLANDS RENEWABLE RESOURCES ASSESSMENT

Recommended Ramparts River and Wetlands CPA Boundary

PROJECTION: UTM Zone 10	DATUM: NAD83	
Scale: 1:1,250,000 25 12.5 0 25 Kilometres		EBA Engineering Consultants Ltd.
FILE No: 1740176_Map016.mxd		DATE: August 10, 2006
JOB NO: 1740176	REVISION NO: 1	
OFFICE: EBA-VANC	DRAWN: KW / CHECK: XX	Figure 16

Q:\Vancouver\GIS\0701_YEL\1740176_Ramparts\Maps\1740176_Map005.mxd