SOCIO-ECONOMIC ASSESSMENT OF TS'UDE NILINE TU'EYETA (RAMPARTS RIVER AND WETLANDS) CANDIDATE PROTECTED AREA

PHASE 2: SOCIO-ECONOMIC ASSESSMENT OF BOUNDARY OPTIONS

Prepared for
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EXECUTIVE SUMMARY

As part of the process for establishing a protected area in the Northwest Territories (NWT), an assessment of the potential socio-economic effects of designating a protected area is required. The NWT is currently assessing whether it should protect all or parts of the Ts'ude niline Tu'eyeta Candidate Protected Area, an area of about 15,000 square kilometres in the Sahtu Region, and has commissioned this study to assess the potential social and economic impacts on the adjacent community of Fort Good Hope. This study is presented in two volumes. Volume 1 provides an overview of current socio economic conditions in the study area and was undertaken by InterGroup Consultants Ltd. in 2009. This report, Volume 2, describes the potential social and economic effects of possible development options for Ts'ude niline Tu'eyeta, ranging from the status quo (no permanent protection for any of the area) to full protection of the entire area.

Current Use of Ts'ude niline Tu'eyeta

The Ts'ude niline Tu'eyeta area is seen as important natural area, featuring important waterfowl and wildlife habitat and populations of species at risk. For residents of Fort Good Hope the area is a sacred place and for generations has been used for traditional harvesting of fish and wildlife for food, as well as for commercial activities such as trapping.

In 2008 41.9% of adults in Fort Good Hope participated in hunting and fishing in 2008 and 76.9% obtained at least 50% of all meat and fish consumed in 2008 from hunting or fishing. Locations in Ts'ude niline Tu'eyeta provide about 600 kilograms of edible fish and 8,900 kilograms of meat per years, with a replacement value of $123,800. Residents of Fort Good Hope also collect medicinal plants from Ts'ude niline Tu'eyeta and use about 100 cords of wood per year to heat cabins and camps in the area. Residents of Fort Good Hope are estimated to enjoy about 700 days of recreational activity in throughout Ts'ude niline Tu'eyeta.

In 2008, there were 76 active trappers in Fort Good Hope and furs trapped from Ts'ude niline Tu'eyeta were valued at $26,600 per year. Ts'ude niline Tu'eyeta is situated in two guided hunting and outfitting zones that generate gross revenues of about $1.3 million per year and provide employment for 20 people. It is estimated that about 30 visitors participated in activities in or adjacent to Ts'ude niline Tu'eyeta. In 2008 59 adult residents of Fort Good Hope produced northern arts and crafts, valued at about $19,000 per year.

The area is also culturally important. Studies of the area have documented the location of 92 cabins and camps, 8 burial sites, 2 heritage sites, 5 and123 areas with Aboriginal place names. While the evidence demonstrates some of the cultural value of Ts'ude niline Tu'eyeta for the Dene and Métis of Fort Good Hope, there is no accepted method of estimating these cultural values in economic terms.

Ts'ude niline Tu'eyeta also generates benefits for local, territorial, Canadian and global residents through the provision of ecological goods and services. For example, the rivers, lakes and

wetlands in Ts'ude niline Tu'eyeta provide a source of clean water for people living downstream but these values are relatively small because of the small number of downstream beneficiaries. The wetlands are also breeding habitat for migratory birds such as scaup, which are harvested by hunters in southern Canadian and the United States, and the Pacific loon, which is of importance to bird watchers in the four coastal US states. The Ramparts River wetlands are estimated to generate about $21,300 per year in hunter benefits and be responsible for $354,600 per year in expenditures by bird watchers. Ts'ude niline Tu'eyeta also has been sequestering about 159,080 tonnes of carbon each year and, based on current market prices of carbon, this represents a benefit of about $2.7 million per year

Overall, it is estimated that Ts'ude niline Tu'eyeta currently generates economic benefits in the range of $3.8 million to $3.9 million per year. These benefits are presented below, but are considered conservative because they do not include the cultural value of the area.

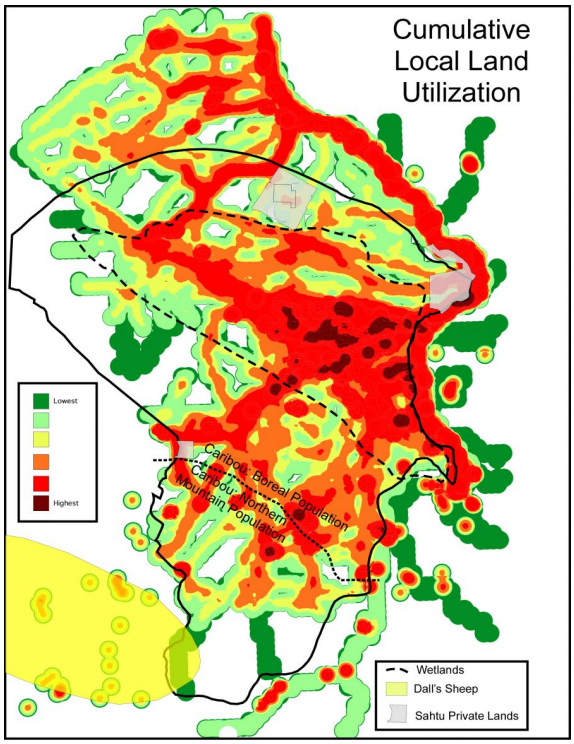
Summary of Economic Benefits Associated with Ts'ude niline Tu'eyeta

Type of Benefit		Low	High
Traditional Resource Use and Values	Consumption of fish	$8,200	
	Consumption of wildlife	$115,600	
	Native plants and berries	Unknown	
	Wood for fuel	$51,700	
	Recreation – expenditures	$24,800	$48,900
	Recreation – non-market benefits	$5,700	$11,300
Commercial Resource Use and Values	Trapping	$26,600	
	Outfitting and guided hunting	$500,000	
	Tourism	$39,300	
	Arts and crafts	$19,000	
	Commercial forestry	Unknown	
Ecological Goods and Services	Drinking water	Unknown but small	
	Climate regulation	$2,675,000	
	Value of migratory waterfowl – hunting	$21,300	
	Value of migratory waterfowl – bird watching	$354,600	
Cultural Values		Not Quantified	
TOTAL		**$3,841,800**	**$3,871,500**

Not all areas within Ts'ude niline Tu'eyeta are of equal importance or value. Many of the traditional, commercial, cultural and ecological values are tied to specific landscape features that have high values. Areas with high value include:

- areas used for traditional and commercial activities (cabins and camps, the locations of harvest areas, and the network of trail systems that connect these locations),
- areas that are of cultural importance to the community (locations with Aboriginal place names
- wetland areas that are of importance for waterfowl hunting and bird watching, and
- areas of importance to outfitting and guided hunting (Dall sheep and caribou habitat)

These four types of spatial features were mapped to produce a 'heat' map which portrays areas believed to be of greatest importance in dark red are on the map while areas believed to be of least importance were shown in dark green. Areas with no spatial information were shown in white. The resulting map (shown here) was submitted for consideration of the Working Group at its meeting in Fort Good Hope in April 2011



Potential Development Opportunities

Preliminary investigations suggest that there are oil, gas and mineral resources in the area. While it is not known if or when development of these resources will ever occur, non-renewable resource scenarios were developed by considering those factors most likely to determine whether development might occur. These resource development scenarios represent what might happen if Ts'ude niline Tu'eyeta were not to be designated as a National Wildlife Area.

Oil - Ts'ude niline Tu'eyeta is believed to have about 20.0 million barrels of undiscovered recoverable oil. Development is likely to proceed immediately because of the high price of oil and the existing Norman Wells pipeline provides an existing means of transporting oil to southern markets. However, based on what is currently known about the possible distribution of oil within Ts'ude niline Tu'eyeta, oil drilling and production is not likely to proceed unless exploration identifies recoverable reserves that are larger than estimated. The oil scenario assumed that, without protection, all of the area would be available for oil exploration, six exploratory wells would be drilled, and three of them would prove commercially viable for oil, with recoverable reserves of 1.0 million barrels each.

Natural Gas - Ts'ude niline Tu'eyeta is believed to have about213 billion cubic feet (Bcf) of undiscovered recoverable natural gas. While exploration for natural gas will occur at the same time as oil exploration, development of these resources will be delayed until the Mackenzie Valley pipeline has been constructed and there is some unused capacity in the pipeline. Based on what is currently known about the possible distribution of natural gas within Ts'ude niline Tu'eyeta, natural gas extraction will only be financially feasible if drilling identifies recoverable natural gas reserves that are significantly larger (triple) than the estimated average for the area. The natural gas scenario assumes that exploration would occur throughout the area, resulting in eight wells that would produce a total of 24 Bcf over 20 years.

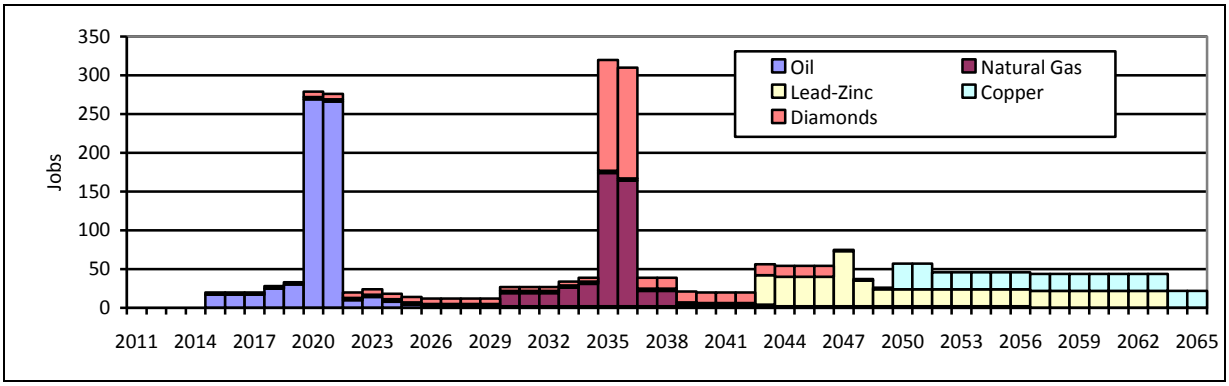
Lead-Zinc - Ts'ude niline Tu'eyeta is believed to have very high potential for Mississippi Valley Type zinc-lead deposits, based on a moderate amount of information. While exploration for lead-zinc would probably commence immediately is the area become open to development, mine construction is unlikely to occur unless exploration identifies resources that are significant to justify construction of a year-round access road (with an estimated cost of $525 million). The scenario assumes that $10.9 million would be spent on exploration over a 25 year period and that there is a 10% probability that a 1,000 ton per day mill costing $175 million to construct and $44 million per year per year to operate would be developed.

Copper - Ts'ude niline Tu'eyeta is believed to have moderate potential for sediment hosted copper and SEDEX zinc-lead deposits, based on some information. It is expected that exploration for copper would occur at the same time as for lead-zinc because the areas with potential are similar. Development of a copper mine is only likely if a road is built to support a lead-zinc mine, or the resources are sufficient to justify construction of an access road. The scenario assumes that there is a 10% probability that a 1,000 ton per day mill costing $175 million to construct and $44 million per year per year to operate would be developed.

Diamonds – There is believed to be low to moderate diamond potential along the northern edge and through the south-central portion Ts'ude niline Tu'eyeta, based on some information. Exploration for diamonds will be delayed (2020) because most exploration will continue in other parts of the NWT with better potential. Mine construction is unlikely unless resources are sufficient to justify the high costs of developing a mine. The scenario assumes that $5 million would be spend on exploration over 5 years and that there is a 20% probability that this would lead to a bulk sampling program costing $5 million and a 10% probability that this would result in construction a 1.0 million tonne per year mine costing $750 million.

Summary – If non-renewable resource development were to proceed in as described above, total spending would amount to $1,019 million over the period to 2065, increase the Gross Domestic Product (GDP) of the NWT by $570 million, and create 3,200 person years of employment. This employment would be spread over time as shown below.

Estimated Direct and Indirect Employment in the NWT from Potential Non-Renewable Resource Development



No Protection Development Option

If Ts'ude niline Tu'eyeta were open to development, it is expected that non-renewable resource development would occur as described above. Under this option, a total of $1,019 million would be invested and that this would generate 3,200 person- years of employment between 2015 and 2065, and that this would increase NWT GDP by $570 million. However, non-renewable resource development will create land use disturbances, especially related to seismic exploration, and these can result in habitat loss and cause habitat fragmentation that, in turn, will adversely affect animal and migratory bird populations as well as the human use of these resources. Given the extent of seismic activity that could occur, it is believed that Woodland caribou would no longer use Ts'ude niline Tu'eyeta because there would no longer be sufficient secure habitat in large patches that are necessary to support caribou herds. As a result it believe that residents of Fort Good Hope would no longer be able to hunt Woodland caribou in Ts'ude niline Tu'eyeta and that their harvests of other animals and fish would decrease by about 5%. Other effects would include major reductions in business for guide-outfitters in the area, as well as 5% reductions in migratory bird populations. The future economic benefits from both non-renewable resource development and use of renewable resources for this option are shown below and have been calculated in terms of the net present value (NPV) of future benefits in current dollars.

Present Value of Economic Benefits Associated with Ts'ude niline Tu'eyeta Without Protection

	Undiscounted	3.0% Discount Rate	7.0% Discount Rate
NPV of Benefits for Canada (millions)[1]			
Renewable Resources	$20.3	$13.5	$9.3
Non-Renewable Resources	$215.1	$96.1	$39.2
TOTAL	$235.4	$109.6	$48.5
NPV of Benefits for Fort Good Hope (millions)			
Renewable Resources	$13.4	$7.5	$4.3
Non-Renewable Resources	$9.8	$5.3	$2.7
TOTAL	$23.1	$12.8	$7.0
NPV of Global Benefits (millions)			
Renewable Resources	$135.5	$76.2	$44.0
NPV of Total Benefits (millions)			
Renewable Resources	$155.8	$89.6	$53.3
Non-Renewable Resources	$215.1	$96.1	$39.2
TOTAL	$370.9	$185.7	$92.5

Full Protection Option

If all of Ts'ude niline Tu'eyeta were to be protected as a National Wildlife Area, there would be no renewable resource development and residents of Fort Good Hope could continue to use the area as they currently do. Full protection would create a number of other benefits. First, there is evidence that Canadians are willing to pay to create protected areas; studies have shown that Canadians would be willing to pay about $5.50 per household to protect landscapes for future

[1] Includes benefits for residents of Fort Good Hope.

generations. This would amount to a NPV of $69.0 million. Second, Canadians are also willing to pay to protect Woodland caribou herds. Information from various studies suggest willingness to pay of between $4.4 million and $21.3 million to protect the one Woodland caribou herd in Ts'ude niline Tu'eyeta. The total value of economic benefits associated with the full protection option for Ts'ude niline Tu'eyeta are summarized below:

Present Value of Economic Benefits Associated with Ts'ude niline Tu'eyeta With Full Protection

	Undiscounted	3.0% Discount Rate	7.0% Discount Rate
NPV of Benefits for Canada (millions)			
Renewable Resources	$118.1	$102.1	$93.5
Non-Renewable Resources	$0	$0	$0
TOTAL	$118.1	$102.1	$93.5
NPV of Benefits for Fort Good Hope (millions)			
Renewable Resources	$13.8	$7.7	$4.5
Non-Renewable Resources	$0	$0	$0
TOTAL	$13.8	$7.7	$4.5
NPV of Global Benefits (millions)			
Renewable Resources	$137.3	$77.0	$44.4
NPV of Total Benefits (millions)			
Renewable Resources	$255.3	$179.2	$137.9
Non-Renewable Resources	$0	$0	$0
TOTAL	$255.3	$179.2	$137.9

Compromise Boundary Option

The Ts'ude niline Tu'eyeta Working Group identified another boundary option for Ts'ude niline Tu'eyeta. The proposed protected area would be about 10,100 km^2 in size and would include most of the wetland areas as well as 76% of the Ramparts River drainage but would exclude the eastern slopes of the Mackenzie Mountains. The areas left outside the protected area have relatively low oil and gas potential and it is unlikely that any oil or gas development will occur in those areas. These areas with lead-zinc and copper development would be excluded from the protected area so development could occur as assumed, with a 10% probability that a lead zinc or copper mine would be developed. About one-third of the area with diamond potential will be situated outside the proposed National Wildlife Area, so expenditures on diamond exploration would be reduced by two-thirds. Under this option, a total of $350 million would be invested and that this would generate 1,360 person- years of employment between 2015 and 2065, and that this would increase NWT GDP by $151 million.

Based on the expected activities for lead-zinc, copper and diamond development, it is assumed that there would be a 1% reduction in wildlife populations, and this will translate into 1% decline in the amount and value of country food being harvested from Ts'ude niline Tu'eyeta. Similar 1% decreases are assumed for revenues from trapping and extra-market benefits. The land use disturbances associated with mining are expected to reduce gross revenues by half for one guide outfitter. However, establishment of a National Wildlife Area would result in the same existence

values for Woodland caribou and for a protected area that would occur under the full protection option.

Present Value of Economic Benefits Associated with Ts'ude niline Tu'eyeta: Compromise Option

	Undiscounted	3.0% Discount Rate	7.0% Discount Rate
NPV of Benefits for Canada (millions)			
Renewable Resources	$124.2	$103.3	$93.6
Non-Renewable Resources	$50.1	16.7	$4.2
TOTAL	$174.3	$120.0	$97.8
NPV of Benefits for Fort Good Hope (millions)			
Renewable Resources	$16.8	$8.4	$4.6
Non-Renewable Resources	$1.2	$0.4	$0.1
TOTAL	$18.0	$8.8	$4.7
NPV of Global Benefits (millions)			
Renewable Resources	$167.8	$84.1	$45.5
NPV of Total Benefits (millions)			
Renewable Resources	$292.0	$187.4	$139.1
Non-Renewable Resources	$50.1	$16.7	$4.2
TOTAL	$342.1	$204.1	$143.3

Implications of Possible Boundary Options

Each of the three protection options would protect a different mix of biophysical and cultural features of the landscape and allow current traditional and commercial activities to continue, while enabling different types of non-renewable resource development to occur. The table on the following page describes the three boundary options in terms of the area or number of features related to the various economic benefits that would be situated in a protected area.

The total economic value of Ts'ude niline Tu'eyeta under the three boundary options would be as follows:

Net Present Value of Future Benefits for the Boundary Options

Location	Discount Rate	No Protection Option (millions)	Compromise Option (millions)	Full Protection Option (millions)
Global (including outside Canada)	Undiscounted	$403.9	$342.1	$293.9
	3.0%	$193.4	$204.1	$188.2
	7.0%	$93.7	$143.3	$139.3
Canada	Undiscounted	$238.3	$174.3	$126.1
	3.0%	$110.2	$120.0	$104.0
	7.0%	$48.6	$97.8	$93.8
Fort Good Hope	Undiscounted	$26.1	$18.0	$16.8
	3.0%	$13.5	$8.8	$8.4
	7.0%	$7.2	$4.7	$4.6

Summary of Potential Protection and Development Afforded by Possible Boundary Options for the Ts'ude niline Tu'eyeta Area

				Full Protection	Compromise Option	No Protection	Full Protection	Compromise Option	No Protection
Type of Benefit		**Data**	**Units**	**Spatial Assessment**			**Percent of Total**		
Traditional Resource Use and Values	Consumption of fish	Known Fish harvesting sites	Catch (1998-2003)	1,787	1,605	0	100%	90%	0%
	Consumption of wildlife	Known Woodland caribou harvest areas	Kills (1998-2003)	10	7	0	100%	70%	0%
		Known moose harvest areas	Kills (1998-2003)	143	129	0	100%	90%	0%
	Native plants and berries	Potential Plant harvest areas	km^2	0.25	0.25	0	100%	100%	0%
	Wood for fuel	Potential Plant harvest areas	km^2	0	0	0	100%	100%	100%
Commercial Resource Use and Values	Trapping	Traplines	% of trails	100%	93%	0%	100%	93%	0%
	Outfitting and guided hunting	Known Dall Sheet harvest areas	km^2	174	0.25	0	100%	0%	0%
		Guiding areas	km^2	3,317	2,037	0	100%	61%	0%
	Commercial forestry	Potential Plant harvest areas	km^2	70	40	0	100%	57%	0%
Ecological Goods and Services	Drinking water	Ontaratue River	km^2	4,105	1,769	0	100%	43%	0%
		Ramparts River	km^2	10,753	8,226	0	100%	76%	0%
	Existence value – Woodland Caribou	Distribution of northern mountain caribou	km^2	3,199	1,917	0	100%	60%	0%
		Distribution of boreal caribou (north)	km^2	11,659	8,120	0	100%	70%	0%
	Climate regulation	Net Biome Productivity	Tonnes of carbon/ year	159,080	107,563	0	100%	68%	0%
	Migratory waterfowl	Wetlands	km^2	4,656	4,533	0	100%	97%	0%
Cultural Values		Cabins and Camps	Sites	92	86	0	100%	93%	0%
		Heritage Sites	Sites	2	1	0	100%	50%	0%
		Burial sites	Sites	8	8	0	100%	100%	0%
		Aboriginal place names	Sites	123	121	0	100%	98%	0%
		Archaeological sites	Sites	5	2	0	100%	40%	0%
Hydrocarbon Resources	Natural Gas	Undiscovered Recoverable	Billion cubic feet	0	54	213	0%	25%	100%
	Oil	Undiscovered Recoverable	Million barrels	0	3.9	20.0	0%	20%	100%
Mineral Resources	MVT Lead -Zinc	Potential	km^2	0	1,166	1,166	0%	100%	100%
	Copper	Potential	km^2	0	1,227	1,227	0%	100%	100%
	Diamond	Potential	km^2	0	2,553	7,043	0%	36%	100%
Sahtu Private Lands			km^2	0	0	442	0%	100%	100%
TOTAL AREA			km^2	**14,859**	**10,047**	**0**	**100%**	**68%**	**0%**

From a both a global perspective and a Canadian perspective, the compromise option and the full protection option would both generate the higher benefits than the no protection option if future values are discounted at a rate of 7.0%. If the lower discount rate (3.0%) is used, the compromise option would still generate the highest benefits, but the benefits from the no protection option would exceed the benefits from the full protection option.

For residents of Fort Good Hope, benefits from the no protection option always exceed the benefits from the full protection or the compromise options because the incremental income benefits from employment in non-renewable resource development more than offset the predicted declines in benefits from renewable resources. However, this economic assessment does not take into consideration the cultural values, social values and attachment to the land that would be at risk under the no protection option. And, while the no protection option has the greatest potential to create new employment and income in Fort Good Hope, it also has the highest potential for positive and negative socio-economic effects. On the other hand, the danger in precluding all non-renewable resource development in Ts'ude niline Tu'eyeta is that this may limit regional economic development opportunities for local residents. Without the creation of additional employment and income for Fort Good Hope, many of the existing social and economic problems in the region, such as low educational attainment and large percentages of households in core need, will continue and may worsen over time.

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1.0 INTRODUCTION

In 1999 the Government of Canada and the Government of the Northwest Territories (NWT) recognized the need to protect areas in the NWT that have unique environmental, geological, cultural or historic features and signed an agreement to establish a Protected Areas Strategy (PAS) for the NWT. The PAS had the goal of establishing a system of designated areas that would protect areas with special natural and cultural features as well as areas that are representative of the 42 ecoregions in the NWT.

One of the areas currently under consideration as part of the PAS program is the Ts'ude niline Tu'eyeta Candidate Protected Area. It consists of an area of about 15,000 square kilometres located in the Sahtu region of the NWT. It is located west of the Mackenzie River across the river from the community of Fort Good Hope. The area is a sacred place for the Dene people of Fort Good Hope, with many archaeological, burial and historic sites. The area has also been used for trapping, hunting, fishing, and camping for generations. The Ramparts River watershed is a critical wetland that filters millions of gallons of water per day. As a key migratory bird terrestrial habitat site, the wetlands provide excellent nesting, brood rearing and staging habitat for ducks, geese and loons. Six species at risk – peregrine falcon, grizzly bear, mountain caribou, wolverine, short-eared owl, and boreal Woodland caribou – are also found within the Candidate Protected Area (PAS, 2009).

Residents of Fort Good Hope have asked that the lands in Ts'ude niline Tu'eyeta be permanently protected to help preserve their cultural heritage and the ecosystems that support them. In November 2007, the Cabinet of Canada issued an Order in Council that prevented any land dispositions being issued for a four-year period in Ts'ude niline Tu'eyeta. Much of the area of interest has been designated as a "Proposed Conservation Initiative" in the Sahtu Land Use Plan – Draft 3 (Sahtu Land Use Planning Board, 2010).

1.1 The Protected Areas Strategy Process

Decisions regarding the protection of land in the NWT are made in the context of its Protected Areas Strategy (PAS). The PAS is a community-driven partnership consisting of communities, Aboriginal governments and/or land claim bodies, federal and territorial governments, and industry stakeholders. Its purpose is to "collaborate to identify and protect the ecological quality and integrity of special areas of land and water" (NWT PAS, 2007). The PAS uses an eight step process to identify, designate and manage protected areas:

1. Identify areas in need of protection, and get community support for protecting the area.
2. Gather information about the area. Use this information to prepare a proposal to protect the area. Get support for this proposal at the regional level.
3. Submit a proposal to a potential sponsoring agency for their review and approval.
4. The sponsoring agency applies for interim (short-term) protection for the area, if needed.

5. Document the candidate area's ecological, cultural and economic values. This information is used to make recommendations on the area's designation, boundaries and management.
6. Formally ask the sponsoring agency to protect the area using their legislation.
7. Approve and establish the protected area.
8. Manage, monitor and review

As part of the PAS process for Ts'ude niline Tu'eyeta, a Working Group was established in 2007. This group consists of representatives from: Fort Good Hope, the Sahtu Renewable Resource Council, the Yamoga Land Corporation, the K'asho Got'ine Dene Band, the Fort Good Hope Métis Local # 54, the Canadian Wildlife Service, the Department of Aboriginal Affairs and Northern Development (AANDC), the Government of the Northwest Territories, an environmental organization (Ducks Unlimited Canada) and other directly affected stakeholders (such as the Association of Mackenzie Mountains Outfitters).

As part of Step 5 of the PAS process, the Working Group issued the terms of reference for Phase 2 of a socio-economic assessment of the Ts'ude niline Tu'eyeta Candidate Protected Area in 2007. This report was prepared in response to the terms of reference.

1.2 Study Objectives

The terms of reference for Phase 2 of the socio-economic assessment call for predicting the potential social, economic and cultural implications on the community of Fort Good Hope, the Sahtu Region, the Northwest Territories and Canada of various boundary options that would provide different levels of protection for the Ts'ude niline Tu'eyeta candidate protected area. These boundary options include:

1. Designation of the area as a National Wildlife Area with the currently proposed boundaries intact
2. Other boundary options developed by the Working Group that reflect the results of various reports prepared for the Pas that describe the cultural, ecological, hydrocarbon and mineral assessments of the candidate area.
3. No formal protection of the area.

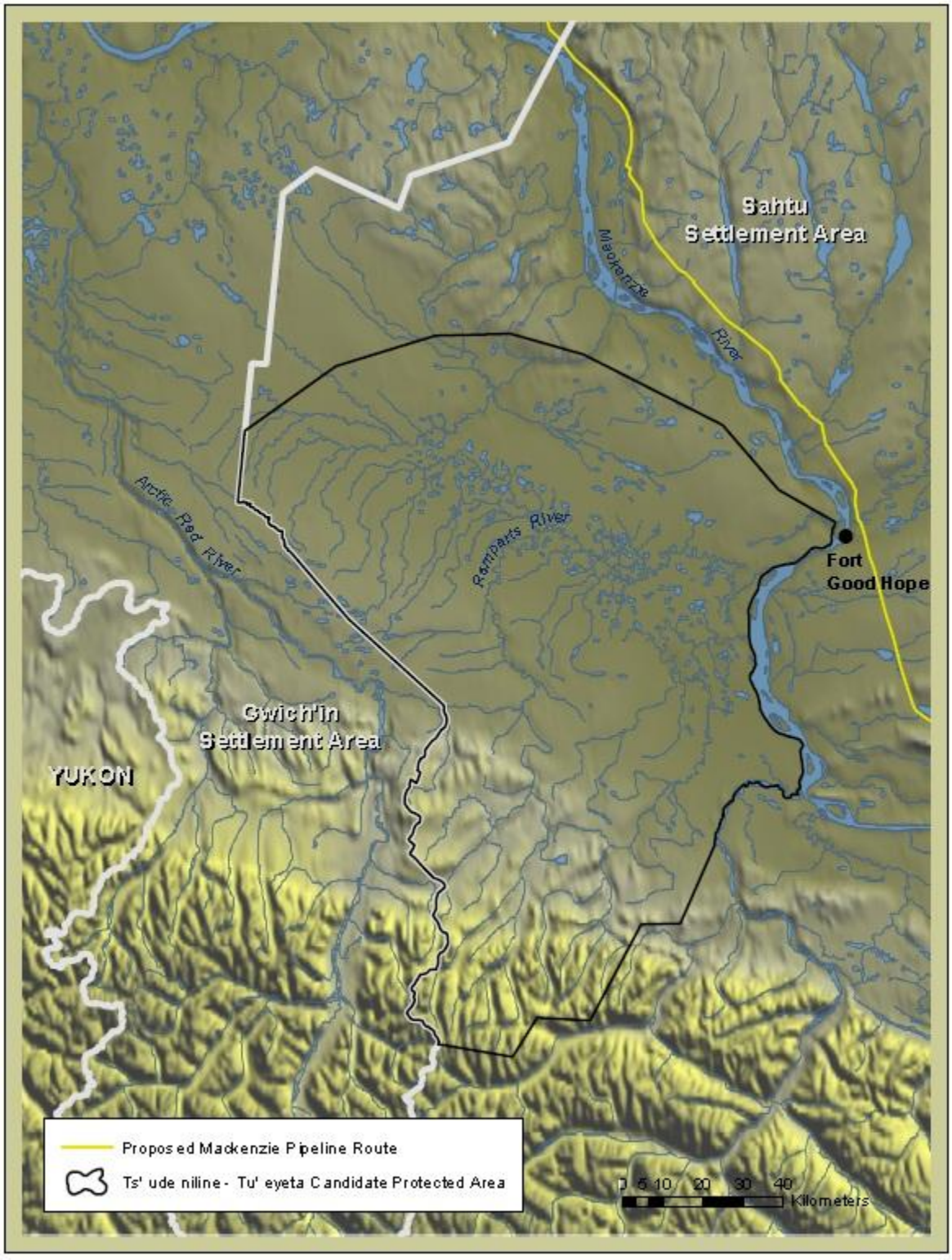
Each boundary option is to be assessed in terms of potential social and economic impacts, and the results are to be provided in a technical report as well as in a plain language report than can be used to present information to stakeholders, communities and First Nations.

1.3 Study Area

A map of the Ts'ude niline Tu'eyeta Candidate Protected Area is provided in Figure 1-1. The area is of ecological significance for a number of reasons:

1. It supports six species at risk, including: peregrine falcon, grizzly bear, mountain caribou, wolverine, short-eared owl, and boreal Woodland caribou

Figure 1-1: Proposed Ts'ude niline Tu'eyeta Candidate Protected Area



Source: NWT PAS (2009).

2. The Ramparts watershed is a critical wetland area that provides excellent nesting, brood rearing and staging habitat for many species of waterfowl.

The area is also being used for traditional socio-economic pursuits but has oil, gas, mineral and forestry development potential that could contribute to the regional economy

1.4 Methodology

The general methodology used for this assessment is similar to that of a socio-economic assessment prepared as part of an environmental assessment of a proposed development project. Impact assessments consist of three tasks:

1. Assess current social and economic conditions in the communities that may be affected by the development using a series of selected indicators (baseline).
2. Use the project description to estimate potential demands on the communities in terms of employment, incomes, population, housing, infrastructure and services, and general well-being.
3. Compare these potential demands with baseline conditions to determine the significance of proposed changes and identify strategies for enhancing benefits and minimizing negative effects.

In terms of current economic and social conditions in Fort Good Hope, this study builds on Phase 1 of the socio-economic assessment which was undertaken by InterGroup Consulting Ltd. (2009).

The Phase 2 study will outline the potential for non-renewable resource development that could occur under the various boundary options and describe the socio-economic effects that could result from that development. However, in the absence of specific resource development proposals for Ts'ude niline Tu'eyeta, this assessment will use generic resource development scenarios patterned after similar existing or proposed projects for which some information does exist to predict the social and economic effects of development. There is some danger using this approach because the nature of development that ultimately may occur in the area could be quite different from what is stated in this assessment and the scenarios may raise economic development expectations that may or may not be realized.

1.4.1 Overall Approach

The overall objective of this study was to assess the socio-economic effects for Fort Good Hope, the Sahtu Region, the entire NWT and Canada that could result from the different boundary options in accordance with the NWT PAS Socio-Economic Assessment Guidelines (the Guidelines)

As per Phase 1 of the Guidelines, the first step involved describing current use of the Ts'ude niline Tu'eyeta Candidate Protected Area. This was done as part of the Phase 1 socio-economic assessment, but this information was expanded using other published information. One of the challenges in assessing the implications of various boundary options is the current lack of information about the location and extent of current use of the area by residents of Fort Good Hope and the surrounding region. To assist in describing spatial patterns of use, available information on land types and land uses in the candidate area was processed using GIS to develop "heat" maps that show the relative intensity of current activities in different parts of the area. The results of this analysis are provided in Section 2.0 of this report.

Phase 2 of the Guidelines call for the identification of potential protection options by the Working Group. These include the no protection option (status quo), the full protection option, and a compromise boundary option.

Phase 3 of the Guidelines involve assessing the potential socio-economic impacts of the various boundary options. This phase involved the following four tasks.

1. The first step involved describing the location and extent of potential non-renewable resource development that might be expected to occur in the near future. While this assessment built on the results of previously completed studies on hydrocarbon and mineral potential in the region, it necessitated making some assumptions about the scale and location of potential development and the timing, scale, cost, and revenues associated with this development. Draft versions of these assumptions were reviewed by the Canadian Wildlife Service, the Government of the NWT and AANDC. The evaluation of non-renewable resource potential in Ts'ude niline Tu'eyeta is provided in Section 3.0.

2. The second step consisted of developing a baseline socio-economic projection for Ts'ude niline Tu'eyeta that assumes no formal protection occurs. This baseline assumes that all of the potential non-renewable resource development identified in Section 3.0 will proceed as described, and examines how social and economic conditions in the community and region will change over time. The baseline projection describes how community and regional employment and income will be expected to change as the area is developed, examines potential revenue and royalty effects for the GNWT, and predicts how community and regional use of Ts'ude niline Tu'eyeta will change. This baseline assessment is presented in Section 4.0.

3. This step examines the social and economic effects of formal designation of Ts'ude niline Tu'eyeta as a National Wildlife Area with the proposed boundary intact and precluding non-renewable resource development opportunities. Social and economic conditions in the community and region will be predicted using key indicators like employment and income and reliance on country foods and resources. The effects of the full protection option are assessed in Section 5.0.

4. The fourth step is to examine the potential effects of the modified boundary option proposed by the Working Group. The economic and social implications of allowing non-renewable resource development to proceed in various parts of Ts'ude niline Tu'eyeta are evaluated, as well the potential implications for wildlife and habitat protection and the ability of the area to supply the community and region with country foods and income. This assessment is provided in Section 6.0.

A summary of the social and economic implications of all possible boundary options, including full protection and no protection, is provided in Section 7.0.

1.4.2 Assessment Methods

The evaluation of boundary options employed a number of different evaluation methods. These are described below.

1.4.2.1 Assessment of Socio-Economic Impacts

The potential economic effects of the various boundary options on employment and economic activity in the NWT were calculated using current information on economic multipliers (Northwest Territories Bureau of Statistics, 2011a). These multipliers represent intensity ratios that estimate the extent to which a change in consumption or output translates into employment and economic activity in the NWT. The multipliers capture direct and indirect economic effects:

Direct effects refer to the increase in economic production in the NWT that occurs in order to meet the demands of the new economic activity.

Indirect effects describe the ripple effects that results when companies that provide goods and services to the new economic activity purchase additional goods and services to meet these demands.

As the NWT economy is highly dependent on imported goods and services, the economic multipliers (also known as intensity ratios) are usually less than one. The analysis uses the following intensity ratios:

Industry	GDP at Basic Prices per Dollar of Output	Labour Income per Dollar of Output	Jobs per $million of Output
Mining and oil and gas extraction	0.75	0.17	1.5
Oil and gas extraction	0.91	0.07	0.7
Diamond mining	0.71	0.14	1.2
Support activities for mining and oil and gas extraction	0.79	0.59	5.2
Pipeline Transportation	0.76	0.12	1.3
Construction	0.46	0.33	3.8
Retail Trade	0.72	0.59	12.0
Arts, entertainment and recreation	0.54	0.39	13.3
Accommodation and food services	0.60	0.46	10.5

The intensity ratios show that some activities, such as retail trade and the entertainment and recreation industries, are very labour intensive (high ratios) while others, such as oil and gas extraction, have very low labour requirements (low ratio). The employment effects are actually measured in terms of person-years (PYs) which can mean 1 person working for 12 months or 12 people working for one month or any other possible combination. It should be noted that the current version of the NWT multipliers does not include information on the economic effects of metal ore mines (not diamonds); for these activities the potential economic effects have been estimated using multipliers from the 2006 version of intensity ratios for the NWT.

A third effect may also occur:

> Induced effects occur when households that directly or indirectly benefit from the increased activity spend part of their income on consumer goods and this triggers additional economic activity.

There are concerns that economic models that calculated induced effects (closed models) overstate potential economic effects, so induced effects are not included in the analysis. However, based on information from Alberta and British Columbia, these induced effects could be nearly as large as the indirect effects, and could increase the overall impacts by 20% to 30%.

Estimation of socio-economic effects at a regional level is more difficult and requires interpreting what percentage of territorial effects would occur within the region and Fort Good Hope. This requires comparing the labour requirements of the various development opportunities with the available skill and occupation capabilities of regional residents, and then predicting how many local workers might be engaged in new development. These estimates were developed based on previous experience with impact assessments of mineral and oil and gas development in Alberta and British Columbia and are considered conservative. Most resource development companies will work with local communities to provide training and employment opportunities on major development projects and such programs would serve to increase regional and local employment and income.

1.4.2.2 Assessment of Economic Benefits and Costs

One of the final steps in moving forward with designating Ts'ude niline Tu'eyeta as a National Wildlife Area will involve Environment Canada making a final recommendation to Cabinet Committee. As part of the decision-making process, the Treasury Board Secretariat requires an evaluation of the costs and benefits. Consequently this study also assessed the potential economic benefits and costs associated with the various boundary options using the techniques associated with social benefit/cost analysis. This involved:

1. Describing each of the three boundary options in terms of the magnitude and timing of regional and local employment and income created by current and traditional land and resource uses as well as for non-renewable resource developments that could occur.

2. Estimating annual benefits and costs from current and traditional land and resource uses and from non-renewable resource development for each boundary option, factoring in the probability (or uncertainty) that such development is likely to occur.
3. Calculating the present value of future benefits and costs for each boundary option using discount rates. Discount rates are used to estimate what the value of future benefits or costs would be in terms of current dollars, on the realization that a dollar today is worth more than a dollar at some point in the future. The current Canadian Cost-Benefit Analysis Guide suggests using an 8% discount rate based on the real rate of return to capital, which would mean that $1.00 to be received one year from now would be valued at $0.92 today. However, recent discussions between the Treasury Board Secretariat and Parks Canada indicate that a discount rate of 7.0% should now be used, with a sensitivity analysis using discount rates of 3.0% and 0.0%.
4. Examining how potential the benefits and costs associated with traditional land and resource uses and from non-renewable resource development will be distributed among various stakeholders, including businesses, consumers and households, and territorial and federal governments.

1.4.2.3 Accuracy of the Estimates

It should be noted that preparing estimates of economic impacts, benefits and costs for the three boundary options requires numerous assumptions about future use of Ts'ude niline Tu'eyeta in terms of both traditional land and resource use and non-renewable resource development. The analysis will list the various assumptions used to make future projections but it is important to understand that the assumptions used in this assessment represent best guesses based on the limited available knowledge about what mineral and oil and gas resources may exist in Ts'ude niline Tu'eyeta and how current and future residents of Fort Good Hope will make use of the renewable resources of the area in the future.

However, as time passes, it is expected that the assumptions about renewable and non-renewable resource development in the Ts'ude niline Tu'eyeta could ultimately prove to be quite different from what actually occurs. The problem is that the only way to gain better information about non-renewable resource potential would be to open up the area for exploration activities that may ultimately delineate economically-viable reserves or conclude that no viable mineral or petroleum resources actually exist but such activities could compromise the important renewable resource and cultural values that residents of Fort Good Hope would like to maintain. The intent of this report is to provide sufficient information about the renewable and non-renewable resource potential in Ts'ude niline Tu'eyeta so that decision-makers can assess how much of the area and which parts of the area need to be preserved in order to provide a reasonable balance between protection and development.

2.0 CURRENT USE OF TS'UDE NILINE TU'EYETA

The Ts'ude niline Tu'eyeta area is the largest of the five proposed conservation initiatives identified in the draft Sahtu Land Use Plan. It is described as being:

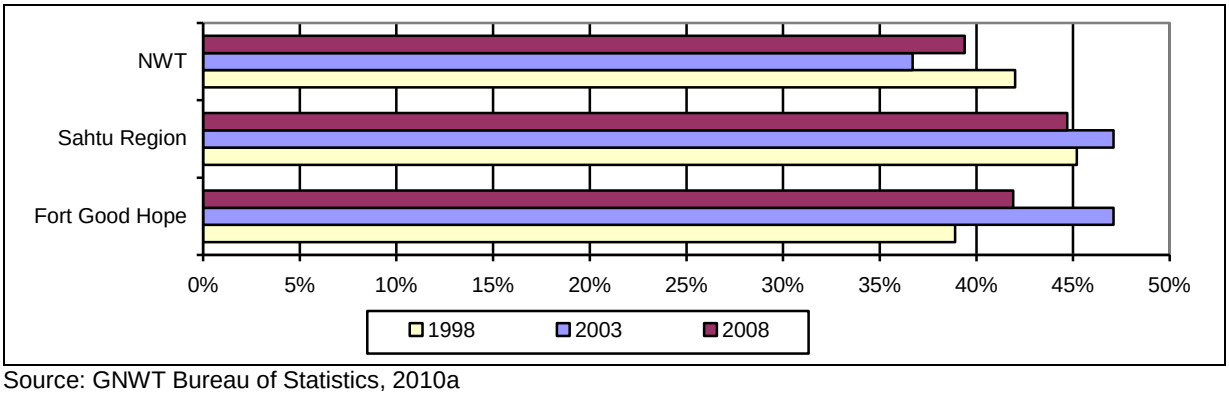
> "…a special natural and cultural place with a lot of ducks and geese, beavers, muskrats and rabbits, caribou, berries, medicine plants and fish lakes. The area has a long history of providing everything the Dene and Métis of the Fort Good Hope area need to make a living. Evidence of Dene and Métis use of this area is everywhere. Many people were born and have passed away here; cabins and camps are scattered across the landscape filled with stories and adventures of their travels. The Dene and Métis hunt, fish, trap and camp here, continuing in the traditional lifestyle practiced by their parents and grandparents." (PACTeam Canada Inc. 2009)

A number of recent studies have attempted to describe the current use of the Ts'ude niline Tu'eyeta area. These include the Phase 1 Socio-Economic Assessment of the Ts'ude niline Tu'eyeta (Ramparts River and Wetlands) Candidate Protected Area (InterGroup Consultants, 2009) and the Renewable Resource Assessment Ramparts River and Wetland Candidate Protected Area (EBA Engineering Consultants, 2006). The following section summarize what is currently known about use of Ts'ude niline Tu'eyeta area by residents of Fort Good Hope and the estimated value of this use.

2.1 Traditional Resource Use and Values

According to the most recent information from the NWT Bureau of Statistics (2010a), 41.9% of the adult residents of Fort Good Hope participated in hunting or fishing in 2008. As shown in Figure 2-1, this proportion was lower than in 2003, when 47.1% hunted or fished, but is higher than the NWT average (39.4%).

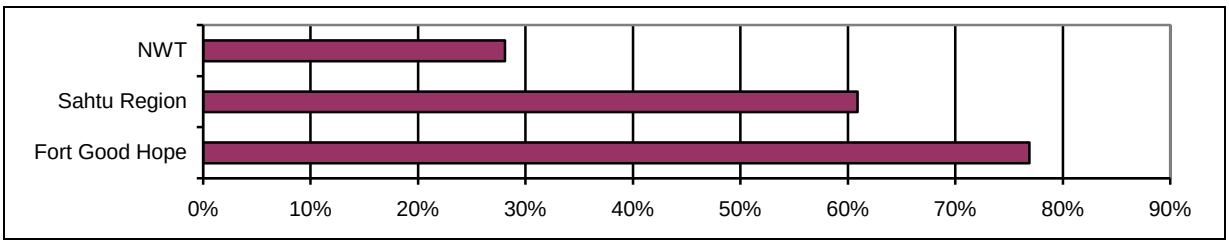
Figure 2-1: Percentage of the Population (Aged 15+) Who Hunted or Fished, 1998 to 2008



Source: GNWT Bureau of Statistics, 2010a

Similarly, a very high percentage of households in Fort Good Hope (76.9%) obtained at least 50% of all meat and fish consumed in 2008 from hunting or fishing. Figure 2-2 shows that this percentage was higher than for the Sahtu Region (60.9%) and more than double the percentage of NWT households (28.1%) that relied on country foods for more than half of their meat and fish consumption.

Figure 2-2: Percentage of Households that Obtained 50% or More of Meat and Fish Consumed Through Hunting or Fishing, 2008

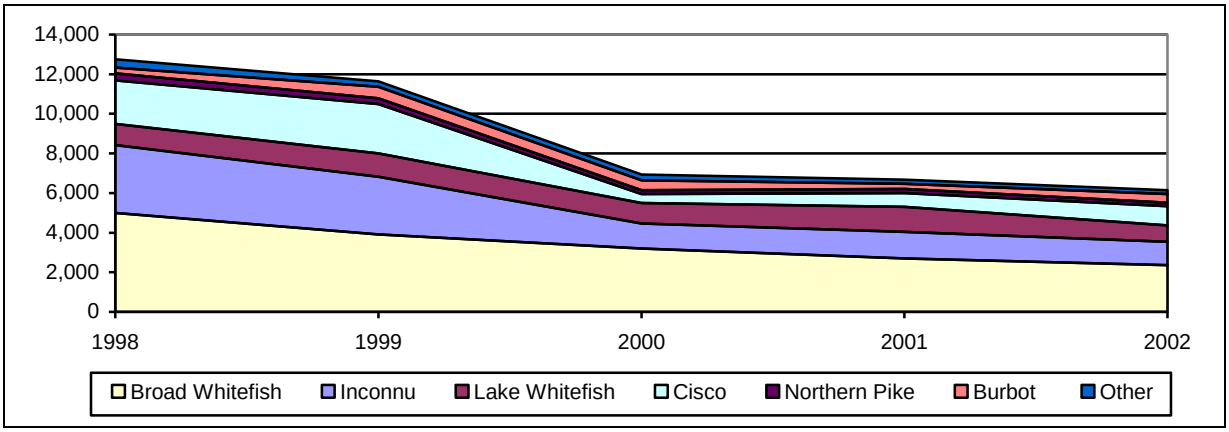


Source: GNWT Bureau of Statistics, 2010a

2.1.1 Fishing

Detailed estimates of fish harvest by residents of Fort Good Hope were developed as part of the Sahtu Settlement Harvest Study. The resulting data show that between 123 and 153 eligible harvesters[2] were interviewed each year and the resulting numbers of fish harvested each year are shown in Figure 2-3. The data indicate that the number of fish being caught has declined steadily between 1998 and 2002. The average harvest during this period consisted of 8,820 fish per year, although this ranged from a high of 12,730 fish in 1998 to a low of 6,150 fish in 2002. Broad Whitefish and Inconnu are the two key fish species being caught.

Figure 2-3: Fish Harvests (Number) by Residents of Fort Good Hope, 1998 to 2002



Source: (Bayha and Snortland, 2002; 2003; 2004)

Based on assumptions about the edible weight of the various fish species being harvested (Ashley 2002), it is estimated that an average 14,300 kilograms of edible fish were harvested each year by eligible harvesters in Fort Good Hope. The current value of the average fish

[2] An eligible harvester is a harvester that meets the following criteria: 1) Sahtu Dene-Métis beneficiary of the claim or non-beneficiary who provides for their Sahtu Dene-Métis family, 2) lives in the Sahtu, 3) 16 years of age or older, and 4) currently hunts, fishes and/or traps.

harvest, based on the cost of locally purchased frozen fish ($13.50 per kilogram, as per InterGroup Consultants Ltd. [2009] and adjusted for inflation) is estimated to be $196,400 per year (2010$). This represents an average of $1,360 per eligible harvester.

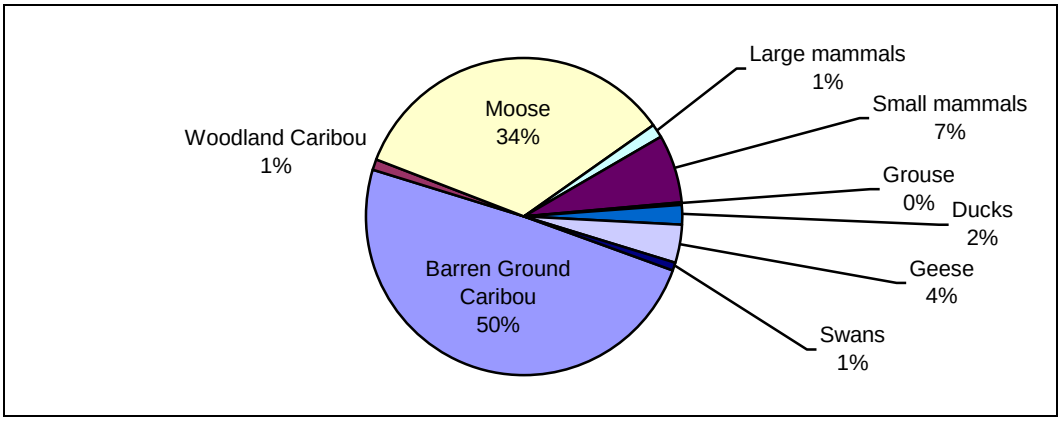
Only a small portion of fish harvesting occurs in Ts'ude niline Tu'eyeta, however. According to information from the Sahtu Settlement Harvest Study, over the period from 1999 to 2003, residents of Fort Good Hope harvested 8% of the Broad Whitefish, 3% of Lake Whitefish, 14% of Northern Pike and 0.2% of Burbot from lakes and stream in Ts'ude niline Tu'eyeta (EBA Engineering Consultants Ltd. 2006). This represents an average catch of about 360 fish per year, or 4% of the total harvest. The average catch from lakes and stream in Ts'ude niline Tu'eyeta are estimated to provide 600 kilograms of edible fish with a replacement value of about $8,200 (2010$).

2.1.2 Hunting

The Sahtu Settlement Harvest Study also provides information on the number of large and small mammals, upland birds and waterfowl harvested by eligible harvesters between 1998 and 2002. Based on assumptions about the edible weight of the animal and bird species being harvested (Ashley 2002), it is estimated that an average of 49,800 kilograms of edible meat were being harvested each year. In terms of replacement cost, this meat is valued at $642,300 (2010$). The value for mammals was based on the replacement cost for red meat in Fort Good Hope ($12.84 per kilogram) while the value for waterfowl and grouse was based on chicken prices ($13.74 per kilogram) (InterGroup Consultants Ltd. 2009 and adjusted for inflation). Thus, hunting is estimated to provide an average of $4,500 worth of meat for each eligible harvester.

Overall, barren ground caribou are the most important meat source for residents of Fort Good Hope. Over the period from 1998 to 2002, an average of 490 barren ground caribou was harvested each year and the resulting 24,460 kilograms of meat accounted for nearly half of the total meat harvest (see Figure 2-4). In 2000 a total of 727 barren ground caribou were harvested by residents of Fort Good Hope but this number dropped to 185 in 2002.

Figure 2-4: Average Meat Harvests (by Weight) by Residents of Fort Good Hope, 1998 to 2002



Source: (Bayha and Snortland, 2002; 2003; 2004)

These caribou are believed to members of the Bluenose West herd. This herd was seen as a distinct herd in 2000 and available census information suggests that the population of the herd has dropped dramatically, from at least 74,000 animals in 2000 to 20,800 animals in 20,800 in 2006 and 18,050 animals in 2006. A subsequent census in 2009 estimated that there were about 17,900 animals. As a result of the declining population, the Sahtu Renewable Resource Board (SRRB) together with other co-management boards and Government of the Northwest Territories are working to implement measures to conserve the herd. As a result, all non-aboriginal hunting of the Bluenose-West herd in the Sahtu Settlement Area stopped in October 2006. The SRRB has since recommended establishing a total allowable harvest for the Bluenose West herd and requiring that aboriginal hunters obtain a tag to harvest caribou from this herd (Circumpolar Rangifer Monitoring and Assessment Network, 2010).

Residents of Fort Good Hope also harvest small numbers of Woodland caribou. On average, eligible harvesters take 8 Woodland caribou per year, although this ranged from 5 in 1998 to 14 in 2000. However, with increasing restrictions on harvests of barren land caribou in areas east of the Mackenzie River, residents of Fort Good Hope may increase their hunting pressure on Woodland caribou in Ts'ude niline Tu'eyeta. This Woodland caribou herd is considered to be a self-sustaining local population under Environment Canada's Recovery Strategy for Woodland Caribou, Boreal Population (Environment Canada, 2011). There is no information on the extent to which members of other communities harvest animals from this herd.

Harvests of moose accounted for about one-third (34%) of the total meat harvest over the period from 1998 to 2002. During this period, an average of 95 moose was taken each year, although this varied from 84 in 2000 to 108 in 2002.

Small mammals accounted for about 7% of the annual meat harvest. This includes meat from hare and rabbits, beaver and muskrat. As hare populations are cyclical, the number harvested dropped from 2,665 in 1999 to 850 in 2002. The numbers of beaver and muskrat harvested each year were also highly variable, but this probably reflects changing fur prices as well as the availability of food from other sources.

Collectively, harvests of waterfowl accounted for nearly 7% of the meat harvested between 1998 and 2002. Geese accounted for 3.9%, various duck species for 2.0% and swans for 0.8%. While nearly 500 grouse and ptarmigan were also harvested each year, these species accounted for only 0.3% of the total meat harvest. Small numbers of other large mammals, specifically black bear and Dall sheep, accounted for about 1.5% of the meat harvested by residents of Fort Good Hope.

Information from the Sahtu Settlement Harvest Study indicates that residents of Fort Good Hope only hunt for some game species in Ts'ude niline Tu'eyeta. In terms of total harvests between 1998 and 2002, hunting activities in Ts'ude niline Tu'eyeta accounted for 58% of the total harvest of Woodland caribou, 37% of moose, 4% of hares, 9% of grouse, 17% of ducks, 32% of

geese, 16% of swans, 63% of Dall sheep and 75% of beaver (EBA Engineering Consultants Ltd. 2006). On average, this represents a harvest of about 8,900 kilograms of meat per year, or about 18% of the total meat harvest by eligible hunters in the community. This harvest is valued at about $115,600 per year (2010$), based on replacement cost.

2.1.3 Harvesting of Plants and Berries

While the collection of medicinal plants occurs throughout Ts'ude niline Tu'eyeta, specific collection sites were not identified (InterGroup Consultants Ltd. 2009). Key medicinal plants include willow, spruce branches and gum, and birch bark. Due to lack of information about the amount of medicinal plants being harvested, it is not possible to estimate the economic value of medicinal plants.

Although berry picking historically occurred along water courses, near wetlands, and adjacent to summer camps and cabins, most berry picking now occurs near the community of Fort Good Hope and not in Ts'ude niline Tu'eyeta (EBA Engineering Consultants Ltd. 2006). Due to lack of information about the amount of berries being harvested, it is not possible to estimate the economic value of berry picking.

2.1.4 Fuel

EBA Engineering Consultants Ltd. (2006) noted that firewood is an important source of fuel for heating in Fort Good Home. Some 168 households in Fort Good Hope were reported to use wood as a heating sources with 21 of these (12.5%) using wood as the main source for heat. The amount of wood burnt for heat is not known. However, a study of firewood use for communities in the Dehcho Region determined that 10.5 cords of wood are consumed by households completely reliant on wood for heating and 5.5 cords are used by households that are partly reliant on wood (IMG-Golder Corporation 2006, Internet site). Based on this information, it is estimated that households in Fort Good Hope consume about 1,030 cords of wood per year.

The value of wood used for heating can be estimated in terms of the cost of an equivalent amount of heating oil. In terms of heat equivalent, a cord of firewood is equivalent to between 400 and 440 litres of heating oil (IMG-Golder Corporation 2006, Internet site). Thus, 1,030 cords of wood would be equivalent to 433,000 litres of fuel oil which, at current prices, would be worth $532,900 per year (2010$).[3] According to EBA Engineering Consultants Ltd. (2006), residents of Fort Good Hope collect all their firewood from islands in the Mackenzie River and from various properties around the community.

There is some use of wood for fuel in Ts'ude niline Tu'eyeta by residents of Fort Good Hope who have cabins and camps in the area. The amount of wood burnt for heat and cooking at these

[3] This is based on an estimated price of $1.23 per litre of oil in Fort Good Hope which, according to Encor International Inc. (2008), reflects a $0.71 per litre cost above the cost of oil in Edmonton, which is currently about $0.52 per litre (AJM Petroleum Consultants, 2010).

cabins and camps is not known. However, in the cultural evaluation of Ts'ude niline Tu'eyeta, PACTeam Canada Inc. (2009) notes that there are 92 cabins and camps in the area, although not all of these are currently being used. Assuming that half of these cabin sites are used for two months per year and burn one cord of wood per month, total wood consumption would be about 100 cords per year. The value of this wood, in terms of replacement fuel oil, would be $51,700 (2010$).

2.1.5 Recreation

As shown in Figure 2-1, about 41.9% of adult residents of Fort Good Hope hunted or fished in 2008. While these activities were undoubtedly part of harvesting native food, participants in these activities enjoy benefits over and above the value of the food they harvested. While there is no method for assessing the value of these traditional activities (other than in terms of the value of country foods being harvested), these values have been estimated in terms of their recreational value. However, this may seriously understate the importance of traditional activities.

The approximate value of recreation-related experience for residents of Fort Good Hope can be estimated based on the results of a nation-wide study that was conducted in 1996 by Environment Canada (1999) to determine the extent to which Canadians benefit from nature in a variety of ways other than just hunting and fishing. The study determined that 85% of Canadians aged 15 and older participated in some form of nature-related activity, including participating in an outdoor activity in a natural area (44%), residential wildlife-related activities (38%), wildlife viewing (19%), fishing (18%), and hunting (5%).[4] While the survey provided results for individual provinces and the Yukon, residents of the NWT were not surveyed because of the extremely high cost.

Nonetheless, it is possible to use the survey information to develop crude estimates of recreational use and values for the communities in the vicinity of Ts'ude niline Tu'eyeta. One estimate was derived by using the Canadian average, while a second estimate was calculated using survey information for residents of the Yukon. The study showed that, when compared to the Canadian average (see Table 2-1), a slightly higher percentage of Yukon residents were involved in nature-related activities and they were more active (more days per year). Yukon residents also spent more money to participate in these activities. Based on their socio-economic characteristics, it is expected that residents of the NWT would have recreational patterns that more closely resemble Yukon residents than a national average.

[4] Percentages for individual activities do not add to 85% because some people participated in more than one activity.

Table 2-1: Participation in Nature-Related Activities by Residents of Canada and the Yukon, 1996

	Canada		Yukon	
	Participation Rate	Days per Person	Participation Rate	Days per Person
Participating in an outdoor activity in a natural area	43.7%	16.1	45.3%	23.5
Residential wildlife-related activities	38.3%	140.1	41.3%	155.5
Wildlife viewing	18.6%	17.6	27.9%	25.4
Fishing	17.7%	17.2	32.2%	19.7
Hunting	5.1%	16.9	11.0%	19.8

Source: Environment Canada, 1999

Based on NWT census information, there were about 449 residents of Fort Good Hope aged 15 years or older in 2009. Given the participation rates and per capita activity in Table 2-1 and adjusting for multiple activities, it is estimated that residents of Fort Good Hope enjoy about 29,000 days of nature-based recreation per year at all locations. Information from the survey, adjusted for inflation, suggests that residents of Fort Good Hope spent between $176,500 and $444,500 (2010$) on nature-related activities per year, with the higher estimated based on expenditures patterns by residents of the Yukon.

Residents of Fort Good Hope also derived benefits from participating in these nature-based recreational activities, over and above what they actually spent to participate. These are termed "non-market benefits". Based on willingness to pay estimates and adjusting for inflation, the non-market benefits of recreation for residents of Fort Good Hope ranged from $64,400 to $107,700 per year (2010$), with the higher value based on the values that Yukon residents placed on their enjoyment of nature-based recreation.

These estimates of recreational activity and value relate to all nature-related activities at all locations. However, based on the information related to fishing (Section 2.1.1) and hunting (Section 2.1.2), residents of Fort Good Hope only spend a portion of their time in Ts'ude niline Tu'eyeta. Assuming that 5% of recreational fishing, 20% of recreational hunting and 10% of all outdoor activities by residents of Fort Good Hope occurred in Ts'ude niline Tu'eyeta, there are estimated to be 700 days of recreational activity in the study area. Spending associated with these activities is estimated to range between $24,800 and $48,900 (2010$), while the non-market benefits enjoyed by Fort Good Hope residents ranging between $5,700 and $11,300 per year (2010$) with the higher value based on the values that Yukon residents placed on their enjoyment of nature-based recreation.

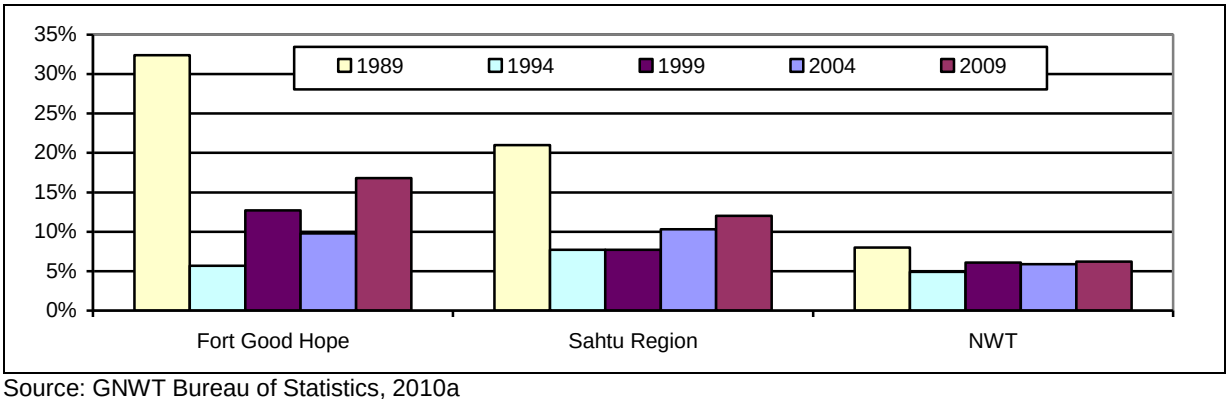
While some other residents of the NWT may participate in recreational activities in Ts'ude niline Tu'eyeta, this activity is estimated to be very small because of the isolation of the area and the availability of other sites that are more readily accessible to their home communities.

2.2 Commercial Resource Use and Values

2.2.1 Trapping

The most recent information from the NWT Bureau of Statistics (2010a) indicates that 16.8% of adults (aged 15 years and older) in Fort Good Hope participated in trapping in 2008. This suggests that there were 76 active trappers. Although much higher percentages of people trapped in 1989 (32.4%), this percentage decreased substantially in 1994 (5.7%) but has gradually been increasing since (see Figure 2-5). Fort Good Hope currently has a higher percentage of adults who participate in trapping than does the Sahtu Region (12.0%) or the NWT (6.2%).

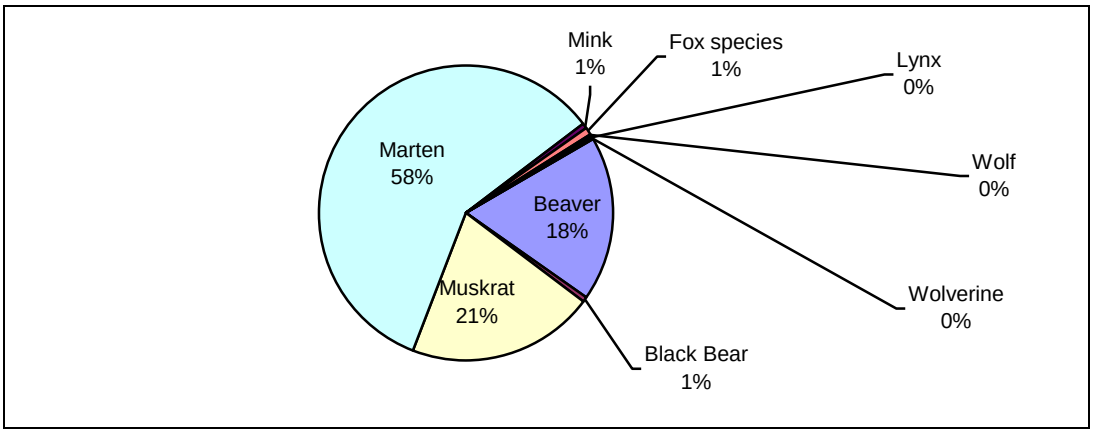
Figure 2-5: Percentage of Adults Participating in Trapping in Previous Year, 1989 to 2009



Source: GNWT Bureau of Statistics, 2010a

The Sahtu Settlement Harvest Study provided information on the number of furbearers trapped by eligible harvesters between 1998 and 2002. Figure 2-6 shows the species composition of the average fur harvest during this period. It shows that marten accounted for 58% of the average annual harvest, with muskrat accounting for 21% and beaver for 18%. The balance of the harvest (3%) consisted of small numbers of mink, fox, lynx, wolf, wolverine and black bear.

Figure 2-6: Average Fur Harvest by Species by Residents of Fort Good Hope, 1998 to 2002



Source: (Bayha and Snortland, 2002; 2003; 2004)

Based on the most recent fur harvest information (NWT Industry, Tourism and Investment, 2009), the average harvest by eligible harvesters in Fort Good Hope would be valued at about $99,100. This represents about 7% of the total revenues from the NWT fur trade in 2007/08.

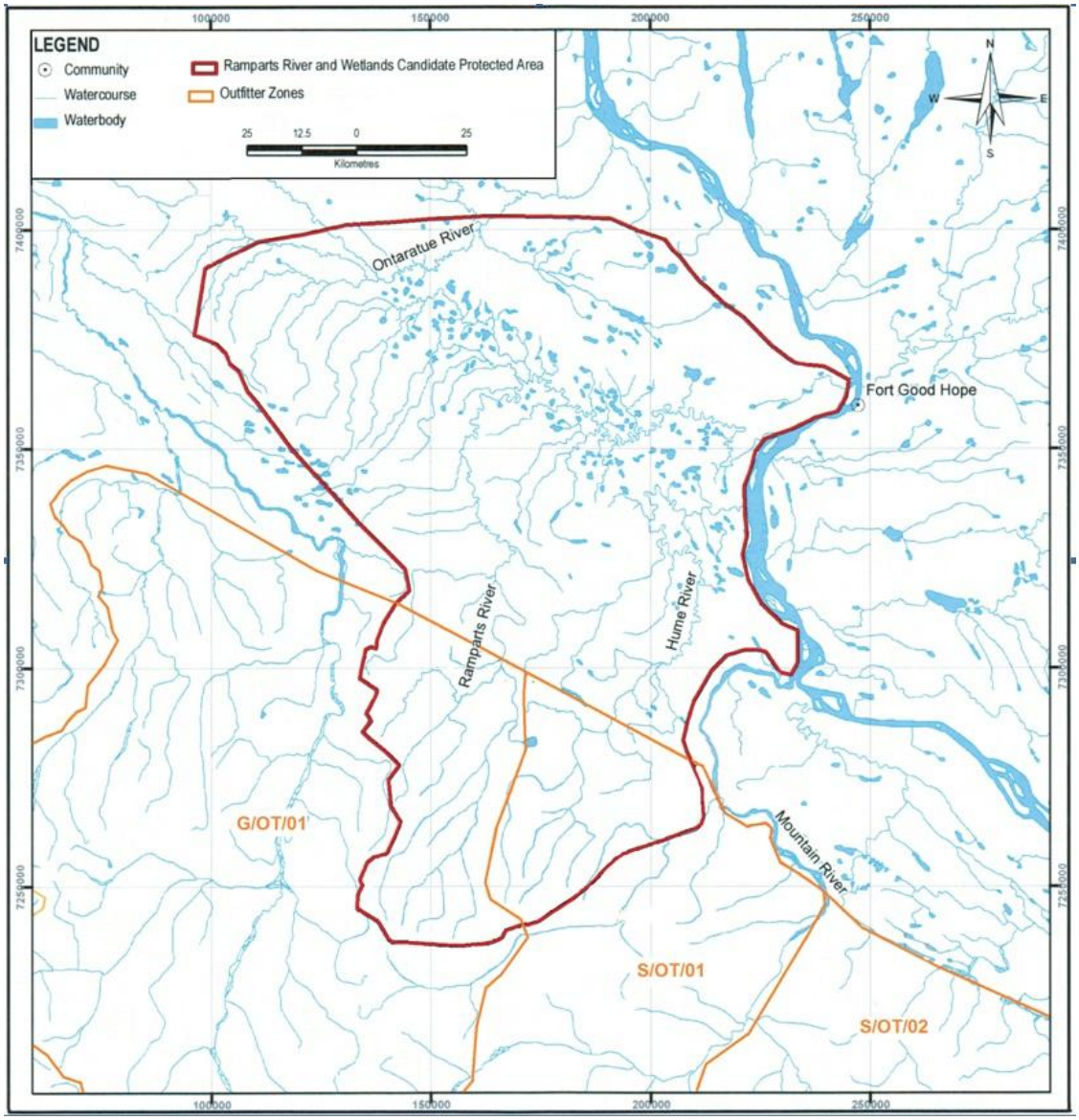
Information from the Sahtu Settlement Harvest Study indicates that eligible harvesters in Fort Good Hope only trap for some species in Ts'ude niline Tu'eyeta. For the period from 1998 to 2002, trapping activities in Ts'ude niline Tu'eyeta accounted for 28% of the total harvest of marten, 75% of beaver and 53% of black bear (EBA Engineering Consultants Ltd. 2006). There were reported to be no known harvest of muskrat, mink, weasel, wolverine, fox, wolf or lynx from Ts'ude niline Tu'eyeta. Using the most recent price information, the value of furs harvested from Ts'ude niline Tu'eyeta is estimated to be $26,600 per year (2010$).

2.2.2 Outfitting and Guided Hunting

The Ts'ude niline Tu'eyeta Candidate Protected Area overlaps with two of the eight outfitting zones in the Mackenzie Mountains. These include Zone G/OT/01, which is operated by Arctic Red River Outfitters, and S/OT/01, which is operated by Gana River Outfitters Ltd. (see Figure 2-7).
Both operations feature opportunities for hunting of trophy Dall sheep, caribou and moose in very remote and undisturbed areas within the Mackenzie Mountains (Arctic Red River Outfitters, 2011; Gana River Outfitters Ltd, 2011). Based on discussions with the outfitters, it is estimated that guided hunting and outfitting in the two zones generates gross revenues of about $1.3 million per year and provides employment for 20 people during the 90-day hunting season (Molnar, 2011; Grinde, 2011).

While relatively small parts of Ts'ude niline Tu'eyeta fall within the two outfitting zones, both operators noted that the long term sustainability of their operations is dependent on maintaining large undisturbed areas that can support ungulate populations. Hunting activities are widely distributed thought the area each year in order to minimize human disturbance and to maintain the high quality wilderness characteristics of the area. In addition, because of the migratory nature of caribou, it is not possible to conclude that some areas represent more important caribou habitat than other areas. Both outfitters are concerned that if energy or mineral development were to be allowed in those parts of Ts'ude niline Tu'eyeta that are located in their outfitting zones, the resulting disturbances will lead to changes in the distribution and number of ungulates and increased access will lead to increased predation by wolves and increased hunting by resident hunters. These effects, combined visual disturbances to the land base, will seriously inhibit the ability of outfitters to continue to sustainably operate at current levels, especially given the highly competitive nature of the world-wide guiding industry. It was suggested that, for one outfitter, the potential development in the Ts'ude niline Tu'eyeta portion of their outfitting area could reduce their gross revenues by half. Thus, it is reasonable to conclude that Ts'ude niline Tu'eyeta current supports guided hunting and outfitting worth about $500,000 per year.

Figure 2-7: Outfitting Zones in the Vicinity of the Ts'ude niline Tu'eyeta Candidate Protected Area



2.2.3 Commercial Fishing and Outfitting

There are no commercial fishing operations or sport-fishing operations within Ts'ude niline Tu'eyeta. The potential for future development of such operations is low because lakes that have the productivity and fish abundance needed to support these activities are rare (EBA Engineering Consultants Ltd. 2006).

2.2.4 Tourism

Tourism activity in the region is difficult to determine with any accuracy because tourism statistics are reported at a regional level and for some individual sites within each region. Fort Good Hope is located in the Sahtu Region and, according to the results of the 2006 Visitor Exit

Survey, about 2,884 tourists visited this region for leisure purposes (NWT Industry Tourism and Investment [ITI], 2007a). A summary of their origin, mode of travel and major visitation purposes is provided in Table 2-1Table 2-2. The table shows that nearly all visitors arrived by air (92.7%) while the remainder (7.3%) traveled by road. About 65.0% of tourists to this region were Canadians, 29.4% were from the United States and the remainder (5.6%) were from other countries. General touring was the reason why 10.4% of the tourists visited the area. About 12.6% were involved in outdoor adventures, 47.2% were there for fishing, 20.8% to visit friends and relatives, and 8.9% for hunting. It is estimated that tourists spent about 17,700 visitor–nights in the Sahtu Region.

Table 2-2: Visitors to the Sahtu Region, 2006

Travel Mode	Origin	Fishing	General Touring	Hunting	Outdoor Adventure	Visiting Friends	Total
Air	Canada	661	236	35	233	544	1,709
	US	576	0	202	17	11	806
	Other	42	11	19	65	25	162
Road	Canada	82	42	0	21	21	166
	US		12	2	27	0	41
	Other		0	0			0
TOTAL	**Total**	1,361	301	258	363	601	2,884
	Percent of Total	**47.2%**	**10.4%**	**8.9%**	**12.6%**	**20.8%**	**100.0%**

Source: NWT ITI 2007a. Totals may not add due to rounding.

Based on average daily expenditures for all visitors to the NWT and adjusting for some visitors having visited more than one region, it is estimated that visitors to the Sahtu Region spent about $1.7 million in 2006, or about $97 per person per night. Total spending includes $281,000 on accommodation; $180,900 on restaurants and groceries; $519,700 on travel in the NWT (airfare and fuel); $171,700 on entertainment, arts and crafts, souvenirs and tours; and $559,200 on other items. It is estimated that tourism-related spending created the equivalent of 20 person-years of direct and indirect employment in the NWT.[5]

There is no information on the amount of tourism that occurs in Ts'ude niline Tu'eyeta. With no road access to Fort Good Hope, and Norman Wells having the only major airport, it is expected that there is currently very little tourism activity in Ts'ude niline Tu'eyeta. Based on the visitation profile in Table 2-2, many tourists visit the Sahtu Region for fishing, but most of that occurs in the vicinity of Great Bear Lake. There is also some tourism related to hunting, but guided hunting activities in Ts'ude niline Tu'eyeta have already been described (in Section 2.2.2). Thus, any other tourism that does occur in the Sahtu Region in and around Ts'ude niline Tu'eyeta would involve outdoor adventure activities, such as rafting and other water-based activities on rivers in the Mackenzie Mountains and on the Mackenzie River itself. The 2009 Northwest Territories Outdoor Adventure Guide and the 2011 Explorers Guide (Spectacular

[5] Calculated use industry intensity ratios for the NWT for the retail, arts, and entertainment, and accommodation and foods services industries (GNWT Bureau of Statistics, 2010e).

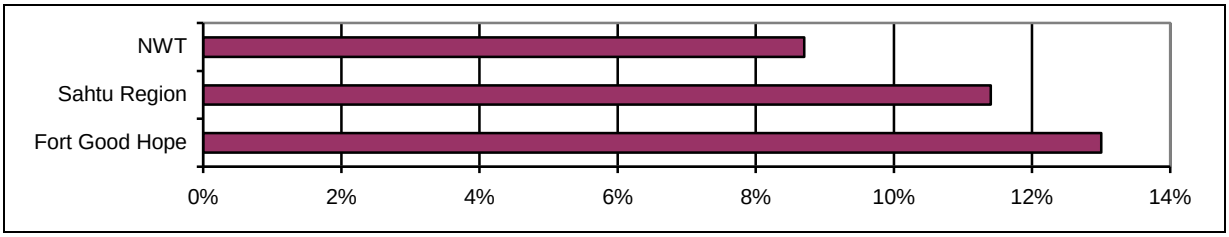
NWT.com, 2010; 2011) both note guided and unguided canoeing opportunities on the Mackenzie River, which has been designated as a Heritage River, as well as the Mountain and Keele rivers, which are considered "Challenging Rivers". The Mountain River runs just south of Ts'ude niline Tu'eyeta. The Ramparts on the Mackenzie River just upstream of Fort Good Hope are also identified as a key tourist attraction in the Sahtu Region. The other major adventure tourism attraction in the region is the Canol Pipeline corridor, near Norman Wells, including Dodo Canyon and Carcajou Falls.

Based on the key tourism features of the Sahtu Region, it is assumed that, at most, 10% of the visitors engaged in outdoor visitors participated in activities in or adjacent to Ts'ude niline Tu'eyeta. This would represent about 30 visitors. These visitors are estimated to have spent 285 visitor-nights in the NWT, with total expenditures of $39,300 (2010$). It is assumed that the majority of these expenditures occurred in Norman Wells as there are limited tourism facilities in Fort Good Hope.

2.2.5 Arts and Crafts

Another form of value derived from Ts'ude niline Tu'eyeta relates to its importance as a source of raw materials for the regional arts and crafts industry. These raw materials include bones and antlers, feathers, fur, animal hair and hides, porcupine quills, sinew, birch bark and materials used to construct baskets, plants used for dyes, wood from trees, and stones. As shown in Figure 2-8, 59 adult residents (aged 15 years and older) of Fort Good Hope produced northern arts and crafts in 2008. These people represent 2.0% of the 2,948 residents of the NWT who reported producing northern arts and crafts in 2008.

Figure 2-8: Percentage of Adults Who Produced Northern Arts and Crafts, 2008



Source: GNWT Bureau of Statistics, 2010a

Arts and craft production is an important economic generator in the NWT. The total value of arts and crafts sold to tourists visiting the NWT in 2006 was $1.9 million in 2006 (ITI, 2007a). Additional arts and crafts were also purchased by wholesalers and retailers who then sell these goods at locations outside the NWT. According to a recent survey of the North American visitor market (Zieba, 2005), actual and potential visitors to the NWT were most interested in spending money on handcrafted items such as pottery, baskets, and woven items and regional food specialties rather than on souvenirs, jewelry or local clothing. Based on its share of tourism in the NWT, it is estimated about $67,600 was spent on arts and crafts by tourists visiting the Sahtu Region. This represents an average of $294 in revenues for each of the 2,024 residents of the Sahtu Region who reported producing northern arts and crafts in 2008. For the 59 residents of

Fort Good Hope who reported producing northern arts and crafts, this suggests annual revenues of $19,000 per year (2010$).

2.2.6 Commercial Forestry

Fort Good Hope has a community sawmill that supplies the community with lumber for the construction of sheds, garages and warehouses and to repair houses in the community and to construct and repair cabins in Ts'ude niline Tu'eyeta (InterGroup Consultants Ltd. 2009). The volume of timber harvested for these purposes is not known and so no value has been estimated for this use of resources in Ts'ude niline Tu'eyeta or the surrounding area.

2.3 Ecological Goods and Services

Various studies have shown that landscapes can generate a variety of benefits other than those listed above. These benefits are related to the ecological goods and services generated by landscapes. For example, a study of the Mackenzie watershed (Anielski and Wilson, 2010) concluded that the ecological goods and services provided by nature (e.g., carbon storage, water filtration, water supply) contribute over 10 times more societal economic value than the GDP generated by natural capital extraction industries. Some of the key ecological goods and services related to Ts'ude niline Tu'eyeta are described below.

2.3.1 Drinking Water

The rivers, lakes and wetlands in Ts'ude niline Tu'eyeta provide a source of clean water for people living downstream. These values are thought to be very small because the number of downstream beneficiaries is very small (4,925 people live in the communities of Fort Good Hope, Tsiigehtchic, Aklavik, and Inuvik) and the overall flow contributed by the Ramparts, Hume, Ontaratue, Mountain and Arctic Red rivers to the flow of the Mackenzie River is very small.

2.3.2 Existence Value for Species at Risk (Woodland Caribou)

There is evidence that Canadians derive some measure of well-being from knowing that Woodland caribou continue to exist in various parts of the country and that they would be willing to pay to continue to conserve caribou. In Saskatchewan, a survey of households conducted in 1993 determined that they would be willing to pay to an average of $14.66 per household (1992 dollars) to implement a hypothetical conservation program that would preserve Woodland caribou in northern Saskatchewan (Tanguay et al., 1995). A 1995 survey of households in Edmonton determined that they would be willing to pay an average of $76.50 per household to remove lands from forestry activities and create a wilderness area that would allow the number of caribou in the region to increase from 400 animals to what is considered a viable population (600 animals) (Adamowicz et al., 1995).

While there have as yet been no studies of what residents of the NWT or Canada would be willing to pay to ensure the continued existence of Woodland caribou in the NWT, it is expected

that their valuation would depend on the extent to which specific caribou populations are threatened. There are two subspecies of Woodland caribou in Ts'ude niline Tu'eyeta and, as shown below, only the Boreal Caribou is considered to be threatened.

Status:	Boreal Caribou	Northern Mountain Caribou
Species at Risk (NWT) Act:	No status	No status
Federal *Species at Risk Act*:	Threatened	Special Concern
COSEWIC Assessment:	Threatened	Special Concern
NWT General Status Rank:	Sensitive	Secure

The Boreal Caribou subspecies is more commonly found in Ts'ude niline Tu'eyeta and in total, there are believed to be between 6,000 and 7,000 animals of this subspecies (GNWT, 2010). There are believed to be a minimum of 1.1 to 1.5 Woodland caribou per square kilometre in Ts'ude niline Tu'eyeta (Canadian Wildlife Service, 2007). The herd is considered to be a self-sustaining local population (Environment Canada, 2011).

Based on the willingness to pay estimates above, it is estimated that Canadian households would be willing to pay between $250 million and $1.2 billion to protect boreal caribou in all of Canada. With 57 Woodland caribou herds in Canada (Environment Canada, 2008), this suggests that average willingness to pay to protect the one herd in Ts'ude niline Tu'eyeta would be between $4.4 million and $21.3 million. This would be equivalent to an annual willingness to pay of between $131,700 and $637,700 (2010$), based on a discount rate of 3.0% and between $308,000 and $1,491,000 based on a discount rate of 7.0%. If the area is not designated as a National Wildlife Area and caribou habitat is not protected, these existence values cannot be considered as an ongoing benefit of Ts'ude niline Tu'eyeta.

2.3.3 Climate Regulation – Carbon Sequestration

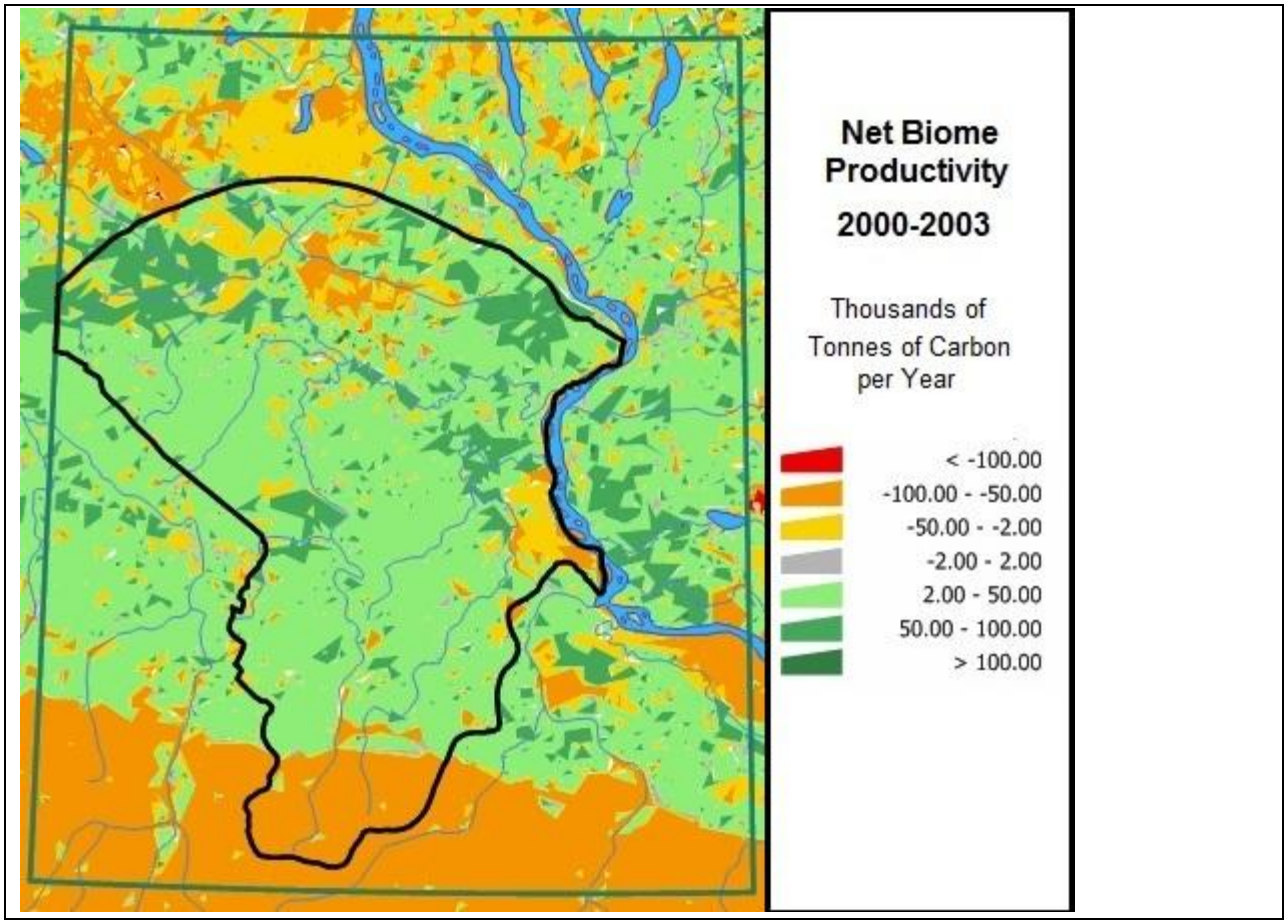
Forests, wetlands, peatlands, tundra, shrub and grassland both sequester and storage carbon dioxide and other climate-change-related emissions. The ability of forests and wetlands to store or release carbon in measured in terms of net biome productivity (NBP). Estimates of NBP in Ts'ude niline Tu'eyeta were developed using information from the national data base developed to show the carbon cycle in Canadian forests (Chen, 2011).[6]

Figure 2-9 shows the estimated NBP by watershed for the area in and around Ts'ude niline Tu'eyeta for the period 2000 to 2003. It shows that while relatively small amounts of carbon (2,000 to 5,000 tonnes of carbon per year) were being sequestered in much of the study area, some parts of the area, notably along parts of the Mackenzie River and the front ranges of the Mackenzie Mountains, were releasing larger amounts of carbon (50,000 to 100,000 tonnes of carbon per year).

[6] Estimates of NBP are based on estimates of annual Net Primary Productivity (NPP) and then adjusted to account for the impacts of land cover changes (e.g. land use impacts, impacts of fire, etc.) on the net carbon balance of ecosystems. The analysis of the NBP data for Ts'ude niline Tu'eyeta used a custom file of Dr. Chen's original raw NBP data, at the 1 square kilometer resolution, analyzed by Global Forest Watch Canada.

Overall, for the period from 2000 to 2003, available information suggests that Ts'ude niline Tu'eyeta has been sequestering carbon each year: about 159,080 tonnes per year. Based on current market prices of carbon (the average global carbon market value was US$26.00 per tonne of CO_2 in 2008), carbon sequestration in Ts'ude niline Tu'eyeta can be valued at $4.14 million (2010$) per year.

Figure 2-9: Average Net Biome Productivity in Ts'ude niline Tu'eyeta, 2000 to 2003



However, rates of carbon sequestration are variable over time and are related to both climatic conditions and various events, such as forest fires, that can release carbon. For example, during the period 1970 to 1974, the NBP estimates for Ts'ude niline Tu'eyeta indicate that the area was sequestering only about 46,600 tonnes of carbon per year. The value of these services during this period is estimated to be $1.21 million (2010$). Given the variability in rates of carbon sequestration over time, an average value of $2.68 million (2010$) has been assumed for this analysis.

2.3.4 Existence Values for Protected Areas

There is evidence that Canadians are willing to pay to protect landscapes because they benefit from knowing that these landscapes exist (existence values), that they can visit these areas in the future (option value) and these landscapes will be available to future generations (bequest value). In 1997, Rollins et al. completed a study for Parks Canada and found that, in 1991, Canadian households would be willing to pay an average of $235.18 for the creation of four new national parks in the NWT and would be willing to pay $261.51 for the creation of 10 four parks. Since 1991 three of the parks have been established and the fourth is currently under consideration.

Assuming that formal designation of Ts'ude niline Tu'eyeta as a National Wildlife Area could be considered as a being equivalent to creating a fifth park, this suggests an average willingness to pay of $4.40 per Canadian household, or $5.50 in 2010 dollars. Thus, total Canadian willingness to pay to protect Ts'ude niline Tu'eyeta as a National Wildlife Area could be as high as $69.0 million, or $2.1 million per year in perpetuity, based on a discount rate of 3%%, or $4.8 million per year, based on a discount rate of 7.0%. The annual benefits for households in Fort Good Hope would be $30 per year, while annual existence values for households in other parts of the NWT would total $2,340. These values are not related to the size of the park or protected area and will not apply if the area is not designated as a National Wildlife Area.

2.3.5 Recreational Value of Migratory Waterfowl

Migratory waterfowl provide both consumptive (hunting) and non-consumptive (bird watching) recreational benefits for people living along the overall migration routes. The Canadian Wildlife Service considers the Ramparts River Wetlands to be a key migratory bird terrestrial habitat site in the NWT, and an important nesting area for scaup and scoter (Canadian Wildlife Service, 2007). The wetlands, which are about 4,660 square kilometres, support 1% of the national populations of a number of migratory species including scaup, scoter and Pacific loons. Based on available information for 1997 and 1998, there are estimated to be about 3,500 scaup, and 1,000 Pacific loons in the wetlands during the late breeding season (Canadian Wildlife Service, 2007).

By combining harvest data for scaup (lesser and greater) from the Canadian Wildlife Service (2008) with scaup population estimates (U. S. Fish and Wildlife Service, 2010), it is estimated that about 7.5% of scaup populations are harvested each year, with 15% being harvested by Canadian hunters and 85% by hunters in the United States. This suggests that, based on scaup breeding populations associated the Rampart River wetlands, an average of 265 scaup are from the Rampart River wetlands are being harvested each year: 40 by Canadian hunters and 225 by US hunters. Based on average hunting success rates of 1.02 ducks per hunter day and average expenditures of $68.88 per day (U.S. Fish & Wildlife Service, 2006), the economic value of scaup from the Ramparts River wetlands to US hunters is about $18,500 (2010$) when converted to Canadian dollars and adjusted for inflation. For Canadian hunters, the scaup from the Ramparts River wetlands generate $2,800 (2010$) per year. This is based on a harvest success rate of 1.07 ducks per hunter-day (Canadian Wildlife Service, 2010), average expenditures of

$41.65 per hunter day and average user benefits of $14.60 per hunter-day (Environment Canada, 1999; 2000), and adjusting for inflation since 1996. Thus, the Ramparts River wetlands generate about $21,300 in annual benefits for migratory bird hunters.

In terms of birds that breed in Ts'ude niline Tu'eyeta, the Pacific loon is considered to be the species of greatest interest to bird watchers. As noted above, the Ramparts River Wetlands support 1% of the national population of Pacific loon. This species spends most of the year on the Pacific Ocean and returns to inland northern and tundra lakes for three months in summer to breed (Cornell Lab of Ornithology, 2009). Thus, Pacific loon from the Ramparts River Wetlands will be of interest to bird watchers along the Pacific coast from Alaska to California. It is estimated that some 4.88 million people participated in wildlife watching away from home in 2006 in the four coastal states and, of these, 4.35 million participated in bird watching and 3.35 million watched waterfowl (US Census Bureau, 2006). Total bird watching activity away from home in the four coastal states is estimated to be 54.8 million user-days, or about 12.6 days per bird-watcher and average trip costs by people who watched wildlife away from home averaged $59.11 per day (2010$), when converted to Canadian dollars and adjusted for inflation. Thus, people travelling away from home to watch waterfowl at sites in the four coastal states resulted in expenditures of $2.43 billion (2010$).

There is no information that directly estimates the extent to which Pacific loon contributes to economic activity related to bird watching in the four coastal US states. While a reasonably large portion of the $2.43 billion in expenditures could be assigned to individual species that attract visiting bird watchers because of their rarity or scarcity, the International Union for the Conservation of Nature (IUCN) has classified the Pacific loon as being a species of least concern and the population is considered abundant (Cornell Lab of Ornithology, 2009). Thus, it is more likely that the observations of Pacific loon would enhance the benefits experienced by bird watchers who have already travelled to a specific location to see a wide range of waterfowl species. Consequently only a small portion of total expenditures could be directly attributed to this species. Unfortunately, there appears to be no information that indicates the extent to which any one waterfowl species adds to the well-being of bird watchers.

As an alternative estimation procedure, it is possible to estimate the value associated with waterfowl viewing in the four coastal US states relative to the value associated with migratory bird hunting. Available information suggests that, for each day of migratory bird hunting in the four coastal states, there were 25.4 days of waterfowl viewing activity and, for every $1 spent by waterfowl hunters in the four coastal US states, people watching migratory birds spent $19.87 (2010$) (US Census Bureau, 2006). Thus, based on the estimated value of US waterfowl hunting associated with the Ramparts River Wetlands, as calculated above, it is estimated that expenditures by bird watchers in the four coastal states that could be attributed to the Pacific loon and other waterfowl species associated with the Rampart River wetlands could be about

$354,600 per year. This amount is equivalent to 0.015% of total expenditures associated with all waterfowl watching in the four coastal US states.

2.4 Cultural Values

An assessment of the cultural values associated with Ts'ude niline Tu'eyeta was completed by PACTeam Canada Inc. based on a review of existing data sources. The study documented the location of cabins and camps, harvest sites, burial sites, heritage sites, archaeological sites, trails, traplines, and areas with Aboriginal place names. A map summarizing these features is provided as Figure 2-10.

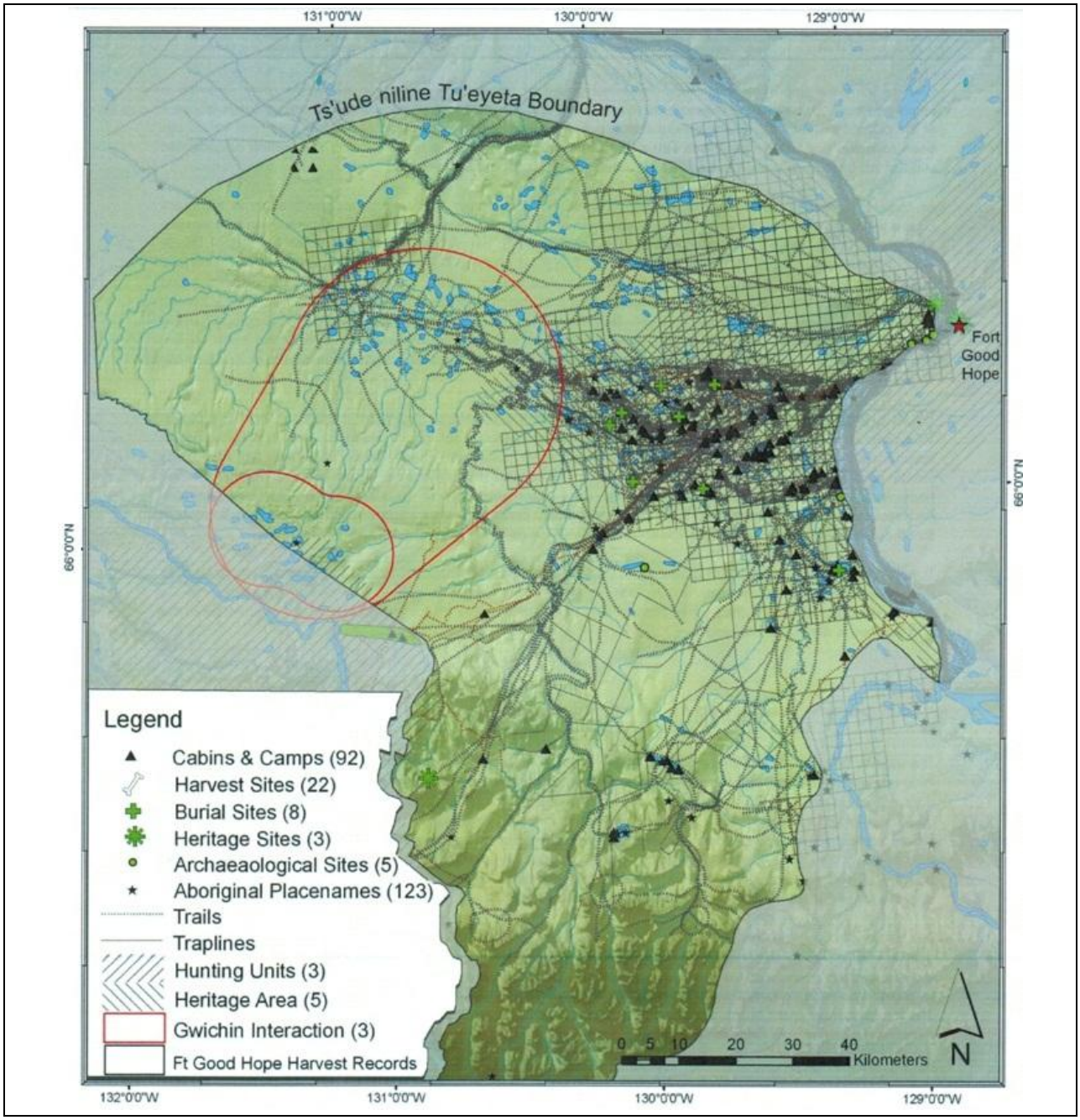
In its analysis, PACTeam Canada Inc. (2009) makes the following conclusions about the cultural values of Ts'ude niline Tu'eyeta:

> The Dene and Métis of Fort Good Hope are a part of the living landscape. This connection is inherent in their history and culture. The ability to access, interact and maintain a relationship with the land and resources is essential for a secure, collective future. The recounting and mapping of cultural values is a recounting of the history, world view and traditional knowledge of the Dene and Métis that has developed over generations. It is also a reaffirmation of their identity. While all the land is important, Ts'ude niline Tu'eyeta has been repeatedly identified by the community of Fort Good Hope as a place of particular significance in their cultural fabric.
>
> The Dene and Métis have a long standing history in Ts'ude niline Tu'eyeta. They date their presence here to a time of giants and giant animals with tremendous powers. Legends like these are a part of Dene and Métis history and one component of their relationship to the land. These stories are linked directly to the land, housed in landscape features. The island that is the giant's boat, the waterfall that is the giant's pee, the whirlpools in the water where the Thunderbird used to live, are each physical elements of their respective legends. Through these features the stories are recounted and given meaning and relevance. They give the legend a tangible sense of place and in turn give the Dene and Métis a deep-rooted belonging to the land.

PACTeam Canada Inc. (2009) also noted that the management plan for Ts'ude niline Tu'eyeta should recognize:

- That Ts'ude niline Tu'eyeta is a cultural landscape, defined by the values the Aboriginal people give to the landscape.
- The cultural importance of Ts'ude niline Tu'eyeta is inherently tied to its traditional use and occupancy by the Dene and Métis
- That the physical and spiritual health of the Dene and Métis are linked to the health of plants and animals in Ts'ude niline Tu'eyeta;

Figure 2-10: Summary of Existing Documented Cultural Values for Ts'ude niline Tu'eyeta



Source: PACTeam Canada, 2009

- Any management plan and resultant actions must enhance, or at the very least bring no negative impacts to, the cultural values in Ts'ude niline Tu'eyeta
- The necessary role that local people must play in the development and implementation of any management plan;
- That protecting Ts'ude niline Tu'eyeta contributes to broader conservation goals, by helping to balance conservation and development and by ensuring that culturally and naturally significant areas are conserved within the Northwest Territories.

While the foregoing analysis clearing identifies the cultural value of Ts'ude niline Tu'eyeta for the Dene and Métis of Fort Good Hope, there is no accepted method of estimating these cultural values in economic terms. However, the ultimate importance of these cultural values may be revealed in terms of how much economic activity would be foregone based on the extent to which Ts'ude niline Tu'eyeta is exempted from development because of its cultural and economic importance to the past, present and future residents of Fort Good Hope.

2.5 Summary

Overall, it is estimated that Ts'ude niline Tu'eyeta currently generates economic benefits in the range of $3.8 million and $3.9 million per year. Table 2-3 shows how this estimate was derived. The economic benefits include market-based measures, such as the income generated by outfitting and tourism and the replacement value of fish, wildlife and wood harvested for subsistence purposes, but also include some non-market based values, such as the benefits that regional residents experience from using the area, over and above their actual costs.

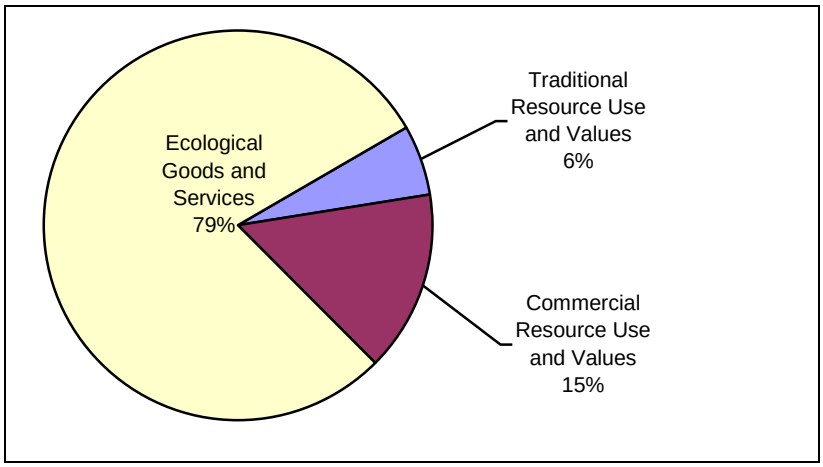
Table 2-3: Summary of Annual Economic Benefits Currently Associated with Ts'ude niline Tu'eyeta

Type of Benefit		Low	High
Traditional Resource Use and Values	Consumption of fish	$8,200	
	Consumption of wildlife	$115,600	
	Native plants and berries	Unknown	
	Wood for fuel	$51,700	
	Recreation – expenditures	$24,800	$48,900
	Recreation – non-market benefits	$5,700	$11,300
Commercial Resource Use and Values	Trapping	$26,600	
	Outfitting and guided hunting	$500,000	
	Tourism	$39,300	
	Arts and crafts	$19,000	
	Commercial forestry	Unknown	
Ecological Goods and Services	Drinking water	Unknown but small	
	Climate regulation	$2,675,000	
	Value of migratory waterfowl – hunting	$21,300	
	Value of migratory waterfowl – bird watching	$354,600	
Cultural Values		Not Quantified	
TOTAL		**$3,841,800**	**$3,871,500**

This estimate of total economic values is considered conservative, however. There is no allowance for the replacement value associated with the native plants and berries that are harvested in the area. Similarly, the value of wildlife supported by Ts'ude niline Tu'eyeta that is harvested in parts of the NWT (Woodland caribou, for example) has not been included. In addition, these values do not include the existence values that would result from designating Ts'ude niline Tu'eyeta as a National Wildlife Area ($2.1 million) that would also protect Woodland caribou ($0.1million to $0.6 million).

Figure 2-11 shows the overall composition of these economic benefits. It shows that the majority of the benefits being generated by Ts'ude niline Tu'eyeta are related to the provision of ecological goods and services (79.1%). Overall, climate regulation through carbon sequestration accounted for 69.4% of benefits while migratory waterfowl accounted for 9.1%.

Figure 2-11: Composition of Economic Benefits Associated with Ts'ude niline Tu'eyeta



Commercial resource use and values accounted for 15.2%, with outfitting and guided hunting accounting for 13.0%. Traditional resource use and values accounted for 5.7% of total values, with consumption of wildlife and fish accounting for 3.2%. These values are known to be conservative, however, because the significant cultural, historic and archaeological values of the area have not been quantified.

2.5.1 Implications for Fort Good Hope

Only a portion of the benefits listed in Table 2-3 are being experienced by residents of Fort Good Hope. Ts'ude niline Tu'eyeta provides local residents with the full range of traditional resource values listed but only a portion of the commercial resource values. The benefits associated with outfitting and guided hunting accrue to the outfitting companies, their employees and their suppliers, most of which are located outside Fort Good Hope and outside the NWT. Nearly all of the quantified ecological goods and services are enjoyed by residents of Canada (existence values), the United States (migratory birds) and the world (climate regulation).

For residents of Fort Good Hope, Ts'ude niline Tu'eyeta provides a small but important source of food (fish and wildlife). Information for 2009, suggest that the average household in the NWT living outside Yellowknife spent an average of $9,570 per year on food (Statistics Canada, 2010). Thus, it is estimated that the 175 households in Fort Good Hope spent a total of about $1.67 million on food in 2009. However, given that food costs in Fort Good Hope were 90.7% higher than in Yellowknife in 2004 (NWT Bureau of Statistics, 2010) and assuming this price differential remains, residents of Fort Good Hope were only able to purchase half as much food as were residents of Yellowknife for the same amount of money. As a consequence, residents of Fort Good Hope are highly reliant on country food. As noted previously, the value of wildlife and fish harvested for food by residents of Fort Good Hope at all locations is estimated to be about $838,600 per year. When the value of this country food is added to the cost of purchased food, it is estimated that residents of Fort Good Hope relied on country food for 33.4% of their total food supplies. Fishing and hunting in Ts'ude niline Tu'eyeta provided 4.9% of the community's annual food supplies.

Ts'ude niline Tu'eyeta also provides residents of Fort Good Hope with a small percentage of their annual income. The annual revenues resulting from trapping, recreation and tourism, and sales of arts and crafts are estimated to be about $121,750 per year, or about $700 per household per year. This represents 1.2% of the estimated total employment income in Fort Good Hope in 2009.[7]

As noted previously, Ts'ude niline Tu'eyeta is also of cultural, historic and archaeological importance to the residents of Fort Good Hope.

2.5.2 Spatial Distribution of Current Uses

It is important to note that, although all the economic benefits listed in Table 2-3 can be attributed to Ts'ude niline Tu'eyeta, not all areas within Ts'ude niline Tu'eyeta are of equal importance or value. Many of the ecological goods and services associated with the area are tied to specific landscape features that have high values (i.e. the wetlands that support migratory birds, for example). However, given the lack of spatially-specific ecological or land and resource use information and related values, it is not possible to assign ecological or economic values to specific landscape features in the study area.

As some knowledge of the value of different landscape features would be of assistance in understanding the potential implications of various boundary options for a protected area, an alternative approach was developed to identify which parts of the study area are of greatest importance and value. This involved using various combinations of available spatial information

[7] According to the NWT Bureau of Statistics (2010), families in Fort Good Hope reported total employment income of $9.245 million in 2007 and this was inflated to 2009 based on changes in the number of families and households, average increases in total income and the percentage of total incomes from employment.

on resource use and species distribution to create a series of "heat maps" that identified areas of importance. Three options were developed and these were submitted for consideration by the Working Group at its meeting in Fort Good Hope in April 2011.

The challenge in preparing the heat maps for presentation to the community was to decide which of the various layers were most likely to demonstrate the importance of the landscape to the community. Based on previous work in other parts of the NWT, traditional land and resource use information was used as the first layer of information. By identifying where people have cabins and camps, the locations of harvest areas, and the network of trail systems that connect these locations, it is possible to locate which areas are likely to be of most importance to the community. An historical perspective can be added by including locations with Aboriginal place names. The resulting heat map for Option 1 is provided in Figure 2-12. Areas in dark red are on the map believed to be of greatest importance; areas in dark green are believed to be of least importance; and areas in white have no information

A second heat map was created by combining the traditional land use information with a second layer of information that identified the locations of landscape units that were determined to support some of the larger ecological goods and service values identified in Table 2-3. Wetlands were identified as being important for waterfowl hunting and bird watching. Figure 2-13 shows the overlap between traditional land and resource use and wetlands.

Outfitting and guided hunting were also shown to generate high economic values, so Option 3 combined information on traditional use and wetlands with the location of Dall sheep and caribou habitat. The resulting heat map is provided in Figure 2-14.

Figure 2-12: Important Areas within Ts'ude niline Tu'eyeta: Option 1

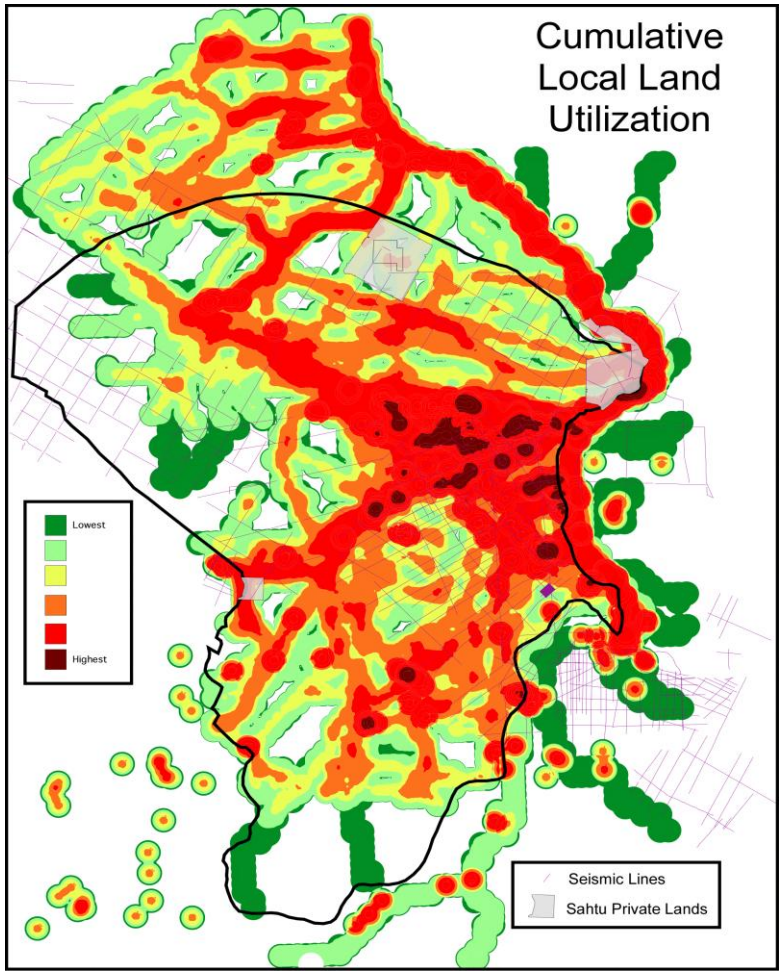


Figure 2-13: Important Areas within Ts'ude niline Tu'eyeta: Option 2

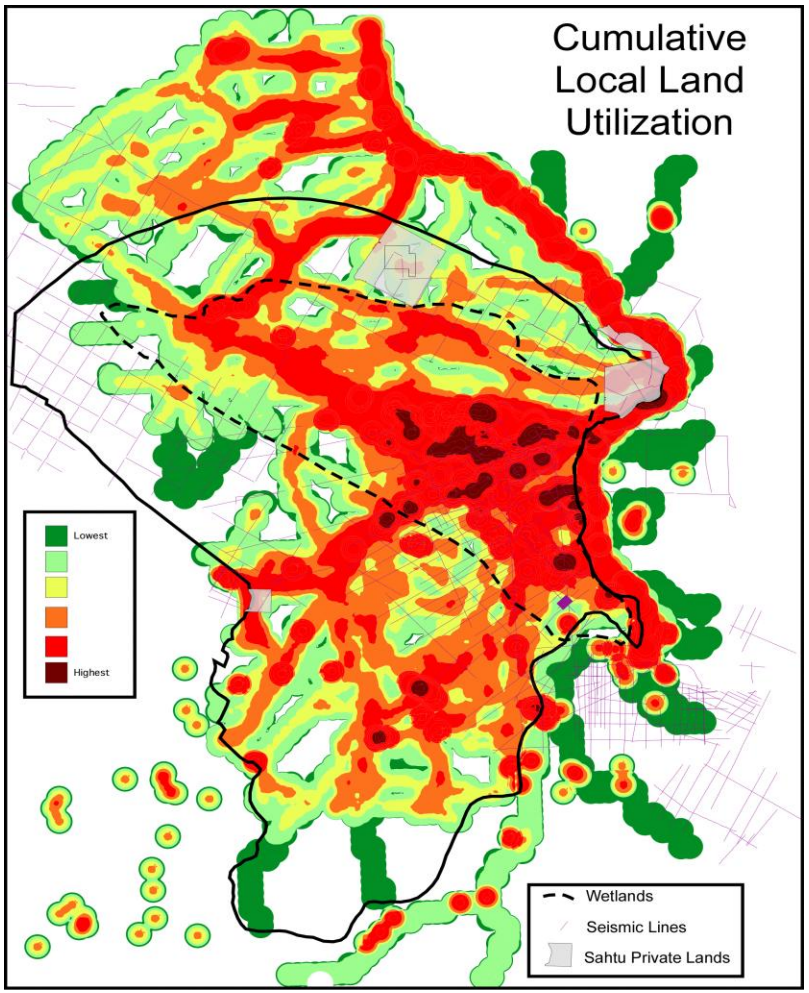
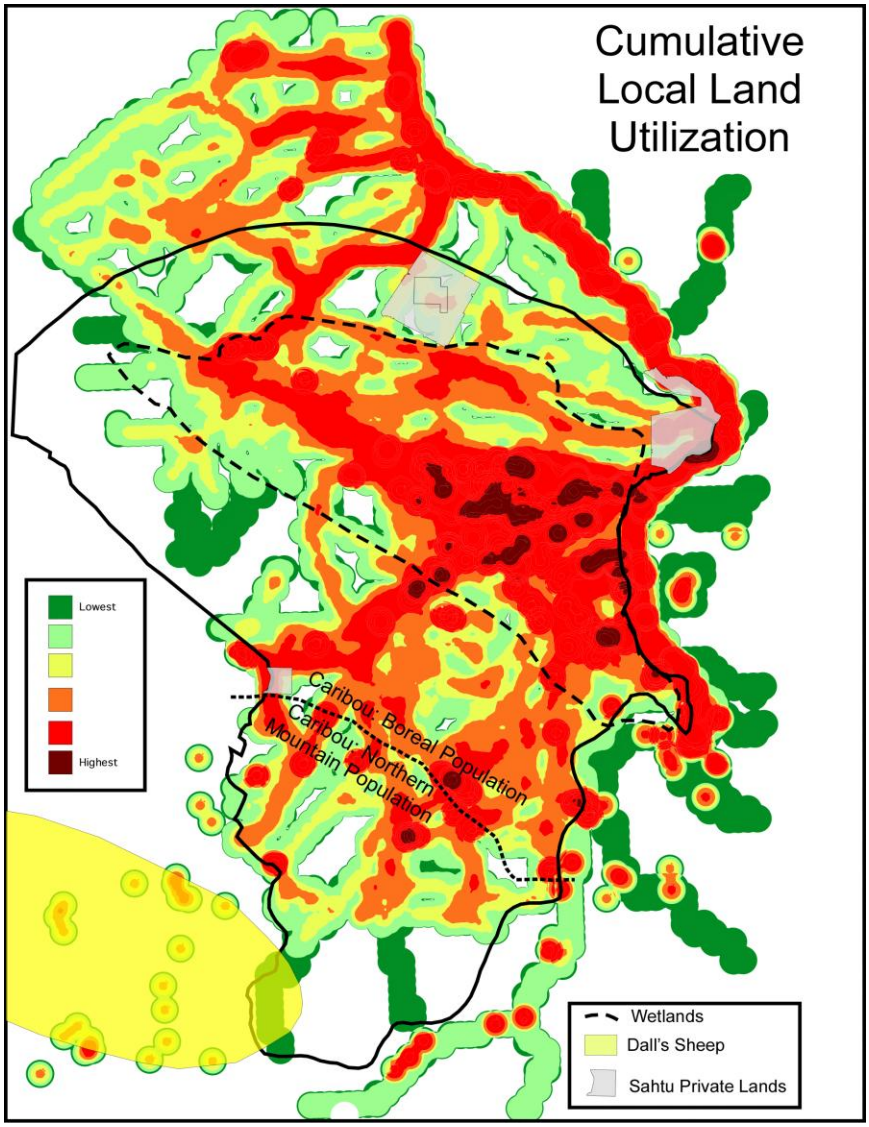


Figure 2-14: Important Areas within Ts'ude niline Tu'eyeta: Option 3



2.5.3 Future Benefits

Over time it is expected that Ts'ude niline Tu'eyeta will continue to benefit the residents of Fort Good Hope, other parts of Canada and the rest of the world through the ongoing provision of the various benefits identified in Table 2-3. The available information suggests that, in the absence of non-renewable resource development and other activities that may alter the productivity of the landscape, all of the current levels of resource use are sustainable and that there is capacity to support increased harvesting. Using the methods described in Section 1.4.2.2, it is possible to estimate the present economic value of these future benefits. The results are shown in Table 2-4 for the time period from 2011 to 2065 using a range of discount rates. It shows that, during this

period, Ts'ude niline Tu'eyeta will generate economic benefits of $57.5 million (assuming a 7% discount rate), with 7.9% of these benefits accruing to residents of Fort Good Hope, 13.0% accruing to residents of Canada, and 79.1% are global benefits. It should be noted that these benefits do not include the cultural values associated with the area.

Table 2-4: Present Value of Future Economic Benefits Currently Associated with Ts'ude niline Tu'eyeta

Benefit	Undiscounted	Discounted (3%)	Discounted (7%)
NPV of Benefits to Fort Good Hope (millions)			
Food (fish and wildlife)	$6.8	$3.4	$1.8
Wood for fuel	$2.8	$1.4	$0.8
Recreation	$2.5	$1.3	$0.7
Trapping	$1.5	$0.7	$0.4
Tourism	$2.2	$1.1	$0.6
Arts and crafts	$1.0	$0.5	$0.3
Sub-total	$16.8	$8.4	$4.6
Percent of total	7.9%		
NPV of Benefits for Canada (millions)			
Outfitting and guided hunting	$27.5	$13.8	$7.5
Sub-total	$27.5	$13.8	$7.5
Percent of total	13.0%		
NPV of Global Benefits (millions)			
Climate regulation	$147.1	$73.8	$39.9
Migratory waterfowl – hunting	$1.2	$0.6	$0.3
Migratory waterfowl – bird watching	$19.5	$9.8	$5.3
Sub-total	$167.8	$84.1	$45.5
Percent of total	79.1%		
NPV of All Benefits (millions)			
Total	$212.1	$106.4	$57.5

These estimates are based on the assumption that the level of benefits that occurred in 2010 will continue unchanged over the entire period. However, this is not likely to be the case for a variety of reasons:

- The number of Fort Good Hope residents who participate in traditional activities (hunting and fishing for food, trapping, manufacturing arts and crafts, etc.) may decline over time depending on the extent to which these traditions are adopted by future generations and population growth in the community.
- The economic importance of traditional activities in Ts'ude niline Tu'eyeta may increase in value if the availability of fish and wildlife in other areas (especially barren ground caribou) declines.
- The tourism potential of the region may increase over time as the area becomes more accessible (i.e. completion of the Mackenzie Valley Highway).
- The importance of wetlands as a breeding ground for migratory birds may increase as the number and size of wetland areas in more southerly parts of Canada continue to decline.

- The value of carbon sequestration could increase over time as the value of stored carbon continues to increase. However, although the amount of carbon stored in Ts'ude niline Tu'eyeta is expected to continue to increase over time, which is a benefit, the growing amount of carbon could also represent a liability if released into the atmosphere by forest fires or other land use disturbances.

A more detailed quantification of these possible trends and their effects on the value of economic benefits from Ts'ude niline Tu'eyeta is beyond the scope of this assessment. However, it should be noted that one of the effects of using discount rates to quantify the present values of future economic benefits is that more weight is given to values in the near future, which are thought to have more certainty and are easier to predict, than to values in the distant future, which have more uncertainty.

3.0 POTENTIAL NON-RENEWABLE RESOURCE DEVELOPMENT OPPORTUNITIES

The assessments of non-renewable resources in the Ts'ude niline Tu'eyeta Candidate Protected Area (Gal 2007; Drummond Consulting 2010;Mills 2008; Ozyer 2010) have concluded that, based on available information, there is some potential for oil and gas development and mineral development potential includes lead-zinc, copper and diamonds. To understand the potential boundary implications for the Ts'ude niline Tu'eyeta Candidate Protected Area and to compare the non-renewable resource development potential with the traditional and ecological values of the area, it is necessary to develop forecasts of how potential oil and gas and mineral development in the region might occur. Development scenarios were constructed for oil, gas and mineral development by using existing information to try to answer the following questions:

- What is the resource potential and where is this potential located?
- When will exploration, development and production of this resource potential be expected to occur and what factors will affect the timing?
- What will be the costs of developing these resources?
- What will be the territorial and regional impacts of developing these resources?
- What opportunities will be available for the local economy?
- What are the potential environmental concerns associated with development?
- What are the potential socio-economic concerns associated with development?

Preparation of these scenarios is particularly challenging, given the limited non-renewable resource information available and the uncertainty about the future local, regional, national and international factors that will determine if and when non-renewable resource development in Ts'ude niline Tu'eyeta actually does occur. To address these uncertainties, the development scenarios incorporate numerous assumptions about the timing and scale of development that could occur. And, since the ultimate decision to create a National Wildlife Area requires a cost/benefit analysis (as per Treasury Board requirements), forecasts of resource development have been developed on an annual basis for the next 55 years (to 2065). This level of detail is necessary if the relatively short term benefits associated with non-renewable resource development are to be correctly compared with the long term benefits associated with the traditional use and ecological values of the area.[8]

The scenarios presented in the following section are perhaps necessarily simplistic because they do not address the multitude of factors that will ultimately determine if and when resource development would occur. For example, the analyses do not take into consideration potential

[8] It is sometimes argued that non-renewable resources should simply be valued in terms of the total value of the resource (i.e., the volume of resource multiplied by the current price) but this approach ignores the question of whether it is actually financially feasible to extract those resources. Consequently, it is necessary to make assumptions about the stream of benefits and costs that will occur over time.

future changes in development policies, royalty rates and other factors that may encourage exploration and development in the NWT. They do not consider how the eventual future devolution of responsibility for resources to the NWT[9] will result in changes to how the revenues from development are shared between the territorial and federal governments; this will not necessarily affect the local and regional share of development benefits. The analysis does not consider how the resources of the NWT will be developed to meet the changing future global demands for and supply of petroleum and base metals, because many of these resources can be found and may be developed in other parts of the world. It does not consider how the negotiation of access and benefits agreements and other collaborative efforts between resource developers and the Sahtu Dene will result in enhanced employment and other benefits for local communities. There is no mention of new technologies than may reduce the costs of exploration and development.

However, given the complexity of these issues and the task at hand, the non-renewable resource development scenarios were formulated based on three fundamental questions:

1. Based on what we currently know about the resource potential of the area in terms of the quantity and quality of those resource, are there sufficient resources to warrant exploration and development?
2. What are the key impediments, such as access and the ability to move resources to markets, which will determine if and when resource development does occur?
3. Based on current practices, policies and management practices, how will the benefits and costs of development be distributed throughout the country, the territory and the region?

The following sections attempt to answer these questions for oil and, gas, mineral, and diamond development based on available information. A generic discussion of some of the socio-economic issues associated with non-renewable resource development is provided in Section 3.7.

3.1 Oil Development

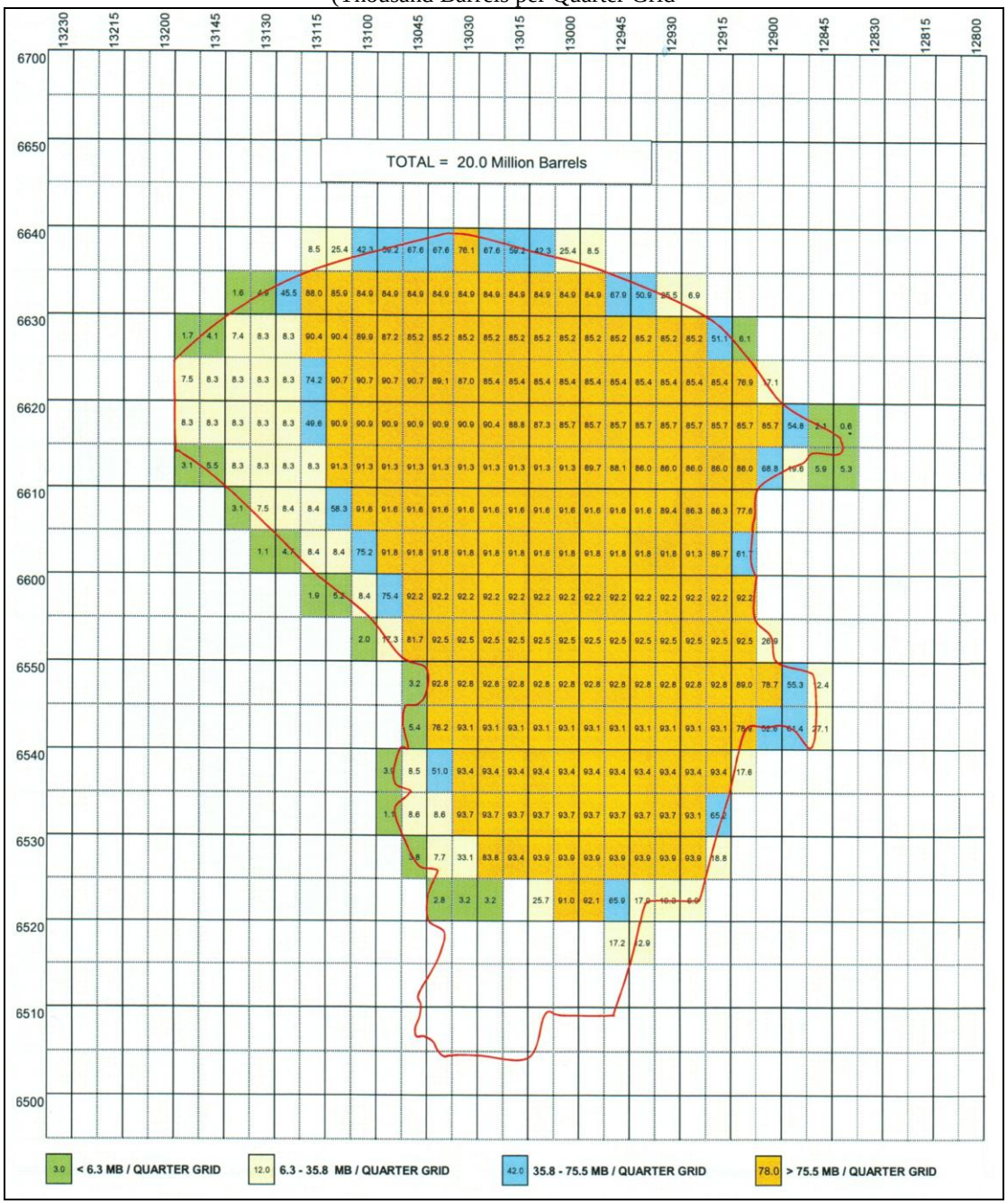
According to the recent study by Drummond (2010), no oil resources have yet been discovered in the study area. However, there are estimated to about 20.0 million barrels (3.2 million cubic metres) of undiscovered recoverable oil within the boundaries of the Ts'ude niline Tu'eyeta Candidate Protected Area. These recoverable oil reserves are believed to occur in three plays: the Arnica/ Landry Platform, the Kee Scarp/Ramparts, and the Cretaceous Clastics. Based on available information, Drummond (2010) estimated petroleum potential for individual quarter grids in Ts'ude niline Tu'eyeta. A quarter grid is an area defined by 1/8 of one degree of longitude by 1/12 of one degree of latitude, and consists of an area of approximately 36 square kilometres (km^2). The resulting estimates of undiscovered recoverable oil per quarter grid are shown in Figure 3-1. It shows that there is some potential for undiscovered recoverable oil

[9] A formal process is now underway to negotiate the devolution of Northwest Territories' public lands and resources and rights in respect of water from the Government of Canada to the Government of the Northwest Territories (GNWT).

throughout the majority of the Candidate Protected Area, with lower values along the front ranges of the Mackenzie Mountains.

Figure 3-1: Location of Undiscovered Recoverable Oil Reserves in the Ts'ude niline Tu'eyeta Candidate Protected Area

(Thousand Barrels per Quarter Grid



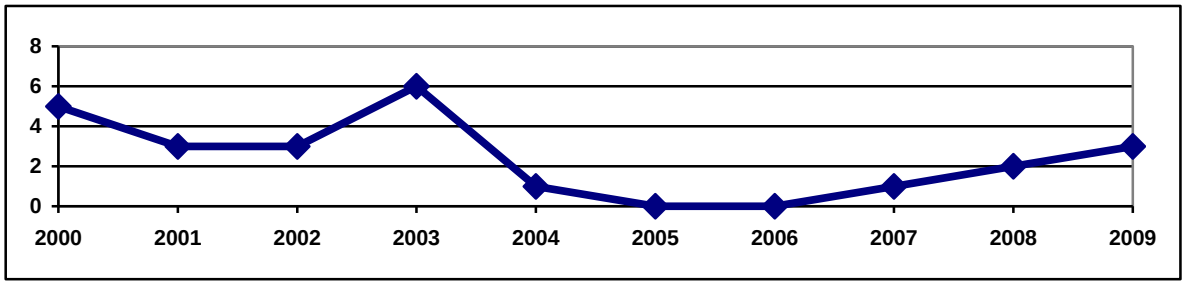
Source: Drummond (2010)
Notes: Oil potential is shown in terms of quarter grids which consist of 1/8 of one degree of longitude and 1/12 of one degree of latitude, an area of approximately 36 km^2.

The 20.0 million barrels of potentially recoverable oil reserves in Ts'ude niline Tu'eyeta represents 3.2% of recoverable discovered and undiscovered natural gas reserves in the entire Mackenzie Valley (Drummond, 2011).

3.1.1 Development Potential and Timing

A review of historical information suggests that it is unlikely that potential oil deposits in the Ts'ude niline Tu'eyeta area will be delineated, explored or developed any time soon. As shown in Figure 3-2, very few new oil wells are being drilled in the Northwest Territories. Although between one and six wells were drilled each year between 2000 and 2004, none were drilled in the NWT or Yukon in 2005 or 2006, only two wells were drilled in 2008, and three were drilled in 2009 (CAPP, 2010). Most current exploration in the mainland NWT is focused in or around existing oil reserves that are being developed at Norman Wells and in the Cameron Hills.

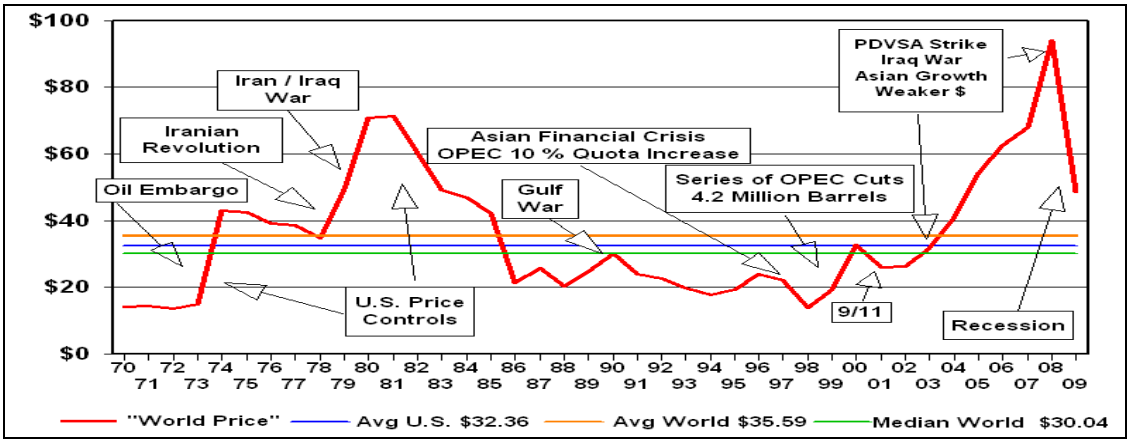
Figure 3-2: Oil Wells Completed in Northern Canada, 2000-2009



Source: CAPP 2010
Note: Includes wells drilled in the mainland territories, Mackenzie Delta & Beaufort Sea and the Arctic Islands

The Ts'ude niline Tu'eyeta area has seen relatively little exploratory work to date (24 wells have been drilled) and small volumes of oil were reported at one site just outside the candidate area, although results for five other wells remain confidential (Drummond 2010). There has not been any exploratory drilling in the area since 1991. And even the very high oil prices experienced in 2007 and 2008 (see Figure 3-3) resulted in very little new drilling activity in northern Canada.

Figure 3-3: Crude Oil Prices, 1970-August 2009 (2008 US Dollars)

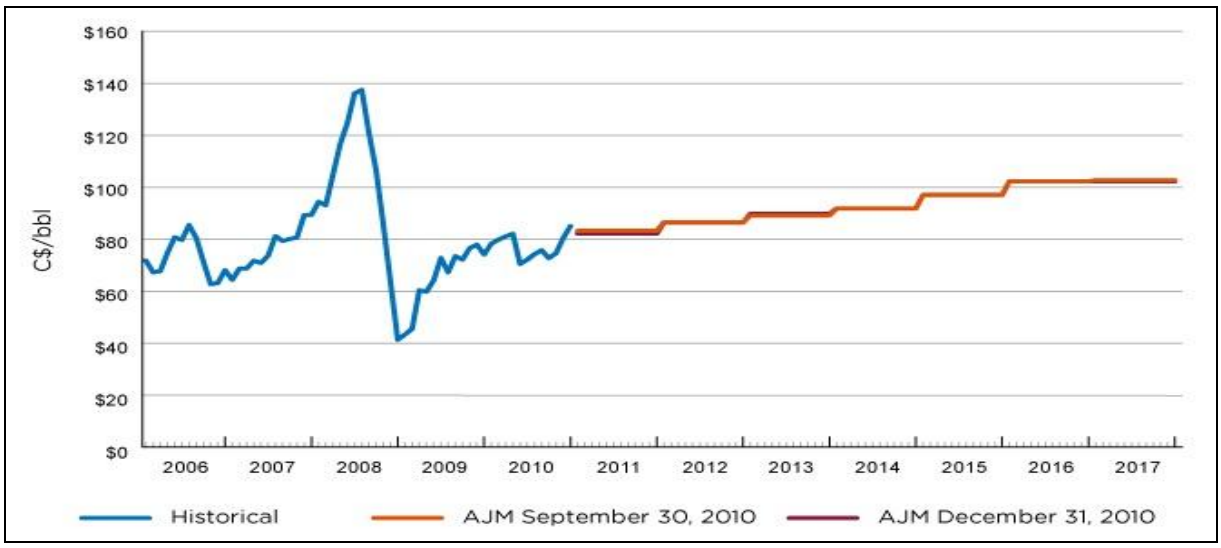


Source: WTRG Economics 2009

However, there are number of reasons why some oil exploration and development might be expected in Ts'ude niline Tu'eyeta in the relatively near future. First, the information from Drummond (2010) suggests that there is some potential for finding undiscovered oil reserves under Ts'ude niline Tu'eyeta. Although there were initially estimated to be 92.9 million cubic metres (m^3) of crude oil reserves in place in the NWT south of 68^o latitude as of December 31, 2009, only 43.0 million m^3 were considered to be established initial reserves and, of this, only 1.9 million m^3 of these established reserves remain (CAPP, 2010). Thus, the potential undiscovered recoverable oil underlying Ts'ude niline Tu'eyeta would amount to 168% of current remaining established reserves.

A second reason why oil exploration and development might be expected in Ts'ude niline Tu'eyeta in the relatively near future relates to the rising price of conventional crude oil. As shown in Figure 3-4, the long term price of conventional oil is expected to increase gradually, exceeding $100 per barrel by 2016. It is expected that this will trigger exploration and development in areas with potential reserves and relatively low development costs.

Figure 3-4: Conventional Crude Oil Price Forecast (Edmonton Par Crude Oil, Real Dollars)



Source: AJM Petroleum Consultants, 2010

A third positive factor potentially affecting oil development in Ts'ude niline Tu'eyeta is that the area is situated about 135 km north of Norman Wells, which has pipeline access to southern Canada. An oil pipeline was constructed between Norman Wells and Zama in the early 1980s. It has three pumping stations with an average throughput of 4800 m^3 (30,000 barrels) per day but has spare capacity, and throughput could be increased substantially by augmenting compression (INAC, 1995). As of 2006, pipeline throughput had decreased to 19,000 barrels per day (CAPP, 2007) and, based on recent statistics on crude oil production from the Norman Wells area (NWT Bureau of Statistics, 2010b), pipeline throughput had dropped to less than 14,000 barrels per day during the summer of 2010.

Given that oil production in the NWT is declining (NWT Bureau of Statistics, 2010c) and that the Norman Wells area accounts for 96% of oil production in the NWT, there will be an interest in maintaining throughput in the pipeline. Consequently, it is reasonable to assume that oil exploration in Ts'ude niline Tu'eyeta would commence in the near future if the area or parts were to become available for the issuance of land use dispositions. In February 2011 AANDC issued a Call for Bids for oil and gas exploration on 11 land blocks in the vicinity of Norman Wells in the Tulita District. AANDC also issued a Call for Nominations for other areas within the Central Mackenzie Valley to be designated as Frontier Lands for subsequent inclusion in a Call for Bids for oil and gas development (AANDC, 2011). These land blocks averaged 81,600 hectares in size and companies that were successful in their bids committed to spending between $17 and $2,160 per hectare over the net nine years to do exploratory work in each block. The average bid for all 11 land blocks was $595 per hectare, although the value of bids for the three land blocks closest to Ts'ude niline Tu'eyeta ranged from $24 to $266 per hectare, with an average of $137 per hectare.

3.1.2 Oil Development Scenario

The timing of potential oil development in Ts'ude niline Tu'eyeta is uncertain. It will depend on numerous factors including the timing of when the interim land withdrawal is suspended, world oil prices at that time, and oil development opportunities in other parts of the NWT. However, the timing of exploration and development will also depend on ease of access to the area. At the present time, Fort Good Hope is only accessible by water (barge) during the summer, a winter-only dirt road from Wrigley, and year-round by air transport. Without year-round surface access, initial activities will be limited to seismic work, including some drilling of exploratory wells, which would be conducted during the winter months. Without development of year-round road access and a means of crossing the Mackenzie River, the potential for major exploration and drilling activities will be limited. While plans to extend the Mackenzie Highway from Wrigley to Fort Good Hope and eventually to Inuvik and Tuktoyaktuk have been discussed for some time, there is as yet no specific timetable for construction to be completed. The NWT Department of Transportation (DOT) is currently working with Land Claims groups and organizations along the proposed highway alignment on the necessary arrangements to enable the preparation of Project Description Reports (NWT DOT, 2010).

Given the estimated oil potential of the area and assuming that the area is opened to exploration and development, it is expected that exploration activities in Ts'ude niline Tu'eyeta would commence in 2015. It is believed that Calls for Bids could be issued for a total of 13 land blocks of about 86,750 hectares each[10]; this represents a total area of about 11,145 km^2 which represents the 75% of Ts'ude niline Tu'eyeta that is believed to have the highest undiscovered recoverable oil potential (more than 35.8 thousand barrels per quarter grid – see Figure 3-1).

[10] This is similar to the average area of the two land blocks in the Tulita District closest to Ts'ude niline Tu'eyeta that were put up for bid in 2011.

Under the terms of the bidding process, exploration licences are issued to those companies that commit to spending the largest amount on exploration over a nine-year period. This consists of two consecutive periods of five and four years. Companies are required to drill one exploratory or delineation well within the first five years as a condition of obtaining tenure for the subsequent four year period. Failure to complete a well within that period will result in the exploration licence being terminated, and the rights revert to the Crown. Companies may also be required to drill a second well to delineate any significant discovery they make.

On the assumption that Calls for Bids are issued in 2014, exploration would commence in 2015, with drilling in 2020 and, if sufficient oil is found, construction of a gathering pipeline and related production facilities are assumed to be completed within two years of drilling, with production commencing after that time (2022). For purposes of analysis it is assumed that production would occur over 20 years, although use of enhanced oil recovery techniques, such as waterfloods, could increase the recoverable volumes and extend the life of the wells but would increase production costs.

3.1.3 Costs of Development

The recent Call for Bids in the Central Mackenzie Valley saw successful companies committing to spend between $17 and $2,160 per hectare over the nine years, with the average bid being $595 per hectare (AANDC 2011). However, the bids for lands nearest Ts'ude niline Tu'eyeta were lower, averaging $137 per hectare. For each land block in the Ts'ude niline Tu'eyeta, it is assumed that a company might commit to spending an average of $150 per hectare during the subsequent nine years, for a total bid of about $12.9 million per block.

This amount would be use for geophysical work plus exploratory drilling. The cost of drilling is expected to be $3.75 million per well. This is estimate is based on information from CAPP (2011) that reports net cash expenditures of the petroleum industry in the NWT and Arctic Islands from 2000 to 2009 as well as the number of wells and metres drilled. During this period, the average cost per well drilled in the NWT amounted about $6,350 per metre. However, this includes drilling in the arctic islands which is considerably more expensive than in the Mackenzie Valley. Equivalent costs range from $644 per metre in Alberta to $1,330 per metre in British Columbia. For the Mackenzie Valley, average drilling costs are assumed to be $2,500 per metre. Based on past drilling activity in Ts'ude niline Tu'eyeta (Drummond, 2010), the average well depth has been about 1,500 metres, suggesting an average cost of $3.75 million per well. Thus, the bid amount would be sufficient to drill two exploratory wells with the other $5.4 million being spent on geological and geophysical exploration.

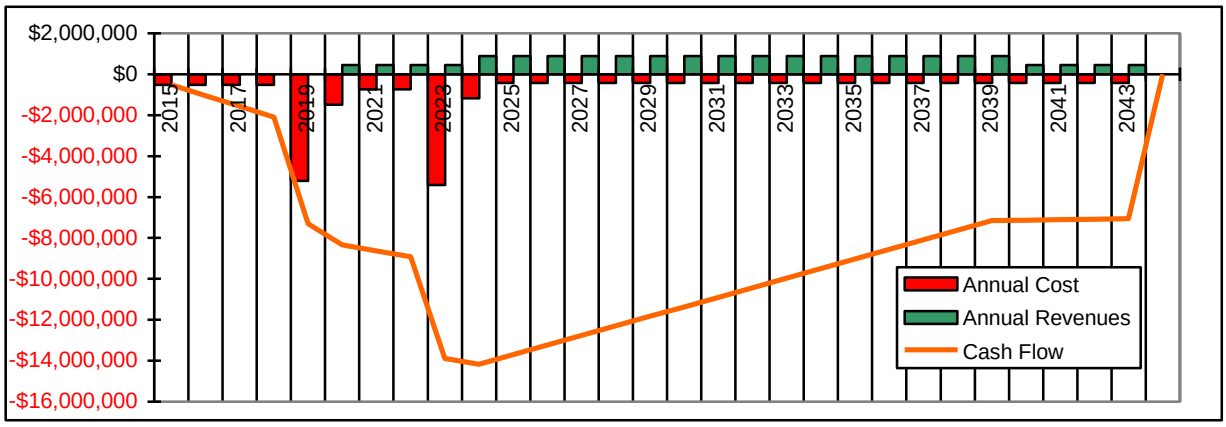
According to CAPP (2011) for every dollar spent on development drilling in western and northern Canada, an additional $0.40 is spent on field equipment to support production, which includes pipeline gathering systems and other infrastructure needed to produce oil. This represents an additional cost of $3.0 million per land block. Based on CAPP (2011) data, the

average annual cost of operating the wells and collection systems is equivalent to about 4% of the value of capital equipment (wells and field equipment), so the average annual cost per land block would be about $0.4 million once all the drilling and installation of field equipment has been completed.

The potential revenues from drilling on each land block will depend on how many wells are successful and the recoverable reserves that are identified. Based on the information in Figure 3-1, there is estimated to be an average of 88,800 barrels of potential undiscovered recoverable oil per quarter grid; each quarter grid is about 5000 ha in area). Assuming all the oil in one quarter grid can be extracted from one well, the resulting gross resource revenues would be about $8.9 million, assuming an average world price of $100 per barrel. This represents average annual revenues of about $0.4 million per land block. Assuming that the second well is also successful and is in a different pool in another quarter grid, revenues would increase by $0.4 million per year.

By using a simple financial model it is possible to assess whether this production scenario would prove to be financially viable. Using the assumptions about costs, revenues and timing, it is possible to estimate the cash flow over time and calculate the internal rate of return on a decision to invest in oil development. The internal rate of is the discount rate at which the net present value of costs (negative cash flows) of the investment equals the net present value of the benefits (positive cash flows) of the investment. The higher a project's internal rate of return, the more desirable it is to undertake the project. For the scenario described above, costs exceed revenues over the life of the project such that the cash flow is always negative (see Figure 3-5), meaning that the investment would not be commercially viable.

Figure 3-5: Cash Flow Analysis on Oil Development in Ts'ude niline Tu'eyeta



The financial model was used to test various assumptions to determine the conditions under which an oil development scenario would be financially viable. Adjusting the cost factors by reducing drilling from two wells to one and by lowering the bid amounts did not make the investment commercially viable. Increasing the price of oil to $150 per barrel also did not make

the investment commercially viable. Only when the size of the recoverable oil reserve was increased to 500,000 barrels (at a price of $100 per barrel) did the project produce an internal pre-tax rate of return of 13% (excluding pipeline tariffs). Thus, the analysis suggests that, based on current prices and the possible distribution of oil within Ts'ude niline Tu'eyeta, oil development, other than exploration activity, is not likely to proceed to production unless the discovered recoverable reserves are more than five times larger than the averages per quarter grid shown in Figure 3-1. It should be noted that the discovered oil reserves in the Cameron Hills (which accounts for 4% of oil production in the NWT) were determined to be 4.5 million barrels (Drummond 2011).

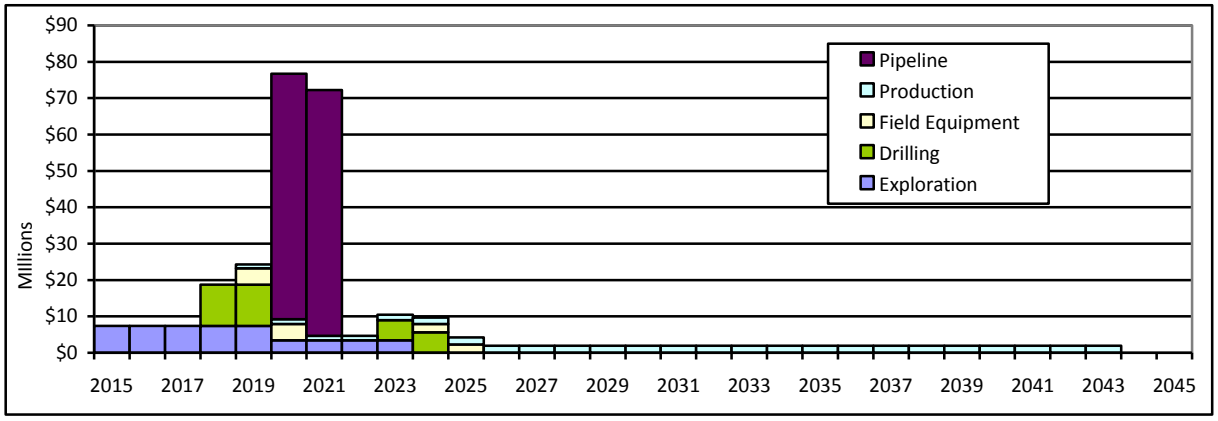
However, assuming that individual, financially-viable oil reserves are identified, oil production will also entail the additional cost of transporting oil from Ts'ude niline Tu'eyeta to the existing pipeline at Norman Wells. It is estimated that the cost of constructing this pipeline would be about $135 million, based on 135 kilometres of pipeline and an average cost of $1 million per kilometre of pipeline. There are very few examples in the NWT that show the cost of constructing small diameter gathering pipelines. The only example is the Inuvik Gas Project which was a 6" diameter line that was built to transport gas 50 kilometres from the Ikhil reservoir to Inuvik (Enbridge Inc., 1999). This project cost $44 million in 1999. When adjusted for inflation, this translates into an average cost of $1 million per kilometre of pipeline.

Given the financial hurdles facing oil development in Ts'ude niline Tu'eyeta, it is challenging to develop a development scenario that would result in any oil production. Given the available information about oil potential in the area (Drummond 2010), it is likely that there would be exploration for oil if the area was to become available for subsurface development. Thus, it is realist to assume that bids would be received on all 13 land blocks, although the amount of the bids may be less than the $150 per hectare originally assumed because of the relatively small oil reserve in the area. Bids of $50 per hectare are perhaps more likely and would make exploration and development commercially viable. It is expected that, for half the land blocks, exploration activities would only occur for the first five years of the exploration licences because the results of the geotechnical studies information do not warrant drilling. For the other six land blocks it is assumed that exploratory drilling does occur, but that only half of the exploratory wells (three) will prove commercially viable for oil, with recoverable reserves of 1.0 million barrels each. It is also assumed that one additional well will be drilled on each of these reservoirs to delineate and produce the oil.[11] The extraction of 3.0 million barrels represents 15% of the 20.0 million barrels (3.2 million cubic metres) of undiscovered recoverable oil within Ts'ude niline Tu'eyeta.

[11] Based on the intensity of development in the Cameron Hills, there could be from 2 to 20 wells drilled in each land block, although the average over that entire area is about 2.5 wells per land block. These estimates are based on the interpretation of drilling activity in the Cameron Hills oil and gas field based on information provided by Drummond Consulting (2007).

Overall, oil development in all 13 land blocks in Ts'ude niline Tu'eyeta, including construction of the pipeline, will cost $275 million spread over 28 years, and could produce $300 million in total revenues if all 3.0 million barrels of oil are recovered. The overall pattern of expenditures for oil development over the period to 2045 would be as shown in Figure 3-6.

Figure 3-6: Oil Development Cost Scenario for Ts'ude niline Tu'eyeta, 2015 to 2045



3.1.4 Impacts of Oil Development on the NWT

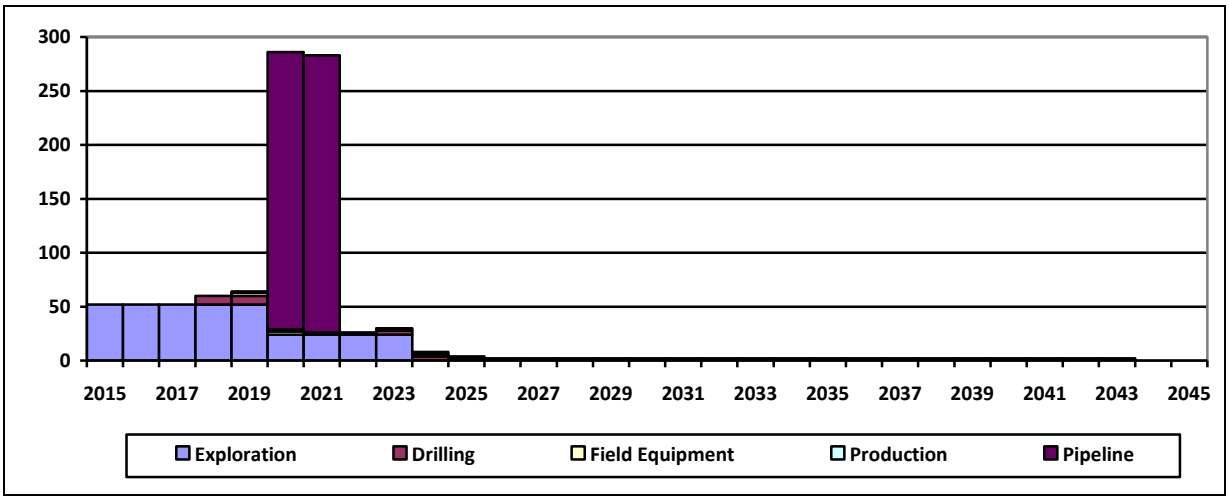
The territorial impacts of oil development in the Ts'ude niline Tu'eyeta area were estimated using the most recent economic multipliers from the GNWT (Northwest Territories Bureau of Statistics, 2011a). Estimates of the potential economic impacts associated with exploration were calculated using multipliers for the professional, scientific and technical services industry. The potential economic impacts associated with development (drilling and field equipment and pipeline construction) were calculated using multipliers for the oil and gas extraction industry and the construction industry. The economic impacts of operations were estimated using the multipliers for the pipeline transportation industry. Based on the costs and revenues described in Section 3.1.3, the resulting impacts on the economy of the NWT are summarized in Table 3-1.

Table 3-1: Impact of Oil Development in Ts'ude niline Tu'eyeta on the Economy of the NWT

		Exploration	Drilling and Field Equipment	Pipeline Construction	Operations
Cost (millions)		$151	$47	$135	$44
Years		9	4	2	25
Direct and Indirect GDP (millions)	Total	$33	$43	$62	$33
	Annual	$3.7	$10.7	$31.1	$1.3
Direct and Indirect Labour Income (millions)	Total	$26	$3	$45	$5
	Annual	$2.9	$0.8	$22.3	$0.2
Direct and Indirect Employment (jobs)	Total	356	33	513	57
	Annual	39.6	8.3	257	2.3

The table shows that oil exploration would produce some employment in the NWT (about 40 direct and indirect jobs) during each year of exploration. Employment would drop slightly as production wells are drilled (8.3 jobs per year of drilling) and would increase dramatically for the two years of pipeline construction (257 jobs per year), and then drop to only about 2.3 jobs per year for the duration of the production period. The overall effect of oil development on employment in the NWT is shown in Figure 3-7.

Figure 3-7: Direct and Indirect Employment Associated with Oil Development in Ts'ude niline Tu'eyeta, 2015 to 2045



3.1.5 Opportunities for Local Employment

Oil development is expected to generate small amounts of employment or business opportunities for residents of Fort Good Hope. Much of the work involved in exploration and pipeline construction is highly specialized or technical. Information from Statistics Canada shows that, in 2006, only 15 residents of Fort Good Hope had experience in the professional, scientific technical services industry (which include seismic and exploration activities), and this number may be high due to rounding. Another 15 residents have experience in the mining and oil and gas industries, while 30 have experience in the construction industry.

The small amount of short-term activity likely to occur in Ts'ude niline Tu'eyeta is unlikely to provide residents of Fort Good Hope with much of an incentive to train for these specialized jobs in the oil industry. However, this could change as a result of a negotiated benefits agreement that requires companies to train and hire local workers, especially the production phase. Based on experience with similar projects, local residents are typically hired to work as labourers during exploration, help with any land clearing, and provide various services (food, accommodation, etc,) to the exploration crews. When drilling and pipeline construction occur, local and regional residents would be expected to provide similar services: general labourers, right of way clearing, camps and catering, and other services. It is expected that residents of Fort

Good Hope might account for 20% of the total labour requirements during exploration and drilling/construction. Pipeline operations will directly and indirectly create the equivalent of 2.3 new jobs, with one worker located in Norman Wells, which currently has people with the specialized skills needed by the oil industry, and the other located in Fort Good Hope.

3.1.6 Potential Environmental Concerns

Oil development has the potential to create a number of environmental issues, although the extent of adverse environmental effects would be minimized by following best management practices and adherence to terms and conditions in the land use permits. These issues are summarized below and are based on experience with current exploration and pipeline construction practices in Alberta as well as the biophysical effects summary from Volume 1 of the environmental impact statement for the Mackenzie Gas Project (2004).

For exploration, the key environmental issues relate to seismic activity which involves cutting lines, potentially resulting in habitat fragmentation, and setting off explosive charges, which creates localized noise issues. Seismic lines typically range in width from 1.75 to 5 metres, so creating 100 linear kilometres of seismic lines could result in the loss of 1.75 to 5 hectares of habitat.

Drilling usually requires creating temporary or permanent access roads that can add to fragmentation issues, generates noise and light pollution during drilling, and can produce potentially hazardous drilling fluids that require disposal. Pipeline construction involves land clearing that can result in erosion and sedimentation problems, affect wildlife movement and migration, and can cause further habitat fragmentation. It is estimated that drilling one well per land block would result in disturbance of 1.0 hectare of land in each land block where drilling operations occur plus additional habitat losses where roads and pipelines are constructed. Assuming a corridor width of 10 metres, development of 135 kilometres of pipeline to Norman Wells would result in the loss of 135 hectares of land. Additional land would be needed for collector pipelines. For this analysis it is assumed that an equivalent amount of habitat would be lost due to these connector pipelines and associated corridors.

During operations, potential environmental issues include accidental releases (oil spills) and the continued maintenance of the pipeline will perpetuate issues related to erosion and sedimentation, wildlife movements, and habitat fragmentation. According to statistics from the Alberta Energy and Utilities Board (2007), there was an average of 1.3 oil pipeline incidents (including hits, leaks and ruptures) per 1,000 kilometres of pipelines of all ages and sizes in Alberta between 2000 and 2006. This suggests a maximum probability of 0.17 incidents per year for a 135 kilometre oil pipeline, or one event every 5.7 years, although the actual probability would be less because the pipeline would be new. Furthermore, the AEUB statistics indicate that 96% of releases were less than 100 cubic metres in volume. Assuming environmental damage

estimates are equivalent to the costs of clean-up (about $83,000 per tonne as per Etkin [1999] and adjusted for inflation), the annualized costs of an oil spill would at most be $14,100.

For Ts'ude niline Tu'eyeta, the greatest concerns relate to the disruption of wetland areas used by migratory birds, although potential effects could be minimized by conducting exploration and development activities in the winter months. Another concern for Ts'ude niline Tu'eyeta relates to the fragmentation of key Woodland caribou habitat that could possibly subject caribou populations to increased predation.

3.1.7 Potential Benefits and Costs

To assist in assessing the potential implications of various boundary options for Ts'ude niline Tu'eyeta, the benefits and costs of oil production must be assessed as part of the benefit/cost analysis. Consequently, it is necessary to estimate the extent to which a proposed activity would add to or subtract from the flow of benefits and costs if the activity did not occur.

From the perspective of the GNWT, it is assumed that some exploration, drilling and production employment would be incremental to expected future economy activity and could be counted as benefits. However, the employment effects shown in Figure 3-7 include both direct and indirect employment resulting from oil development and spin-off effects (indirect employment) are not normally included in a benefit-cost analysis. Available information for the NWT does not allow differentiation of direct and indirect effects so use of the employment estimates in Figure 3-7 will tend to overstate both employment and income benefits from development. Information from Alberta (Alberta Finance, Statistics, 2007) and British Columbia (BC Stats 2007) suggests that direct employment in the oil and gas extraction industry ranges from 10% of direct and indirect effects in British Columbia to 25% in Alberta. However, the ratio in the NWT is expected to be much higher because Alberta and BC have more diverse economies that are capable of providing the full range of goods and services required for supporting oil and gas development (resulting in higher indirect employment) than does the NWT. For purposes of this analysis it is assumed that direct employment accounts for 75% of the overall employment effects shown in Figure 3-7.

The territorial labour income benefits would generally follow the same pattern as in Figure 3-7 although the average annual labour income by drillers ($100,000)[12] is higher than for workers doing exploration ($74,286) or production ($92,308). The actual amount of labour income that can be counted as a benefit will depend on the extent to which unemployed and underemployed labour is employed by oil development. For workers doing short-term activities like exploration and construction, they would likely be working on a similar project elsewhere in the NWT, if not in Ts'ude niline Tu'eyeta, so would otherwise be employed. Consequently, none of their income

[12] Average income is estimated by dividing the expected direct and indirect labour income resulting from a $1 million in new industry activity by the new direct and indirect employment that would occur. Data are taken from the NWT Bureau of Statistics (2011a).

would be considered "new" income. However, employment income could be counted as benefits if any of the workers were otherwise unemployed or if the project results in new long-term jobs, such as during project operations. Thus, it is assumed that 15% of labour income associated with oil exploration and drilling is estimated to be incremental income earned by workers who would otherwise be unemployed or underemployed. This assumption is based on the observation that, in 2009, the NWT had an unemployment rate of 10.3%, although 16.5% of the labour force in the Sahtu Region and 28.3% of the labour force in Fort Good Hope were unemployed. For pipeline operations it is assumed that all associated labour income can be counted as a project benefit.

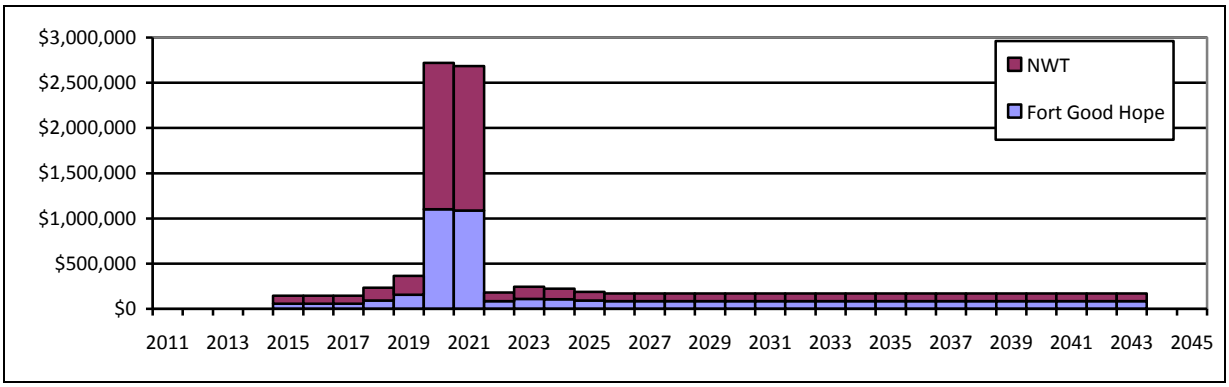
Oil production would also generate benefits for the NWT in terms of corporate taxes, as well as any profits that are retained by companies that are based in the NWT. Assuming that corporate taxes would be equivalent to 3% of gross revenues (GNWT 2000), oil development in Ts'ude niline Tu'eyeta could generate an average of about $0.4 million per year in corporate tax payments. Total retained profits have been estimated based on 10% of gross revenues (or $1.2 million per years) and it is assumed that GNWT-based businesses would retain 20% of these profits.

From a Canadian perspective, the incremental labour income benefits exploration, drilling and pipeline activities associated with oil development in Ts'ude niline Tu'eyeta would be the same as for the NWT, as this represents income received by workers who would otherwise be unemployed or under-employed. Oil production would also generate royalty income for the Federal Government (AANDC)[13], federal corporate income tax[14], and profits for Canadian based companies. Based on the production assumptions for Ts'ude niline Tu'eyeta, payments to the Federal Government could average $1.7 million per year.

It is assumed that residents of Fort Good Hope will account for 20% of total employment during exploration, drilling and pipeline construction, based on the skills required for oil development and the current capabilities of the local residents. With an unemployment rate of 28.3% in Fort Good Hope 2006, it is assumed that 30% of income earned by regional residents can be counted as new or incremental income. Community residents could account for 50% of all production jobs. Some companies in Fort Good Hope are expected to provide goods and services needed to support oil development and their retained profits would also be a benefit. It is assumed that companies in Fort Good Hope would account for 10% of the retained profits of all GNWT-based businesses. Figure 3-8 shows the incremental labour income stream for Fort Good Hope and the NWT, assuming that all phases of oil development – exploration, drilling, pipeline construction and production – actually proceed as assumed.

[13] Royalty payments for oil are estimated to be the greater of 30% of net revenues or 5% of gross revenues after project payout (Aboriginal Affairs and Northern Development Canada, 2008).
[14] Corporate federal taxes are assumed to account for 9% of gross revenues (GNWT 2000).

Figure 3-8: Incremental Labour Income Potentially Associated with Oil Development in Ts'ude niline Tu'eyeta



3.1.8 Summary of Benefits and Costs

Based on available information about the size of reserves and the costs of development, it is expected that some oil development will occur in Ts'ude niline Tu'eyeta if area is made available for exploration and development. While this development is expected to happen relatively soon because of the high world oil prices, the declining production from the Norman Wells, and available capacity in the Norman Wells pipeline, the ultimate production of oil will depend on discovering oil reserves that are large enough to be financially viable and to support the cost of constructing a pipeline connection to Norman Wells.

The economic benefits of oil development have been calculated assuming that oil exploration and production occurs according to the timeline set out in Section 3.1.3 and based on the cost and revenues assumptions presented above. Table 3-2 summarizes these benefits for the period from 2011 to 2045 in terms of total benefits at full value (undiscounted) and discounted using rates of 3.0% and 7.0%.

Assuming a discount rate of 7.0%, the net present value (NPV) of the future stream of incremental labour income and other benefits associated with oil development in Ts'ude niline Tu'eyeta over the period to 2065 is estimated to be $27.4 million for Canada, of which $8.8 million will occur in the NWT, and $2.1 million will accrue to residents of Fort Good Hope.

Table 3-2 shows that, of the $27.4 million in benefits from oil development in Ts'ude niline Tu'eyeta that accrue to Canada, nearly one-third (31%) would be in the form of retained profits for Canadian companies ($8.5 million), another 28% would be from Federal corporate taxes ($7.6 million), and 15% would be from royalties ($4.2 million). About 32% of the benefits of oil development in Ts'ude niline Tu'eyeta would accrue to the government and people of the NWT. Residents of Fort Good Hope are expected to account for 24% of the incremental labour income and other benefits experienced in the NWT.

Table 3-2: Present Value of Economic Benefits Associated with Oil Development in Ts'ude niline Tu'eyeta

Benefit	Undiscounted	Discounted (3.0%)	Discounted (7.0%)
NPV of Benefits for Canada (millions)			
Labour Income	$10.3	$7.1	$4.5
Royalties	$15.0	$8.4	$4.2
Canadian taxes	$27.0	$15.2	$7.6
NWT taxes	$9.0	$5.1	$2.5
Retained profits	$30.0	$16.9	$8.5
Total	$91.3	$52.7	$27.4
NPV of Benefits for NWT (millions)			
Labour Income	$10.3	$7.1	$4.5
NWT taxes	$9.0	$5.1	$2.5
Retained profits	$6.0	$3.4	$1.7
Total	$25.3	$15.5	$8.8
Percent of Canada	28%	29%	32%
NPV of Benefits for Fort Good Hope (millions)			
Labour Income	$4.53	$3.04	$1.92
Retained profits	$0.60	$0.34	$0.17
Total	$5.13	$3.38	$2.09
Percent of NWT	20%	22%	24%

3.2 Natural Gas Development

According to the recent study by Drummond (2010) there are estimated to about 213 billion cubic feet (5,987 billion cubic metres) of undiscovered recoverable natural gas within the boundaries of the Ts'ude niline Tu'eyeta Candidate Protected Area. The location of these reserves in provided in Figure 3-9.

No natural gas has yet been discovered in the Ts'ude niline Tu'eyeta Candidate Protected Area. According to Drummond (2010) there is an 80% probability the undiscovered recoverable gas is in the range of 2.47 to 10.53 billion cubic metres (92 to 363 billion cubic feet), with an average (mean) of 5.99 billion cubic metres (212.5 billion cubic feet) at a probability of 39%. The Kee Scarp/ Ramparts carbonate play is estimated to have the largest potential volume of natural gas (62.9 billion cubic feet or 1,772 million cubic metres) and this represents 29.6% of total estimated ultimate natural gas potential. The top four gas plays possibly have large enough undiscovered resources to be considered for exploration.

The 213 billion cubic feet of potentially recoverable oil reserves in Ts'ude niline Tu'eyeta represents 1.4% of recoverable discovered and undiscovered natural gas reserves in the entire Mackenzie Valley (Drummond, 2011).

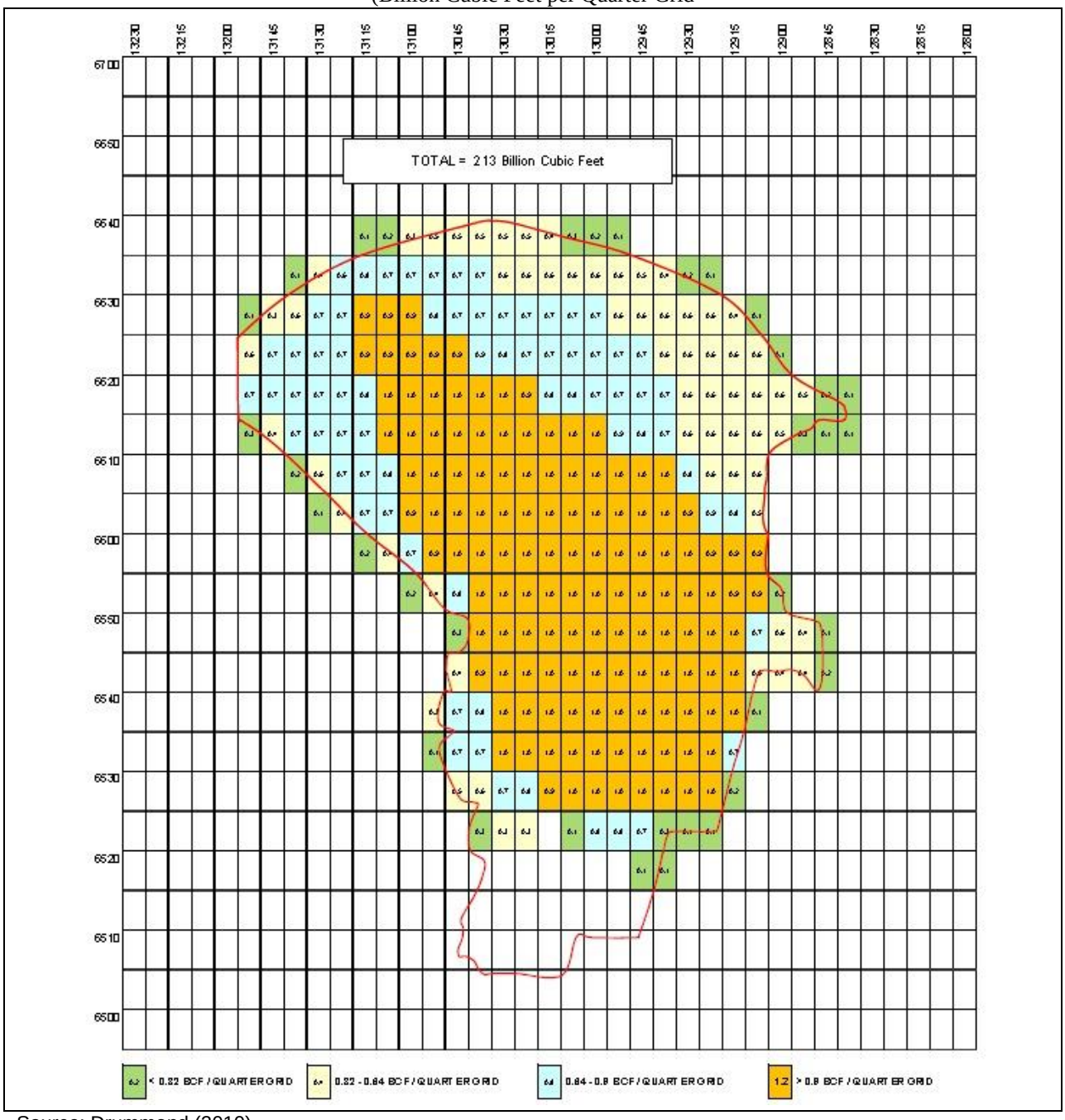
3.2.1 Development Potential and Timing

It is unlikely that the natural gas deposits in the Ts'ude niline Tu'eyeta area will be delineated or explored until such time as a pipeline has been constructed to take natural gas to southern

markets. At the present time, there is no such pipeline. However, this would change with construction of the proposed Mackenzie Gas Project, as this pipeline would parallel the Mackenzie River and pass just east of the Ts'ude niline Tu'eyeta area.

Figure 3-9: Location of Undiscovered Recoverable Natural Gas Reserves in the Ts'ude niline Tu'eyeta Candidate Protected Area

(Billion Cubic Feet per Quarter Grid



Source: Drummond (2010)
Notes: Oil potential is shown in terms of quarter grids which consist of 1/8 of one degree of longitude and 1/12 of one degree of latitude, an area of approximately 36 km^2.

The current proposal for the pipeline is to have construction begin by December 31, 2015 and operational by early 2019 so that proven reserves in the Mackenzie Delta owned by partners in the Project can be moved to market. Although the project was approved by the National Energy Board in December 2010, the timing for actually commencing construction of the pipeline will depend on world natural gas prices which will need to be on the order of $8 per Mcf (or $7.60 per gigajoule [GJ]) in order to make the project financially viable. Recent reductions in natural gas prices may be cause for additional delays in producing northern gas reserves. As noted in **Error! Not a valid bookmark self-reference.**, natural gas prices did rise above $7.60 per GJ in 2005 and 2008 but have since dropped below $5 per GJ.

Figure 3-10: Conventional Natural Gas Price Forecast (AECO Natural Gas, Real Dollars)

Source: AJM Petroleum Consultants, 2010

Underground storage of natural gas in the US rose to an all time high in October 2009 and, as a result, natural gas for November delivery fell to US$4.49 per 1,000 cubic feet in New York (Associated Press, 2009). This is equivalent to about Cdn$4.70 per GJ. The expectation is that, until demands increase substantially, low gas prices are expected for the near future. It is unclear how these recent drops in natural gas prices will affect the development schedule for a northern gas pipeline.

For purposes of this assessment, it is assumed that the pipeline construction will be completed in time to commence operations in 2020. Given that producers will want to move discovered gas to markets as quickly as possible, in order to cover costs they have already incurred to discover the gas, it is unlikely that the Mackenzie Gas Project pipeline will have capacity to accommodate as yet undiscovered gas from other fields. An assessment of the Mackenzie Gas Project for the GNWT (Wright Mansell Research Ltd. 2007) suggested that 5.5 trillion cubic feet (Tcf) can be produced by the three "anchor fields" that underpin the application to construct the pipeline (Case 1). It suggested that another 3.43 Tcf of natural gas can be produced from other fields already discovered in the Mackenzie Delta as well as from several new discoveries (Case 2). The assessment examined two additional cases which assumed that additional discoveries will be

made in the later years of the project and will allow the pipeline to continue to operate near capacity for 12 to 13 years after the pipeline has commenced operating because production from known reserves will start to decline.

Consequently, it is unlikely that gas from the Ts'ude niline Tu'eyeta area would be of interest until after 2035, suggesting the window for development is more than 20 years away. However, even this date may be optimistic given that the expected volumes of gas at Ts'ude niline Tu'eyeta are relatively small when compared to potential reserves in other parts of northern Canada. A more realistic assessment for developing natural gas in Ts'ude niline Tu'eyeta might be 25 or 30 years into the future.

3.2.2 Natural Gas Development Scenario

As noted in Section 3.1.2, it is assumed that oil exploration in Ts'ude niline Tu'eyeta would commence in 2015 and it is expected that exploration activities would seek to identify both oil and natural gas at the same time in each of the land blocks. And, while exploratory drilling might identify and delineate both oil and natural gas, the development of any natural gas finds would be delayed until 2035, when capacity becomes available in the Mackenzie Gas Pipeline. Any natural gas deposits identified during the initial phase of exploration would be shut in until additional exploration and drilling identifies reserves that are themselves commercially viable and collectively sufficient to warrant construction of a pipeline connection to the Mackenzie Valley Pipeline.

Thus, it is assumed that three of the exploratory wells drilled in the period from 2015 to 2020 would have identified financially-viable, recoverable natural gas reserves and these would have been shut-in. Based on the availability of capacity in the Mackenzie Valley Pipeline, it is assumed that a second Call for Bids would be issued in 2029 on the 13 land blocks that have the greatest natural gas potential. Exploration, including geophysical studies and drilling would occur from 2030 to 2039, with construction of surface production facilities starting in 2034 and construction of the connecting pipeline to the Mackenzie Valley Pipeline commencing in 2035. This would allow production from the wells to commence in 2037, with production lasting 20 years.

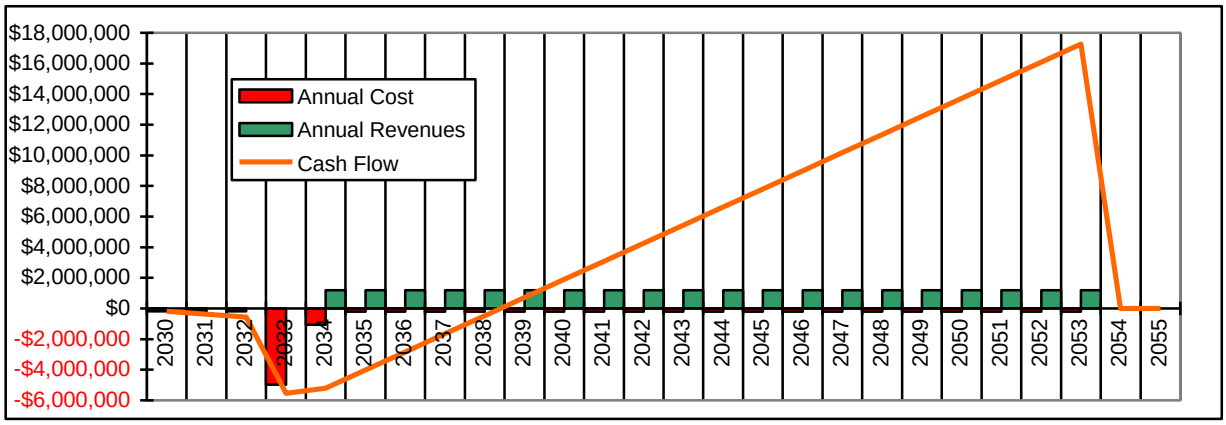
While the high costs of heating fuels costs in Fort Good Hope may spur interest in finding and developing alternative fuel sources like natural gas, as happened in Inuvik (Enbridge Inc., 1999), this is unlikely to occur in Ts'ude niline Tu'eyeta sooner than 2037 because of the relatively high costs of building a connector pipeline and the relatively small local market, although this could change if a major mineral development that requires natural gas were to be developed. The more likely scenario is that natural gas for the local markets will be withdrawn from the Mackenzie Valley Pipeline once complete.

3.2.3 Costs of Development

Development of natural gas would commence with the Call for Bids and, as noted in Section 3.1.3, the average bid on lands closest to Ts'ude niline Tu'eyeta were on the order of $137 per hectare. However, the assessment of the commercial viability of oil drilling suggested that bids of $50 per hectare are more likely, given the size of the reserves and the costs of development. At $50 per hectare, the companies bidding on the 13 blocks would commit to spending $55.7 million on exploration over the following nine years. This would suggest $22.3 million on geophysical activities and up to $33.4 million for exploratory drilling, if drilling occurs on all 13 blocks.

For an individual company, the $50 per hectare suggests a commitment of $4.3 million. This would be sufficient to allow $1.7 million for geophysical activities and $3.8 million for drilling one well.[15] Assuming that gas deposits are found, development of surface facilities, including a gas plant, will be equivalent to 45% of the costs for drilling. Average annual operating costs are assumed to be 4% of capital costs. Based on these costs, and assuming a price of $8 per Mcf (the price necessary for construction of the Mackenzie Valley Pipeline), a natural gas deposit could be financially feasible if 3.0 Bcf of natural gas could be extracted over 20 years. This would generate a pre-tax internal rate of return (IRR) of 11% (see Figure 3-11). The IRR would drop to 5% if only 2.5 Bcf could be recovered but would increase to 15% for 3.5 Bcf.

Figure 3-11: Cash Flow Analysis on Gas Development in Ts'ude niline Tu'eyeta



To put these numbers into perspective, the average recoverable natural gas per quarter grid, as shown in Figure 3-9, is about 1.0 Bcf. Thus, natural gas development in Ts'ude niline Tu'eyeta only appears to be financially feasible if drilling identifies recoverable natural gas reserves that are significantly larger (triple) than the estimated average for the area. It should be noted that the discovered natural gas reserves in the Cameron Hills (which accounted for 32.8% of total natural

[15] This assumes that gas deposits are found at a depth of 1,500 metres and an average drilling cost of $2,500 per metre, as per Section 3.1.3.

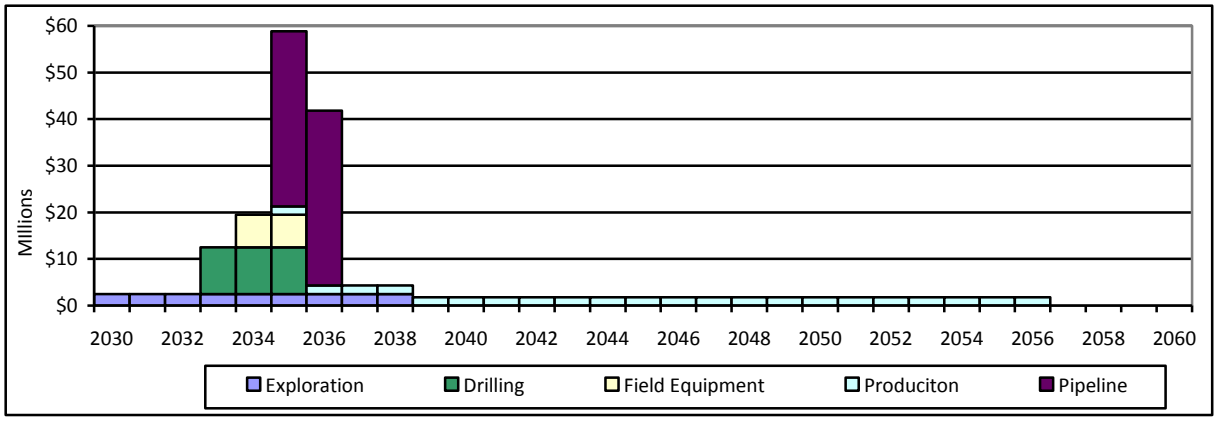
gas production in the NWT from 2006 to 2010) were determined to be 53.2 Bcf (Drummond 2011).

The natural gas scenario assumes that, while exploration would occur on all 13 blocks, exploratory drilling would occur on eight of the land blocks because the results of the geotechnical studies on the other five land blocks information do not warrant drilling. It is assumed that, by 2035, five of the new exploratory wells would prove commercially viable for gas, such that production of the three shut-in wells and the five new wells could shortly thereafter. It is assumed that these eight wells would each produce 3.0 million Mcf, for a total of 24 Bcf. This represents 11% of the 213 Bcf of undiscovered recoverable natural gas in Ts'ude niline Tu'eyeta.

Transportation of natural gas from Ts'ude niline Tu'eyeta to the Mackenzie Valley Pipeline would entail some additional costs. It is estimated that the cost of constructing this pipeline would be about $75 million, based on 75 kilometres of pipeline and an average cost of $1 million per kilometre of pipeline. As noted earlier, there is only one example of a small diameter gathering pipeline in the NWT and the average cost of the Inuvik Gas Project, which was built in 1999, is about $1 million per kilometre of pipeline, when adjusted for inflation.

Under this scenario, the total cost of natural gas development in Ts'ude niline Tu'eyeta is estimated to be $180.1 million. This includes $22.3 million for geophysical activities, $30.0 million for drilling, $14.1 million for surface production equipment, $75.0 million for a connector pipeline, and $38.9 million on operations over 20 years. The total revenue from eight wells producing a total of 24 Bcf over 20 years is estimated to be $192.0 million. The overall pattern of expenditures for oil development over the 40 years would be as shown in Figure 3-12.

Figure 3-12: Natural Gas Development Cost Scenario for Ts'ude niline Tu'eyeta, 2030 to 2060



Given the costs of development and production, production from eight wells at 3 Bcf per well is necessary if revenues from natural gas production are to exceed costs. Thus, there is an

important threshold effect if natural gas is to be produced from Ts'ude niline Tu'eyeta. Production of about 1.2 Bcf of natural gas per year will be required to generate sufficient revenues to cover the costs of development, operations and pipeline transportation. If annual and total potential production cannot yield this amount, there will not be sufficient reserves to support the construction and operation of the connector pipeline and, without the pipeline, any identified reserves would be shut-in until prices and/or natural gas volumes make pipeline construction financially feasible.

3.2.4 Impacts of Natural Gas Development on the NWT

The territorial impacts of natural gas development in the Ts'ude niline Tu'eyeta area were estimated using the most recent economic multipliers from the GNWT (Northwest Territories Bureau of Statistics, 2011a). Estimates of the potential direct and indirect economic impacts associated with exploration were estimated using multipliers for the professional, scientific and technical services industry. The potential economic impacts associated with development (drilling and pipeline construction) were calculated using multipliers for the oil and gas extraction industry. The economic impacts of production were estimated using the multipliers for the pipeline transportation industry. The impacts of constructing the pipeline were estimated using multipliers for the construction industry. Based on the costs and revenues described in Section 3.2.3, the resulting impacts on the economy of the NWT are summarized in Table 3-3.

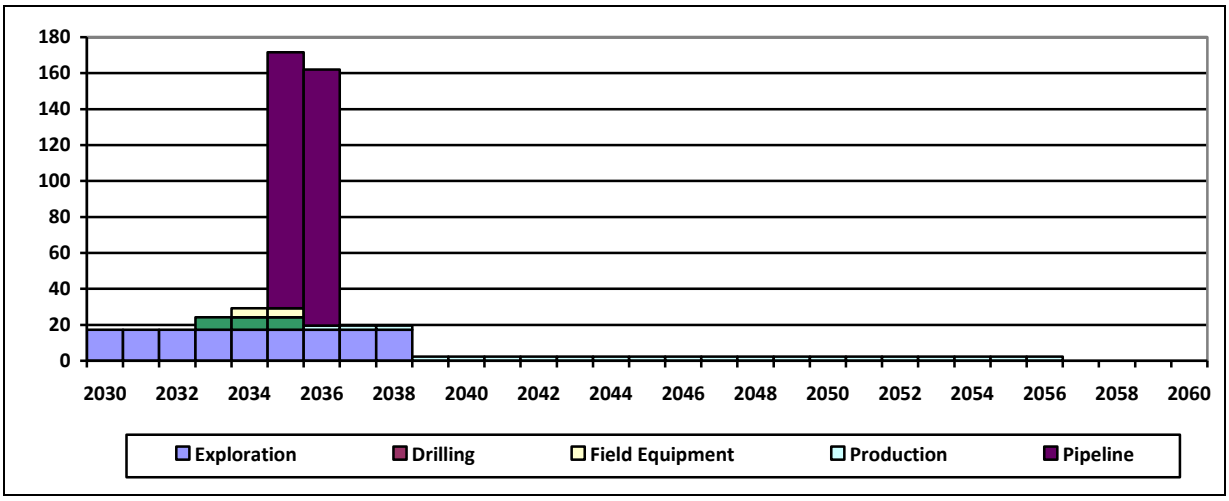
Table 3-3: Impact of Natural Gas Development in Ts'ude niline Tu'eyeta on the Economy of the NWT

		Exploration	Drilling and Field Equipment	Pipeline Construction	Production
Cost (millions)		$22	$44	$75	$37
Years		9	3	2	20
Direct and Indirect GDP (millions)	Total	$14	$40	$35	$28
	Annual	$1.6	$15.5	$17.3	$1.4
Direct and Indirect Labour Income (millions)	Total	$12	$3	$25	$4
	Annual	$1.3	$1.2	$12.4	$0.2
Direct and Indirect Employment (jobs)	Total	156	31	285	48
	Annual	17.3	11.9	142.5	2.4

Table 3-3 shows that the overall economic effect of natural gas development in Ts'ude niline Tu'eyeta would be a small increase in employment in the NWT (17 jobs per year) for the nine years of exploration, and 11.9 jobs per year for drilling and installation of field equipment. Pipeline construction would involve another 142.5 jobs for each of the two years needed for construction. Employment would then drop to about 2.4 person-years per year during production.

The overall effect of natural gas development on employment in the NWT is shown in Figure 3-13, and shows that, after an initial flurry of economic activity during exploration, drilling and construction, natural gas development will create very little long term employment.

Figure 3-13: Direct and Indirect Employment Associated with Natural Gas Development in Ts'ude niline Tu'eyeta, 2030 to 2060



3.2.5 Opportunities for Local Employment

As was the case for oil development, development of natural gas reserves in the Ts'ude niline Tu'eyeta area is also unlikely to generate major employment or business opportunities for local or regional residents because much of the work involved in exploration and pipeline construction is highly specialized or technical and short-term. Few if any local or regional residents are currently qualified for this work and the exploration and construction phases of natural gas development are likely too short to encourage residents of Fort Good Hope to train for these specialized jobs. For these reasons, the best opportunities for employment of local and regional residents are as labourers during exploration and construction, land clearing, camps and catering to drilling crews, and in various other service industries. For the exploration and pipeline construction phases, up to 20% of total employment are assumed to involve residents of Fort Good Hope. Gas production and operation of the gas pipeline and compressor stations will provide employment opportunities for 20 years and directly and indirectly create the equivalent of 1.6 new jobs per year. However, it is expected that half of these jobs will be located in Norman Wells, which currently has people with specialized skills in the petroleum industry, with the other half being available for residents of Fort Good Hope.

3.2.6 Potential Environmental Concerns

Natural gas development has many of the same environmental concerns as oil development. For exploration, the key environmental issues again relate to seismic activity, with causes problems related to habitat fragmentation and noise, and drilling, which can add to fragmentation issues, generates noise and light pollution during drilling, and can produce potentially hazardous drilling fluids that require disposal. The construction of pipelines requires land clearing that can cause

erosion and sedimentation problems, affect wildlife movement and migration, and further fragment habitat.

During operations, the potential implications of accidental releases are much less than for oil (unless it is sour gas). However, the petroleum industry has developed standard practices that will minimize these effects. The probability of large accidental releases of natural gas is very low. As noted previously, AEUB (2007) statistics indicate that 96% of releases in Alberta were less than 100 cubic metres. In addition, available information shows an average of 1.5 natural gas releases from all causes per 1000 kilometres of pipeline, suggesting a maximum probability of 0.11 incidents per year for a 75 kilometre oil pipeline, or one event every 8.9 years, although the actual probability would be less because the pipeline would be new. The environmental damage associated with natural gas releases would be minimal because the natural gas would dissipate into the environment and, in a worst case scenario, would be ignited and burnt according to the terms of approved emergency response plans.

For Ts'ude niline Tu'eyeta, the greatest concerns relate to the disruption of wetland areas used by migratory birds, although this can be minimized by conducting exploration and construction during the winter months. Another concern for Ts'ude niline Tu'eyeta could relate to the fragmentation of key Woodland caribou habitat and the possibility of increased predation. It is estimated that drilling eight natural gas wells would result in disturbance of 8 hectares of land for drilling operations plus additional habitat losses where access roads and pipelines are constructed. Assuming a corridor width of 10 metres, development of 75 kilometres of pipeline would result in the loss of 75 hectares of land. An equivalent amount of habitat would be lost due to road construction. Thus, at full development, about 160 ha of habitat would be lost, with most of this consisting of linear developments (seismic lines, roads and pipeline corridor) that would cause habitat fragmentation.

3.2.7 Potential Benefits and Costs

For the GNWT, it is assumed that some natural gas drilling and production employment would be incremental to expected future economy activity and could be counted as benefits. However, the employment effects shown in Figure 3-13 include both direct and indirect employment resulting from gas development and spin-off effects (indirect employment) are not normally included in a benefit-cost analysis. As noted previously, available information for the NWT does not allow differentiation of direct and indirect effects so, for purposes of this analysis, it is assumed that direct employment accounts for 75% of the overall employment effects shown in Figure 3-13.

The territorial labour income benefits would generally follow the same pattern as in Figure 3-13 although the average annual labour income by drillers ($100,000)[16] is higher than for workers doing exploration ($74,286) or production ($92,308). The actual amount of labour income that can be counted as a benefit will depend on the extent to which unemployed and underemployed labour is employed by natural gas development. It is assumed that most workers doing short-term activities like exploration and construction would be otherwise employed on a similar project elsewhere in the NWT. However, it is assumed that 15% these workers would be otherwise unemployed, based on the observation that, in 2009, the NWT had an unemployment rate of 10.3%, and that 16.5% of the labour force in the Sahtu Region and 28.3% of the labour force in Fort Good Hope were unemployed. Thus, it is assumed that the income earned by these workers could be counted as new or incremental income. As pipeline operations would generate new long-term employment, it is assumed that all associated labour income can be counted as a project benefit.

Gas production will generate some corporate taxes and retained profits for the NWT government and NWT-based companies. NWT corporate taxes have been calculated based on 3% of gross revenues (GNWT 2000) and would generate about $0.3 million per year. Total retained profits have been estimated based on 10% of gross revenues (or $1.0 million per year) and it is assumed that GNWT-based businesses would retain 20% of these profits.

From a Canadian perspective, the incremental labour income benefits would be the same as for the NWT. Natural gas production would also generate royalty income for the Federal Government (AANDC)[17], federal corporate income tax[18], and profits for Canadian based companies. Based on the natural gas production assumptions for Ts'ude niline Tu'eyeta, payments to the Federal Government could average $1.3 million per year.

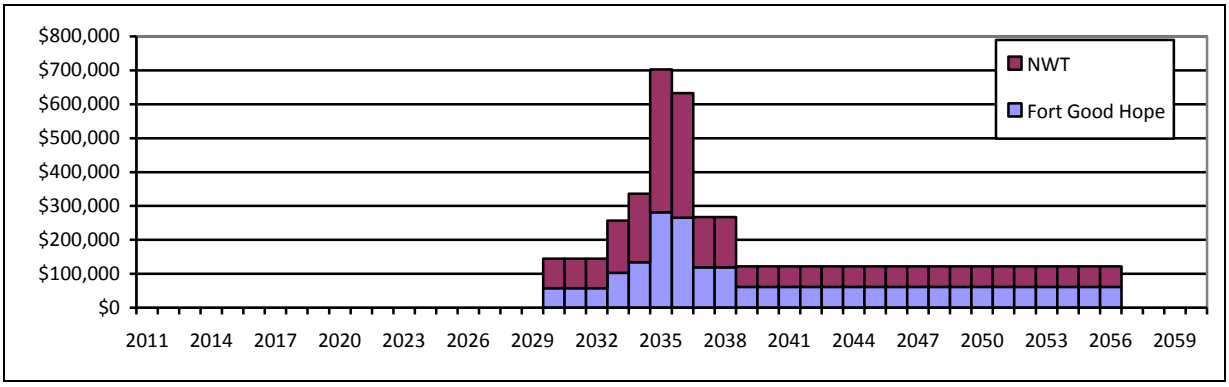
Figure 3-14 shows the incremental labour income stream for Fort Good Hope and the NWT, assuming that all phases of natural gas development – drilling and development, pipeline construction and production – actually proceed as assumed.

It is assumed that residents of Fort Good Hope will account for 20% of total employment during exploration, development and pipeline construction, based on the current capabilities of the local residents and the skills required for natural gas development. With an unemployment rate of 28.3% in Fort Good Hope 2006, it is assumed that 30% of income earned by community residents can be counted as new or incremental income. Community residents are assumed to account for 50% of all operational jobs. Some companies in Fort Good Hope are expected to

[16] Average income is estimated by dividing the expected direct and indirect labour income resulting from a $1 million in new industry activity by the new direct and indirect employment that would occur. Data are taken from the NWT Bureau of Statistics (2011a).
[17] Royalty payments for oil are estimated to be the greater of 30% of net revenues or 5% of gross revenues after project payout (Aboriginal Affairs and Northern Development Canada, 2008).
[18] Corporate federal taxes are assumed to account for 9% of gross revenues (GNWT 2000).

provide goods and services needed to support natural gas development and their retained profits would also be a benefit. It is assumed that companies in Fort Good Hope would account for 10% of the retained profits of all GNWT-based businesses.

Figure 3-14: Incremental Labour Income Potentially Associated with Natural Gas Development in Ts'ude niline Tu'eyeta



3.2.8 Summary of Benefits and Costs

Although there are some recoverable natural gas reserves in Ts'ude niline Tu'eyeta, it is expected that actual drilling and development of these reserves will not occur until after the Mackenzie Valley Pipeline has been constructed and can provide a means of conveying this gas to southern markets. While some identification of natural gas deposits will occur as part of oil exploration activities, it is expected that extensive exploration, drilling and development will not occur until 2030, with potential production commencing in 2037 once there is capacity in the Mackenzie Valley Pipeline.

The economic benefits of natural gas development have been calculated assuming that this development occurs according to the schedule described above and based on the various cost and revenues assumptions. Table 3-4 summarizes these benefits for the period from 2011 to 2060 in terms of total benefits at full value (undiscounted) and discounted using rates of 3.0% and 7.0%. Assuming a discount rate of 7.0%, the net present value (NPV) of the future stream of incremental labour income and other benefits associated with natural gas development in Ts'ude niline Tu'eyeta over the period to 2065 is estimated to be $5.7 million for Canada, of which $1.7 million will occur in the NWT, and $0.4 million will accrue to residents of Fort Good Hope. These values are lower than for oil development (Table 3-2) because natural gas development is assumed to occur much later so the values are more heavily discounted.

Table 3-4 shows that, of the $5.7 million in benefits of natural gas development in Ts'ude niline Tu'eyeta that accrue to Canada, 32% would be in the form of retained profits for Canadian companies ($1.8 million), another 29% would be from Federal corporate taxes ($1.6 million), and 16% would be from royalties ($0.9 million). About 30% of the benefits of oil development in Ts'ude niline Tu'eyeta would accrue to the government and people of the NWT. Residents of

Fort Good Hope are expected to account for 23% of the incremental labour income and other benefits experienced in the NWT.

Table 3-4: Present Value of Economic Benefits Associated with Natural Gas Development in Ts'ude niline Tu'eyeta

Benefit	Undiscounted	Discounted (3.0%)	Discounted (7.0%)
NPV of Benefits for Canada (millions)			
Labour Income	$5.0	$2.2	$0.8
Royalties	$9.1	$3.3	$0.9
Canadian taxes	$16.4	$5.9	$1.6
NWT taxes	$5.5	$2.0	$0.5
Retained profits	$18.2	$6.6	$1.8
Total	$54.2	$19.9	$5.7
NPV of Benefits for NWT (millions)			
Labour Income	$5.0	$2.2	$0.8
NWT taxes	$5.5	$2.0	$0.5
Retained profits	$3.6	$1.3	$0.4
Total	$14.1	$5.4	$1.7
Percent of Canada	26%	27%	30%
NPV of Benefits for Fort Good Hope (millions)			
Labour Income	$2.2	$1.0	$0.3
Retained profits	$0.4	$0.1	$0.0
Total	$2.6	$1.1	$0.4
Percent of NWT	18%	20%	22%

3.3 Lead-Zinc Mine Development

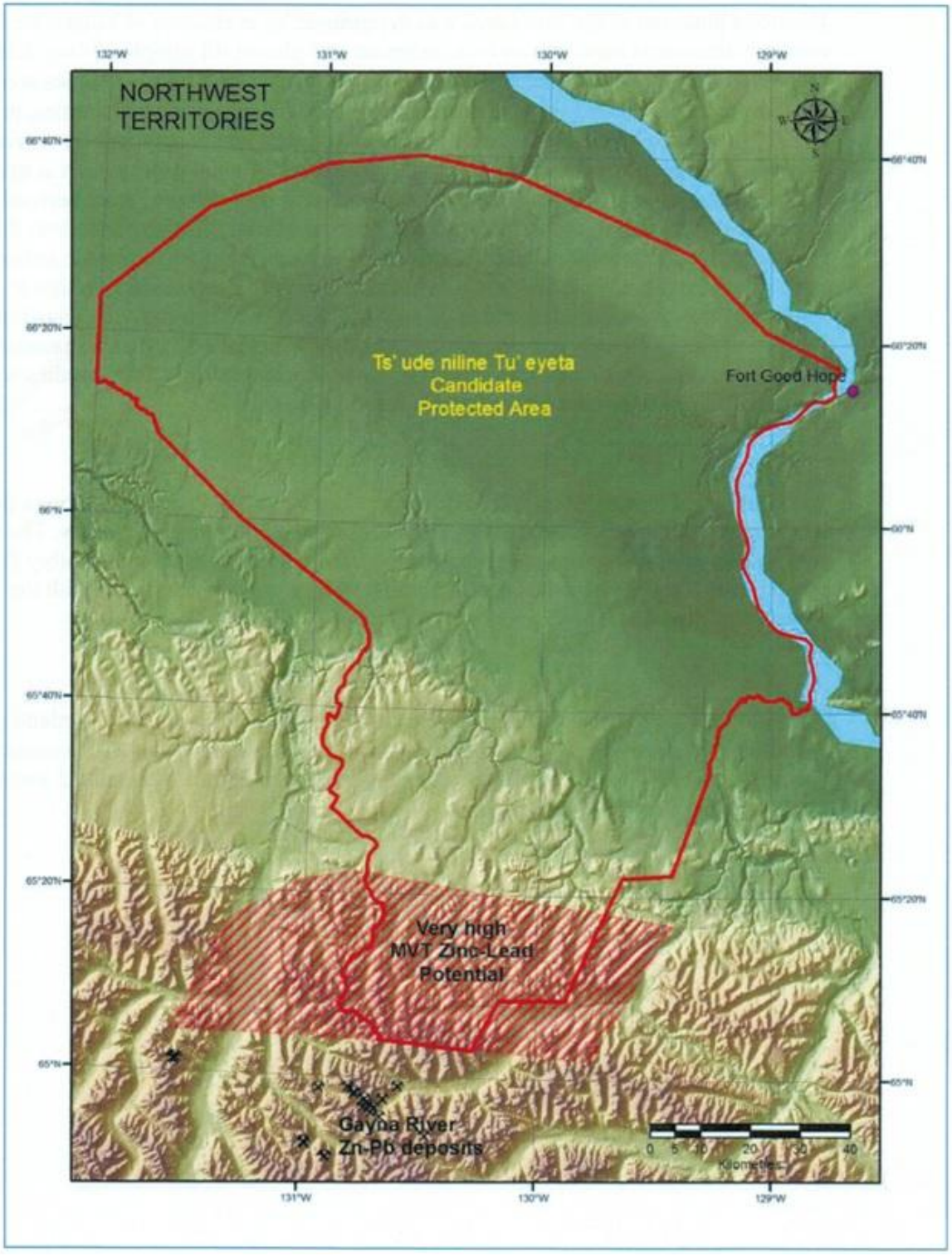
The recent study by Ozyer (2010) determined that there is a very high potential for Mississippi Valley Type (MVT) lead-zinc along the north facing slopes of the Mackenzie Mountains at the south end of the Ts'ude niline Tu'eyeta Candidate Protected Area. These areas are shown in Figure 3-15. While potential for mineral development exists, the exact location of economically viable deposits is unknown and will require extensive exploration to identify and delineate these deposits. It is possible that more than one mine could be developed.

In terms of the reliability of the assessment of lead-zinc potential, the Northwest Territories Ozyer (2010) classified the mineral potential for Ts'ude niline Tu'eyeta as being:

- A2 (very high potential based on a moderate amount of information) for MVT zinc-lead deposits,
- D3 (moderate potential based on some information) for SEDEX zinc-lead deposits (in the Mackenzie Mountains)

As noted by Ozyer (2010), the Gayna River deposits, which are located just south of Ts'ude niline Tu'eyeta, are considered to be one of the world's largest undeveloped zinc-lead properties.

Figure 3-15: Summary of MVT Zinc-Lead Potential in the Ts'ude niline Tu'eyeta Candidate Protected Area



Source: Adapted from Ozyer (2010)

3.3.1 Development Potential and Timing

Despite the very high potential for zinc-lead development in Ts'ude niline Tu'eyeta, it is difficult to predict when or even if mineral development would occur. At present, the NWT does not have an operating zinc-lead mine although the proposed Prairie Creek mine, which is located within the same region, is being pursued. The proponent, Canadian Zinc Corporation, has submitted applications to the Mackenzie Valley Land and Water Board for operating permits for the Prairie Creek mine (Canadian Zinc Corporation 2011) and the environmental review process is still underway. Interest in re-opening the Prairie Creek mine was precipitated by increases in base metal prices in 2006 and 2007 (see Figure 3-16). However, zinc and lead prices then declined dramatically (by 80%), dropping to lows of about $0.50 US per pound in late 2008. Since then, prices have begun to recover, and are currently in the range of $1.00US to $1.20US per pound. It is possible that rising prices may once again raise interest in mineral exploration in the NWT, possibly leading to mineral development in the Ts'ude niline Tu'eyeta region.

Figure 3-16: Zinc and Lead Prices, March 2001 to January 2011

Source: Global InfoMine.com (2011)

However, the greatest challenge to mineral development in the Sahtu Region is the current lack of physical infrastructure (power and roads). The NWT is home to the world's largest undeveloped zinc deposit at Howard's Pass in the Sahtu Region. In 2009 the Mackenzie Valley Review Board approved an application to drill up to 100 exploratory holes over a five-year period to further explore and define sub-surface zinc and lead resources on claims and leases. The activities will primarily be helicopter supported and the developer will create up to 10 km of new access trails for the project activities (Mackenzie Valley Review Board, 2009). It is expected that the same challenges related to infrastructure will be faced by any company wishing to explore for and/or develop the zinc-lead resources in the Ts'ude niline Tu'eyeta region.

Ultimately, development of a mine in the Ts'ude niline Tu'eyeta region would require construction of a year-round access road so that ore or concentrates can be moved to market on a daily or weekly basis. The cost of such a road is unknown, but current estimates for completion of the Mackenzie Highway from Wrigley to the Dempster Highway average about $1.5 million per kilometre (excluding major bridges) (NWT Department of Transportation 2009). On that basis, construction of a year round road from the Dempster Highway to a mine site in the Mackenzie Mountains in the vicinity of Ts'ude niline Tu'eyeta would cost about $525 million. Once the Mackenzie Highway to Norman Wells is completed, the cost of constructing an all weather road to a mine site would be less ($270 million) but this estimate does not include the cost of a bridge across the Mackenzie River. Thus, mine development in the region is highly unlikely unless zinc lead discoveries are more than adequate to cover the costs of constructing and operating the mine and access road.

3.3.2 Lead-Zinc Mine Development Scenario

It is expected that, based on the recent information on potential zinc-lead deposits in the region, exploration for minerals would commence once the boundaries of the Ts'ude niline Tu'eyeta Protected Area have been finalized, and assuming that base metal prices continue to increase as the global recovery continues. Thus, exploration could be expected to commence by 2015, and would consist of geophysical surveys, geochemical surveys, sampling and diamond drilling. This work could be accomplished without having to construct a road into the area. It is expected that, because of the remoteness of the area and because most of the exploratory work in the NWT will focus on gold and other high valued minerals, exploration for zinc-lead deposits in Ts'ude niline Tu'eyeta activities would occur in small amounts over an extended period of time.

It is estimated that the construction of an operating mine in the Ts'ude niline Tu'eyeta area would not be likely until about 2050 at the very soonest. Development of a mine presumes that metal prices and the discovered reserves are adequate to more than offset the cost of construction and operating the mine and an access road. This timeline is predicated on 25 years of exploratory drilling and delineation of ore bodies, followed by three years of conducting the requisite environmental studies, obtaining all the necessary permits, and negotiating an agreement with the Sahtu Dene and Métis people. Construction of an access road would take about five years while construction of the mine and processing plant would require another two years. With this sequencing, operations could start in 2052. While the operational life of the mine could range from 10 to 20 years, a 15-year mine life has been assumed.

3.3.3 Costs of Development

The costs of exploration and development for a lead-zinc mine were drawn from a recent report on mining and exploration in the Northwest Territories (Northwest Territories Industry Tourism and Investment, 2008). According to the report, $2.5 million was spent on activity related to exploration permits in 2007, $13.4 million related to claims, and $112.2 million on exploration and deposit appraisal, for a total of $128.1 million. In that same year a total of 17.08 million

hectares were subject to a mineral permit or claim. Thus, annual expenditures on exploration appear to amount to $7.50 per hectare or $750 per square kilometre. Given that there are about 1,166 square kilometres in the proposed Ts'ude niline Tu'eyeta area that have moderate potential for lead-zinc, this suggests annual spending of $0.9 million per year. However, given the high cost of access to the area and the attractiveness of other lead-zinc deposits in the region, it is assumed that annual exploration costs in the Ts'ude niline Tu'eyeta area would be only half this amount and that exploration would occur over 25 years. Thus, total exploration costs would be about $10.9 million.

The ultimate costs of developing the mineral resources in Ts'ude niline Tu'eyeta will depend on the size of the ore body, the concentrations of lead, zinc and other minerals, and the size of operation needed to cost-effectively mine these reserves. In the absence of specific development proposals, the Prairie Creek zinc–lead mine offers a possible analogue for estimating the costs of mine construction and mineral development in Ts'ude niline Tu'eyeta. The Prairie Creek mine would be similar to a mine in Ts'ude niline Tu'eyeta for a number of reasons:

- The ore body being mined includes cavity infill sulphides (MVT) which are similar to the deposits found in the Mackenzie Mountains in the vicinity of Ts'ude niline Tu'eyeta.
- It has the same operational constraints, including having to truck ore concentrates to load out facilities on rail lines at Fort Nelson (BC Rail) or Hay River (CP Rail), constructing an all-weather road, and relying on diesel generated electric power.

The Prairie Creek mine was originally developed as a 1,000 ton per day mill and 200-person work camp in 1981, for an amount estimated to be about $100 million in 2000 dollars. Cost information from the Canadian Zinc Corporation showed that, in 2000, it needed to invest another $40 million to construct a road and have the mill operating at capacity, including a workforce of 155 people working 12-hour shifts, seven days and week for four weeks. In 2010, construction of a similar sized mine is estimated to cost $175 million. This mine is relatively small, based on expectations for development of the zinc deposit at Howard's Pass, and there would be economies of scale in constructing and operating a larger mining operation. However, without cost information for a larger operation, this assessment employs the cost information for the Prairie Creek mine.

The cost of permitting and approvals is estimated to equal to 5%of capital costs, or $8.8 million. Assuming that this stage of development would last three years, the average annual cost would be $2.9 million.

Operational cost information for the Prairie Creek mine is not available. However, recent information from a proposed copper-gold mine in central BC can be used instead. The proposed BC mine is approximately five times bigger than the Prairie Creek mine in terms of both capital costs and operating workforce, so the operating costs for an Ts'ude niline Tu'eyeta mine were assumed to be at least 20% of the annual operating costs for the BC mine. This number was then

increased by 25% to account for higher costs in the NWT, including higher ore transport costs. On these assumptions, the estimated annual operating cost would be about $44 million per year, with operations expected to last 15 years.

Under this scenario, a 1,000 ton per day mill operating at 95% capacity would have to produce ore with a 20% lead-zinc concentration[19] over 15 years to be financially viable. Based on the current price of about $1 per pound for lead and zinc and assuming that the costs of the access road were paid by another party, such a project would have an internal rate of return of 18%, with a payback period of 10 years after the commencement of permitting and approvals process.

However, if the cost of constructing road access were to be borne by the mine operator (the more likely scenario) and included in the financial analysis, the project would only financially viable if the price of lead and zinc were to double (in 2010$) or the ore would have to have a lead-zinc concentration of 40%. At $2 per pound, the project would have an internal rate of return of 13% with a pay-back period of 13 years after the commencement of permitting and approvals process. For purposes of the following analysis, it is assumed that road construction is included as part of the project and that lead-zinc prices will double in real terms. While this price assumption is highly optimistic, the likelihood of this actually occurring (uncertainty) is factored into the benefit/cost analysis.

3.3.4 Impacts of Lead-Zinc Mine Development on the NWT

The territorial impacts of constructing a mine at Ts'ude niline Tu'eyeta have been estimated using recent economic multipliers for the NWT. Estimates of the potential economic impacts associated with exploration and with permitting and approvals were calculated using multipliers for the professional, scientific and technical services industry (NWT Bureau of Statistics, 2011a). Estimates of the economic impacts of constructing the mine and the road site were calculated using the NWT multiplier for the construction industry. The effects of mine operations were estimated using the multiplier for the other metal ore mining industry, as taken from the 2007 analysis provided by the NWT Bureau of Statistics. Based on the cost estimates provided in Section 3.3.3, the potential economic effects of developing a 1,000 ton per day lead-zinc mine and associated road in the Ts'ude niline Tu'eyeta area are summarized in Table 3-5.

Table 3-5 shows that the economic effects of mine development are relatively small during the exploration phase (about 3 jobs per year), increase slightly during the permitting process (20 jobs), and then increase substantially during mine construction (333 jobs per year) and then decrease to 220 direct and indirect jobs per year during operations. This means that, in addition to the 150 jobs directly at the mine (as per the Prairie Creek mine), another 70 jobs will be

[19] Ore at the Prairie Creek Mine is estimated to consist of 10.71% zinc and 9.90% lead (Canadian Zinc Corporation, 2011).

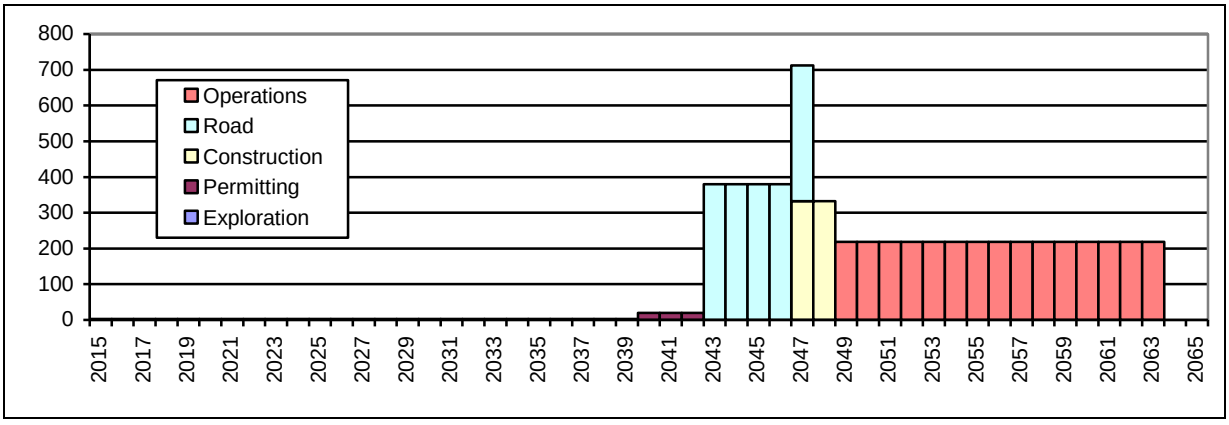
created in those sectors of the NWT economy that will provide goods and services needed for mine operation.[20] Road construction would generate 380 jobs per year.

Table 3-5: Impact of Developing a Lead-Zinc Mine in the Ts'ude niline Tu'eyeta Area on the NWT Economy

		Exploration	Permitting	Construction	Operations	Road
Cost/Revenues (millions)		$11	$9	$175	$656	$500
Years		25	3	2	15	5
GDP (millions)	Total	$7	$6	$81	$160	$230
	Annual	$0.3	$1.9	$40.3	$10.7	$46.0
Labour Income (millions)	Total	$6	$5	$58	$95	$165
	Annual	$0.2	$1.5	$28.9	$6.3	$33.0
Direct and Indirect Employment (jobs)	Total	77	61	665	3,280	1,900
	Annual	3	20	333	220	380

The annual impacts of mine operation on total labour income in the NWT will amount to $6.3 million, with territorial GDP increasing by $10.7 million per year. The overall effects of developing a lead-zinc mine on employment in the NWT are shown in Figure 3-17. This clearly shows that, once in operation, mine development would provide high levels of long term employment.

Figure 3-17: Direct and Indirect Employment Associated with a Lead-Zinc Mine in Ts'ude niline Tu'eyeta, 2015 to 2065



3.3.5 Opportunities for Local Employment

Much of the labour required for mineral exploration and for permitting and approvals is highly specialized and technical, and these skills are not generally available in the local labour force. While some local labour and businesses will be called upon to provide support these activities, the overall labour requirements are very small (3 jobs per year for exploration and 20 jobs per

[20] This is consistent with the assumption in previous sections that direct employment and income impacts are equivalent to 75% of combined direct and indirect impacts.

year during permitting and approvals). Consequently, it is expected that workers will either be sourced from Norman Wells (because of its history in supporting oil and gas development and its role as the regional transportation centre) or imported into the region. Consequently, it is assumed that no residents of Fort Good Hope will be employed during exploration and that two residents (10% of the total) will be employed during permitting and approvals.

During mine construction, the creation of 333 jobs each lasting two years would severely strain the labour resources of the region and would require considerable importation of labour, goods, and services. In 2006 there were only 110 construction workers in the three communities closest to Ts'ude niline Tu'eyeta, with 30 in Fort Good Hope, 55 in Norman Wells and 25 in Tulita. Based on experience with mine developments in other areas, it is expected that most of the construction trades people would be relatively specialized and would be brought into the region. Local people would be contracted to clear the site, provide the camp services, and operate equipment. For the proposed mine, it is estimated that regional residents would account for 10% of the project workforce (about 35 people per year over the construction period). These would mostly be residents of Fort Good Hope (20) and Norman Wells (10). Thus, residents of Fort Good Hope are estimated to represent 6% of the total construction labour force. Similar assumptions were adopted for estimating the percentage of local labour used to construct the road into the mine.

For operations, all of the management, laboratory, and engineering labour and half the processing and maintenance staff will have to be brought into the region because they require special skills that are not available in the regional workforce. The number of Fort Good Hope residents employed in mining operations will depend on whether it is an open pit or underground mine, and will largely entail equipment operating jobs. Most blasters and people operating specialized drilling equipment will be brought into the region. It is estimated that 30 residents of Fort Good Hope could be directly employed at the mine (about 20% of the total workforce). As noted above, mine operations would create another 70 indirect jobs, and it is expected that 10 of these jobs would be in Fort Good Hope.

3.3.6 Potential Environmental Concerns

The assessment of the potential environmental effects of a zinc mine were based on comments provided by AMEC mining staff in Ontario, based on their review of a draft report on the environment effects of diamond mining (Environment Canada, 1993). During the exploration phase the environmental effects will be fairly minimal, consisting mainly of noise and some localized loss of habitat associated with diamond drilling. There will be no need for road access because all of the equipment can be brought in by helicopter.

The primary effect of mine construction will be a loss of habitat as ground is cleared for the camp, processing and maintenance buildings, diesel power generators, and tailings disposal site. For the Prairie Creek mine, this area amounted to about 130 hectares. However, the Prairie

Creek mine was an underground mine and if open pit mining was the preferred mining method at Ts'ude niline Tu'eyeta, the loss of habitat could be much greater. Additional land clearing can also occur as a result of ongoing exploration to further delineate potential deposits and identify new deposits. With land clearing, removal of overburden, and construction of a permanent road into the mine, there are also concerns about disrupting drainage patterns, especially at open pit mines. With on-site power generation, heavy equipment, and the potential for blasting, noise and dust are also environmental issues.

Once metal mines begin operation the key environmental concern relates to the volume and composition of mine tailings. Potential problems include high concentrations of metals in tailing ponds and metals leaching into groundwater. Appropriate disposal of waste rock is also problematic, especially if the rock is acidic and exposure to air and water can lead to acidification of surface water and adverse effects on aquatic life. Acid rock is not a problem at the Prairie Creek mine and, based on the geology of the Ts'ude niline Tu'eyeta area, may not be a problem there either, but the possibility of acid rock cannot be conclusively be ruled out. While there is always the potential for breaches of tailings ponds and possible contamination of water bodies and land, the probability of failure is very low: about 1 in 10,000 (Hill et al., 2003). Thus, the annualized cost of a spill costing $25 million to clean up with an annual probability would be $2,500, and the net present value of this would be only $31,250 (using a 7.0% discount rate).

Other environmental problems associated with metals mining include increased habitat loss and effects on drainage if the footprint of the mine is expanded over time, and noise and dust will continue to be an issue. It is expected that, in order to obtain approval to construct a mine anywhere in the region, an environmental assessment will have to be completed and a plan developed to ensure that any adverse effects are minimized. A strategy for mine closure will also have to be developed and implemented to ensure that there are no ongoing environmental issues once the mine ceases operations.

Another problem is that if project construction or operation workers living in camps are allowed to hunt and fish when not working, they can adversely affect fish and wildlife stocks. Many proponents restrict fishing and hunting activities by workers while in camp to ensure that there are no such effects.

3.3.7 Potential Benefits and Costs

For the GNWT, it is assumed that some exploration, construction and production employment would be incremental to expected future economy activity and could be counted as benefits. However, the employment effects shown in Figure 3-17 include both direct and indirect employment resulting from lead-zinc development and spin-off effects (indirect employment) are not normally included in a benefit-cost analysis. As noted previously, available information for the NWT does not allow differentiation of direct and indirect effects so, for purposes of this

analysis, it is assumed that direct employment accounts for 75% of the overall employment effects for the exploration and construction phases shown in Figure 3-17. For the operational phase, the information for the Prairie Creek mine suggests that there would be 150 jobs, and this is equivalent to 75% of the total direct and indirect jobs predicted using the multiplier for the NWT mining industry.

The territorial labour income benefits would generally follow the same pattern as in Figure 3-17 although the average annual labour income by the construction workforce ($86.842)[21] is higher than for workers doing exploration and permitting and approvals ($74,286) or operations ($72,000). The actual amount of labour income that can be counted as a benefit will depend on the extent to which unemployed and underemployed labour is employed to construct and operate a lead-zinc mine. For workers doing short-term activities like exploration and construction, they would likely be working on a similar project elsewhere in the NWT, if not in Ts'ude niline Tu'eyeta, so would otherwise be employed. Consequently, none of their income would be considered "new" income. However, employment income could be counted as benefits if any of the workers were otherwise unemployed or if the project results in new long-term jobs, such as during project operations. Thus, it is assumed that 15% of labour income associated with oil exploration and drilling is estimated to be incremental income earned by workers who would otherwise be unemployed or underemployed. This assumption is based on the observation that, in 2009, the NWT had an unemployment rate of 10.3%, although 16.5% of the labour force in the Sahtu Region and 28.3% of the labour force in Fort Good Hope were unemployed. As mining operations would generate new long-term employment, it is assumed that all associated labour income can be counted as a project benefit.

Production from a lead-zinc mine will generate corporate taxes and retained profits for the NWT government and NWT-based companies. NWT corporate taxes have been calculated based on 5% of gross revenues[22]. Assuming that lead-zinc prices are $2 per pound (in 2010$) at the time of project start-up, the project would generate about $15.3 million per year in taxes over the 15 years of production. Total profits have been estimated based on 10% of gross revenues (or $30.6 million per year) and it is assumed that GNWT-based businesses would retain 20% of these profits.

From a Canadian perspective, the incremental labour income benefits from exploration and mine construction and operation activities would be the same as for the NWT. Lead-zinc production would also generate annual royalty income of about $21.4 million and corporate income taxes of

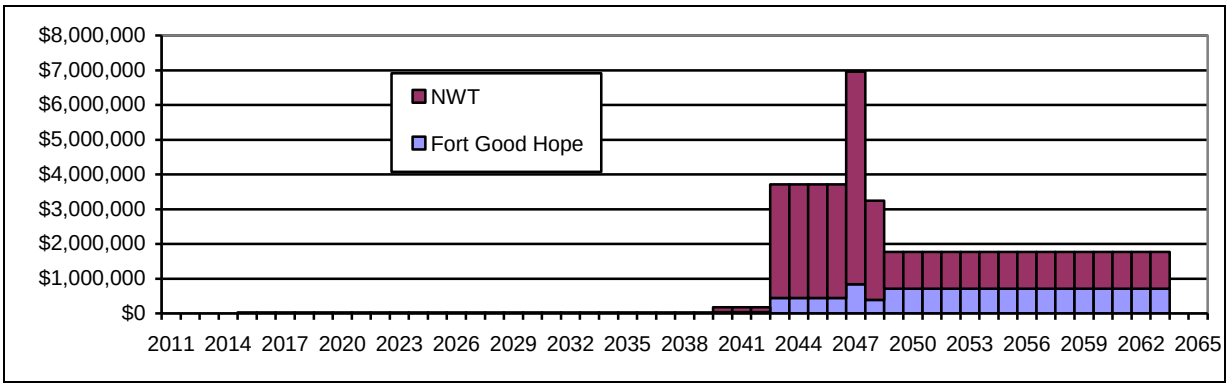
[21] Average income is estimated by dividing the expected direct and indirect labour income resulting from a $1 million in new industry activity by the new direct and indirect employment that would occur. Data are taken from the NWT Bureau of Statistics (2011a).
[22] As there are no other operating lead zinc mines in the NWT, the corporate tax rate for such a mine is not known. Consequently, it was assumed that the average NWT corporate taxes estimated for diamond mining, or 5% of gross revenues, (GNWT 2000) would apply.

$33.6 million for the Federal Government[23]. It is also assumed that mining development would be undertaken by Canadian-based companies that would retain annual profits of $30.6 million.

It is assumed that residents of Fort Good Hope will account for 20% of total employment during operations, 10% during permitting and approvals, and 6% during construction, based on the skill requirements for these activities and the current capabilities of the regional residents. With an unemployment rate of 28.3% in Fort Good Hope 2006, it is assumed that 30% of income earned by regional residents employed during permitting and approvals and construction can be counted as new or incremental income. All of the income earned by residents of Fort Good Hope during mine operations is considered to be new income. In addition, some companies in Fort Good Hope are expected to provide goods and services needed to support natural gas development and their retained profits would also be a benefit. It is assumed that companies in Fort Good Hope would account for 10% of the retained profits of all GNWT-based businesses.

Figure 3-18 shows the incremental income stream for both Fort Good Hope and the NWT, assuming that all phases of developing a lead-zinc mine – exploration, permitting and approvals, mine and road construction and operations – actually proceed and that the mine has a 15-year operating life. The estimates in Figure 3-18 are predicated on the assumption that lead-zinc prices will double (in 2010$) by the time of mine start-up.

Figure 3-18: Incremental Labour Income Potentially Associated with Lead-Zinc Development in Ts'ude niline Tu'eyeta



3.3.8 Summary of Benefits and Costs

As noted previously, the Ozyer (2010) rated the potential MVT type zinc-lead deposits in Ts'ude niline Tu'eyeta as being A2 (very high potential based on a moderate amount of information. However, given the uncertainty about the lead-zinc potential of the area and the very high cost of constructing road access to the mine, it has been assumed that there is only a 10% probability

[23] As there are no other operating lead zinc mines in the NWT, there was no information on royalty rates and federal taxation rates for lead-zinc mines in the NWT. Consequently, the corresponding rates for the diamond industry were used. This involved royalty payments of 7% of gross revenues and corporate federal taxes of 11% (GNWT 2000).

that mine construction and operation would occur, but there is a 100% probability that mineral exploration would occur. Based on these assumptions and the annual incremental labour income shown in Figure 3-18, the net present value (NPV) of the future stream of incremental labour income associated with lead-zinc development in Ts'ude niline Tu'eyeta over the period to 2065 is estimated to be $0.5 million for the NWT, of which $0.04 million will accrue to residents of Fort Good Hope (assuming a discount rate of 7.0%). Thus, regional residents would account for about 8% of labour income benefits in the NWT. These values are summarized in Table 3-6.

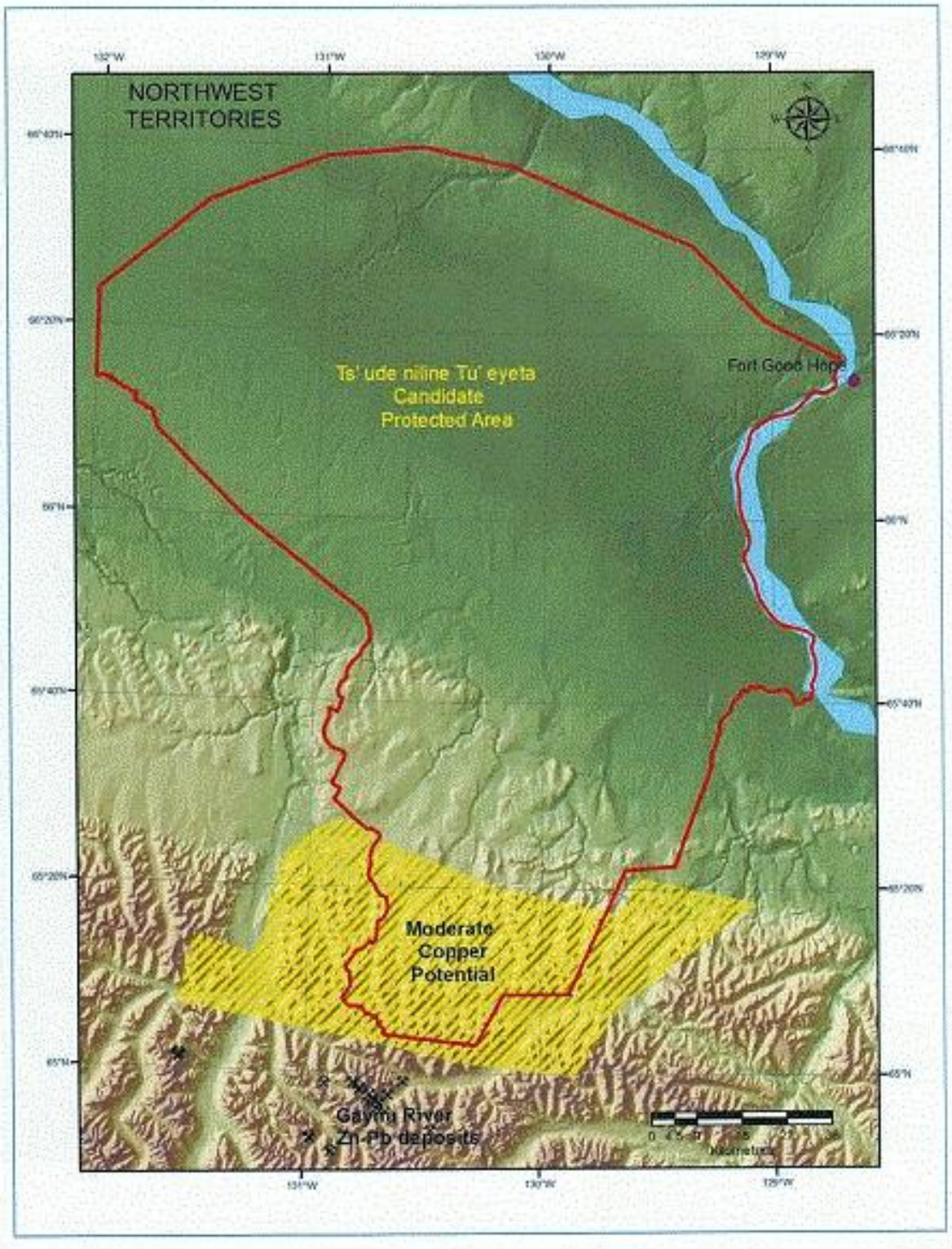
Table 3-6: Present Value of Economic Benefits Associated with a Lead-Zinc Mine in Ts'ude niline Tu'eyeta

Benefit	Undiscounted	Discounted (3.0%)	Discounted (7.0%)
NPV of Benefits for Canada (millions)			
Labour Income	$3.6	$1.4	$0.5
Royalties	$3.9	$1.2	$0.3
Canadian taxes	$6.1	$2.0	$0.5
NWT taxes	$2.8	$0.9	$0.2
Retained profits	$5.5	$1.8	$0.4
Total	$21.9	$7.3	$1.9
NPV of Benefits for NWT (millions)			
Labour Income	$3.6	$1.4	$0.5
NWT taxes	$2.8	$0.9	$0.2
Retained profits	$1.1	$0.4	$0.1
Total	$7.4	$2.7	$0.8
Percent of Canada	34%	37%	43%
NPV of Benefits for Fort Good Hope (millions)			
Labour Income	$0.45	$0.16	$0.04
Retained profits	$0.11	$0.04	$0.01
Total	$0.56	$0.19	$0.05
Percent of NWT	8%	7%	6%

Assuming a discount rate of 7.0%, the net present value (NPV) of the future stream of incremental labour income and other benefits associated with development of a lead-zinc mine in Ts'ude niline Tu'eyeta over the period to 2065 is estimated to be $1.9 million for Canada, of which $0.8 million will occur in the NWT, and $0.05 million will accrue to residents of Fort Good Hope. These values are much lower than for either oil development or natural gas development because mine development is assumed to occur quite late in the forecast period and because of the much higher level of uncertainty that mine development would proceed because of the high cost of building road access to the mine.

Table 3-6 shows that, of the $1.9 million in benefits of lead-zinc mine development in Ts'ude niline Tu'eyeta that accrue to Canada, 28% would be in the form of incremental labour income ($0.5 million), 24% would be from Federal corporate taxes ($0.5 million), 22% would be in the form of retained profits for Canadian companies ($0.4 million), and 15% would be from royalties ($0.3 million).

Figure 3-19: Summary of Copper Potential in the Ts'ude niline Tu'eyeta Candidate Protected Area



Source: Adapted from Ozyer (2010)

About 43% of the benefits of lead-zinc development in Ts'ude niline Tu'eyeta would accrue to the government and people of the NWT. Residents of Fort Good Hope are expected to account for 6% of the incremental labour income and other benefits experienced in the NWT.

3.4 Copper Mine Development

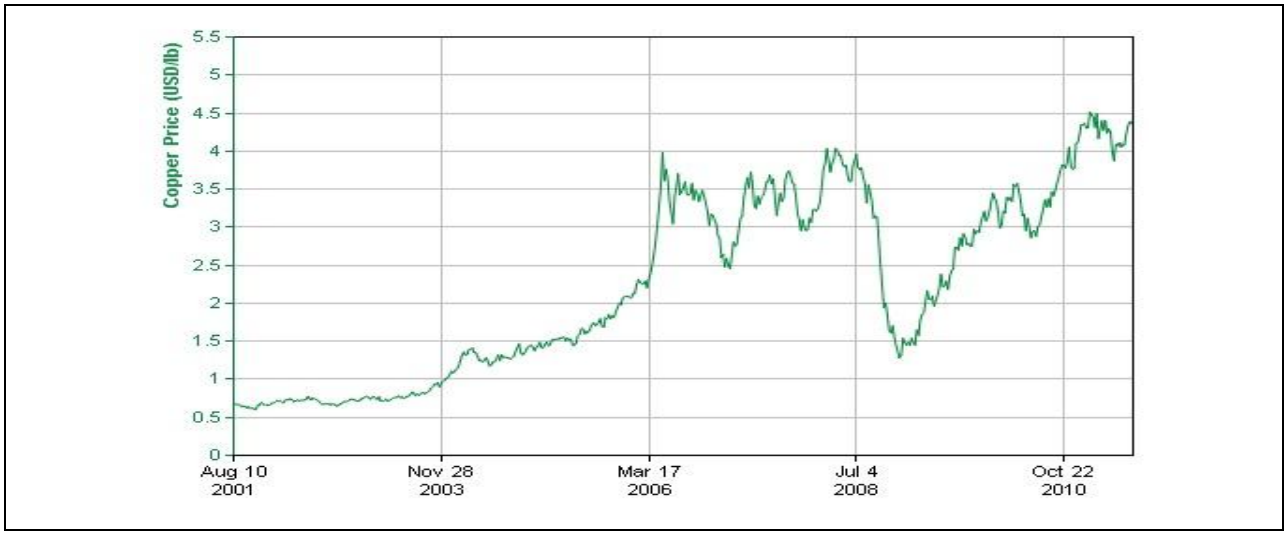
The recent study by Ozyer (2010) also determined that there are moderate sediment hosted copper deposits along the north facing slopes of the Mackenzie Mountains at the south end of the Ts'ude niline Tu'eyeta Candidate Protected Area. These areas are shown in Figure 3-19. While potential for mineral development exists, the exact location of economically-viable deposits is unknown and will require extensive exploration to identify and delineate these deposits. It is possible that more than one mine could be developed.

In terms of the reliability of the assessment of copper potential, Ozyer (2010) classified Ts'ude niline Tu'eyeta as being D3 (moderate potential based on some information) for sediment hosted copper and SEDEX zinc-lead deposits (in the Mackenzie Mountains).

3.4.1 Development Potential and Timing

Despite the very high potential for zinc-lead development in Ts'ude niline Tu'eyeta, it difficult to predict when or even if development of a copper mine would ever occur. At present, the NWT does not have an operating copper mine. However, unlike world prices for lead and zinc, which declined in 2008 and have never recovered to the high prices levels that occurred in 2006/2007, copper prices have rebounded since 2008 and the current prices (in the range of $4.00US to $4.50 US per pound) are higher than at any time during the last 10 years. Thus, increasing prices for copper may generate some interest in mineral exploration in the NWT, and possibly the Ts'ude niline Tu'eyeta region.

Figure 3-20: Copper Prices, August 2001 to August 2011



Source: Global InfoMine.com (2011)

However, as was noted in the assessment of lead-zinc potential, the greatest challenge to any mineral development in the Sahtu Region is the current lack of physical infrastructure (power and roads). It is expected that these challenges would be faced by any company wishing to explore for and/or develop the copper resources in the Ts'ude niline Tu'eyeta region. Development of a copper mine in the Ts'ude niline Tu'eyeta region would ultimately require construction of a year-round access road and, as noted previously, the cost of such a road could be in the range of $525 million. Consequently, mine development in the region is highly unlikely unless copper discoveries are more than adequate to cover the costs of constructing and operating the mine and access road.

3.4.2 Copper Mine Development Scenario

It is expected that the release of the Ozyer (2010) report on mineral potential in the region will generate some interest in exploration for minerals and that this would commence once the boundaries of the Ts'ude niline Tu'eyeta Protected Area have been finalized and accepted, and assuming that the price of copper remains high. Thus, exploration is likely to commence by 2015, and would consist of geophysical surveys, geochemical surveys, sampling and diamond drilling. This work could be accomplished without having to construct a road into the area. And, given that the portion of Ts'ude niline Tu'eyeta that has moderate copper potential also has very high lead-zinc potential, it is expected that prospectors will be conducting exploration activities for both minerals at the same time.

Given the remoteness of the area and the challenges of developing a mine in the area, it is expected that potential development of its copper resources would be similar to the development of lead-zinc resources. Thus, exploration activities would occur over 25 years. Three years would be required to conduct the requisite environmental studies, obtain all the necessary permits, and negotiate an agreement with the Sahtu Dene and Métis people. Construction of the mine and processing plant would require another two years. With this sequencing, operations could start in 2052. A 15-year mine life has been assumed. For copper development it is assumed that submission of the application for development and subsequent construction and operation activities would commence after the road to the lead-zinc mine has been completed. Thus, permitting would not commence until 2051, mine construction would commence in 2054 and operations would commence in 2056.

3.4.3 Costs of Development

As exploration for copper and zinc-lead deposits could occur in the same areas at the same time, no additional costs have been assumed for copper exploration.

With no specific information on capital and operating costs related to copper mines and no information on the size of the ore body, the concentrations of copper and other minerals, or the size of operation needed to cost-effectively mine these reserves, it is assumed that these costs would be the same as for the lead-zinc mine described in Section 3.3. Thus, mine construction is

estimated to cost $175 million. The cost of permitting and approvals is estimated to equal to 5%of capital costs, or $8.8 million. The estimated annual operating cost would be about $44 million per year, with operations expected to last 15 years.

Under this scenario, a 1,000 ton per day mill operating at 95% capacity would have to produce ore with a 3% copper concentration over 15 years to be financially viable. Based on the current price of about $4.50 per pound for copper and assuming that the costs of the access road were paid by another party, such a project would have an internal rate of return of 20%, with a payback period of 10 years after the commencement of permitting and approvals process. The financial viability of a copper mine is contingent on the existence of an access road that would be constructed by the developers of the lead-zinc mine who are assumed to pay all road construction costs. In reality, if both mines were to be developed, it is likely that the costs of road construction would be shared by both operations.

3.4.4 Impacts of a Copper Mine Development on the NWT

With the costs of constructing a copper mine at Ts'ude niline Tu'eyeta assumed to be the same as for construction of a lead zinc mine, the resulting economic impacts on the NWT would be quite similar. The only exception is that there would be no impacts for exploration or road development because these have already been include in the costs and impacts of developing a lead-zinc mine. Based on the cost estimates provided in Section 3.4.3, the potential economic effects of developing a 1,000 ton per day lead-copper mine in the Ts'ude niline Tu'eyeta area are summarized in Table 3-7.

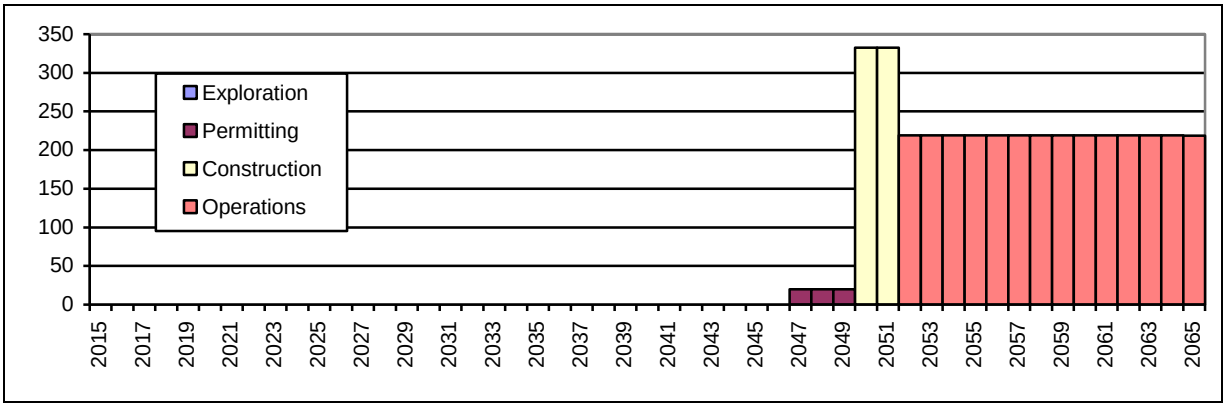
Table 3-7: Impact of Developing a Copper Mine in the Ts'ude niline Tu'eyeta Area on the NWT Economy

		Exploration	Permitting	Construction	Operations	Road
Cost/Revenues (millions)		Included in the cost for a lead-zinc mine	$9	$175	$656	Included in the cost for a lead-zinc mine
Years			3	2	15	
GDP (millions)	Total		$6	$81	$160	
	Annual		$1.9	$40.3	$10.7	
Labour Income (millions)	Total		$5	$58	$95	
	Annual		$1.5	$28.9	$6.3	
Direct and Indirect Employment (jobs)	Total		61	665	3,280	
	Annual		20	333	220	

Table 3-7 shows that there would be no additional employment during exploration, the permitting and approvals process would create 20 jobs per year, mine construction would create 333 jobs per year over two years, and mine operations would generate 220 direct and indirect jobs per year. During operations, there would be 150 jobs directly at the mine and another 70 jobs will be created in other sectors of the NWT economy. The annual impacts of mine operation on total labour income in the NWT will amount to $6.3 million, with territorial GDP increasing

by $10.7 million per year. The overall effects of developing a copper mine on employment in the NWT are shown in Figure 3-21.

Figure 3-21: Direct and Indirect Employment Associated with a Copper Mine in Ts'ude niline Tu'eyeta, 2015 to 2065



3.4.5 Opportunities for Local Employment

The opportunities for employment of residents of Fort Good Hope associated with a copper mine will be similar to those of a lead-zinc mine. It is assumed that two residents of Fort Good Hope (10% of the total) will be employed during permitting and approvals and local residents are estimated to represent 6% of the total construction labour force (20 jobs). Another 30 residents of Fort Good Hope could be directly employed at the mine (about 20% of the total workforce). Mine operations would create another 70 indirect jobs, and it is expected that 10 of these jobs would be in Fort Good Hope.

The permitting and construction phases of a copper mine will not significantly stress the capacity of the local workforce because these activities would occur after the corresponding activities for development of a lead-zinc mine. Thus, local skills and experience gained from development of the lead-zinc mine could be transferred to development of a copper mine. However, the operations of two mines simultaneously could place some major demands on the local workforce (60 jobs in combination).

3.4.6 Potential Environmental Concerns

The potential environmental effects of a copper mine would be similar to those of the lead-zinc mine, as described in Section 3.3.6.

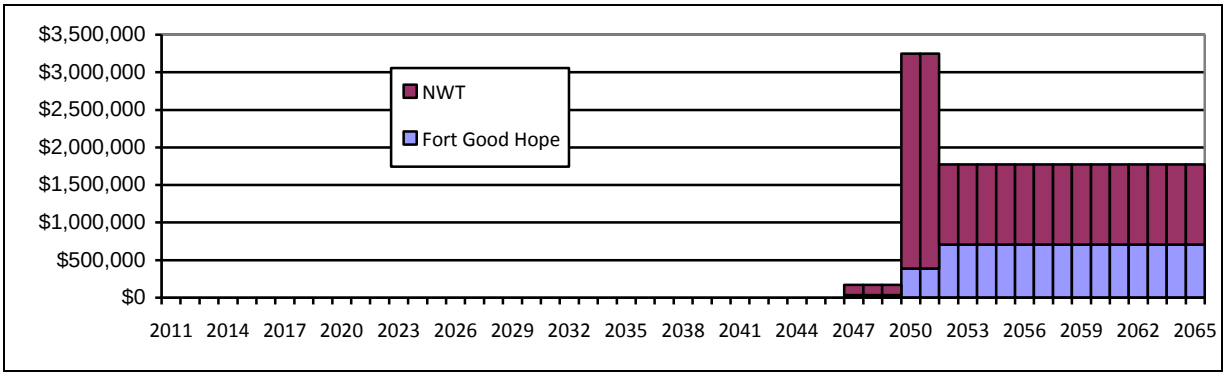
3.4.7 Potential Benefits and Costs

The potential benefits and costs of developing a copper mine are expected to be similar to those of a lead-zinc mine. The benefits and costs were assessed using the following assumptions:

- Direct employment accounts for 75% of the overall employment effects for the exploration and construction phases shown in Figure 3-21.
- The territorial labour income benefits would generally follow the same pattern as in Figure 3-21, with the average annual labour incomes being $74,286 for permitting and approvals, $86.842 for mine construction workforce being, and $72,000 for mine operations.
- 15% of labour income associated with permitting and mine construction is estimated to be incremental income earned by NWT workers who would otherwise be unemployed or underemployed.
- All labour income associated with mine operations is considered to be incremental income and is counted as a project benefit.
- NWT corporate taxes have been calculated based on 5% of gross revenues.
- Total profits have been estimated based on 10% of gross revenues and it is assumed that GNWT-based businesses would retain 20% of these profits.
- Annual royalty payments to the Federal Government were estimated assuming royalty payments of 7% of gross revenues.
- Annual federal corporate income taxes were estimated assuming a rate of 11% of gross revenues.
- Residents of Fort Good Hope will account for 20% of total employment during operations, 10% during permitting and approvals, and 6% during construction
- All income earned by residents of Fort Good Hope during mine operations and 30% of income earned during permitting and construction is considered to be new income.
- Companies in Fort Good Hope would account for 10% of the retained profits of all GNWT-based businesses.

Based on these assumptions, the incremental income stream for both Fort Good Hope and the NWT is shown in Figure 3-22, assuming that all phases of developing a copper mine – permitting and approvals, mine construction and operations – actually proceed and that the mine has a 15-year operating life. .

Figure 3-22: Incremental Labour Income Potentially Associated with Copper Development in Ts'ude niline Tu'eyeta



3.4.8 Summary of Benefits and Costs

Ozyer (2010) rated the copper development potential of Ts'ude niline Tu'eyeta as being D3 (moderate potential based on some information) for sediment hosted copper. For purposes of estimating the potential economic benefits and costs of copper development, it is assumed that based on the uncertainty about the copper potential of the area and whether a lead-zinc mine and associated road would be constructed into the area, it is assumed that there is only a 10% probability that construction and operation of a copper mine would actually occur.

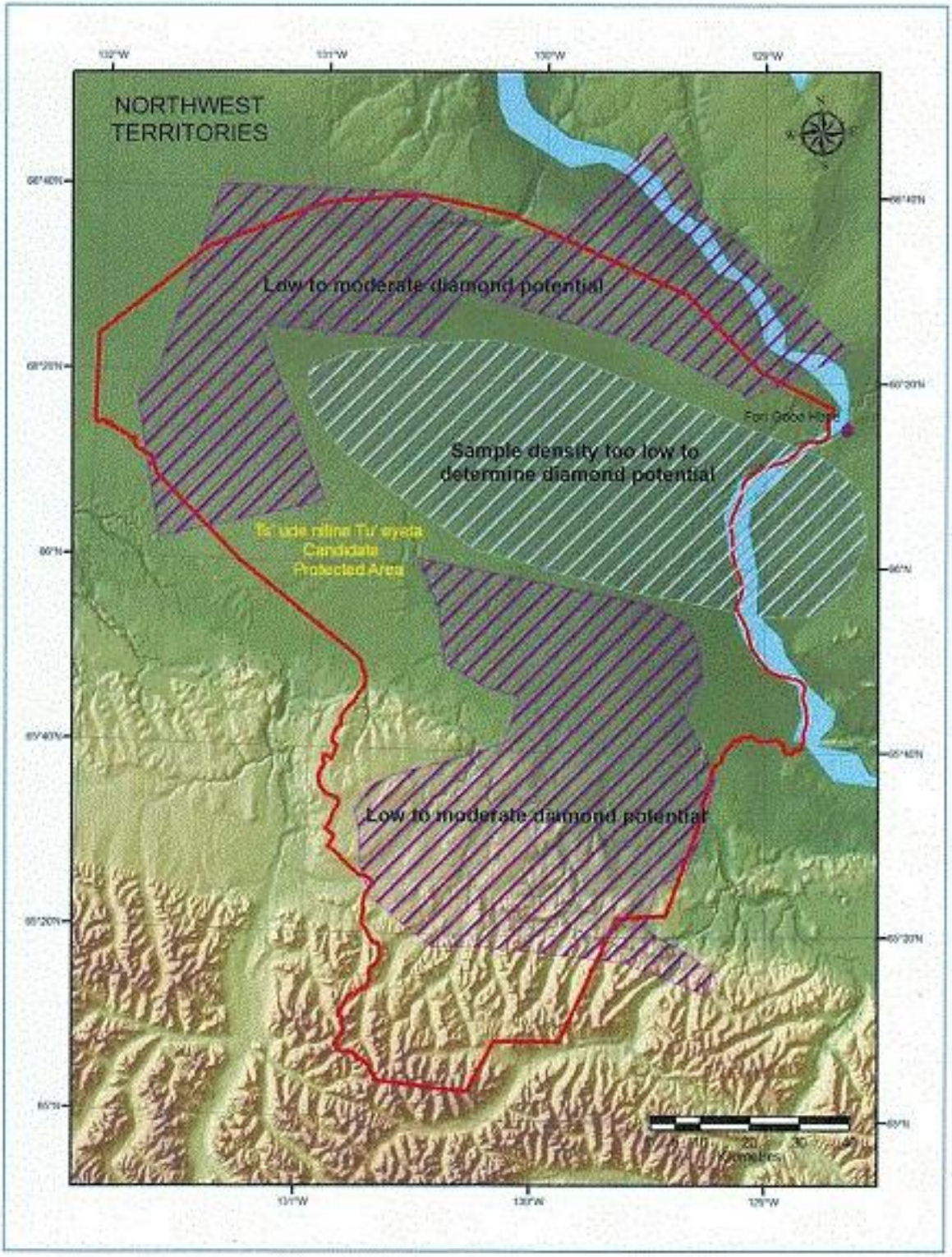
Based on these assumptions and the annual incremental labour income shown in Figure 3-22, the net present value (NPV) of the future stream of incremental labour income associated with copper development in Ts'ude niline Tu'eyeta over the period to 2065 is estimated to be $0.42 million for the NWT, of which $0.03 million will accrue to residents of Fort Good Hope (assuming a discount rate of 7.0%). Thus, regional residents would account for about 7% of income benefits in the NWT. These values are summarized in Table 3-8.

Table 3-8: Present Value of Economic Benefits Associated with a Copper Mine in Ts'ude niline Tu'eyeta

Benefit	Undiscounted	Discounted (3.0%)	Discounted (7.0%)
NPV of Benefits for Canada (millions)			
Labour Income	$0.4	$0.1	$0.0
Royalties	$3.9	$1.2	$0.3
Canadian taxes	$6.1	$2.0	$0.5
NWT taxes	$2.8	$0.9	$0.2
Retained profits	$5.5	$1.8	$0.4
Total	$18.7	$6.0	$1.4
NPV of Benefits for NWT (millions)			
Labour Income	$0.4	$0.1	$0.0
NWT taxes	$2.8	$0.9	$0.2
Retained profits	$1.1	$0.4	$0.1
Total	$4.3	$1.4	$0.3
Percent of Canada	23%	23%	23%
NPV of Benefits for Fort Good Hope (millions)			
Labour Income	$0.05	$0.02	$0.00
Retained profits	$0.11	$0.04	$0.01
Total	$0.16	$0.05	$0.01
Percent of NWT	4%	4%	4%

Assuming a discount rate of 7.0%, the net present value (NPV) of the future stream of incremental labour income and other benefits associated with development of a copper mine in Ts'ude niline Tu'eyeta over the period to 2065 is estimated to be $1.0 million for Canada, of which $0.2 million will occur in the NWT, and $0.01 million will accrue to residents of Fort Good Hope. These values are much lower than for a lead-zinc mine because no exploration or road construction is required and because it is assumed that copper development will occur even later in the forecast period so the resulting benefits are more heavily discounted.

Figure 3-23: Summary of Diamond Potential in the Ts'ude niline Tu'eyeta Candidate Protected Area



Source: Adapted from Ozyer (2010)

Table 3-8 shows that 23% of the benefits of mine development in Ts'ude niline Tu'eyeta would accrue to the government and people of the NWT while residents of Fort Good Hope would account for 4% of the incremental labour income and other benefits experienced in the NWT. The balance of the benefits (77%) would accrue to Canada in the form of retained profits for Canadian companies, royalty payment and corporate taxes.

3.5 Diamond Development

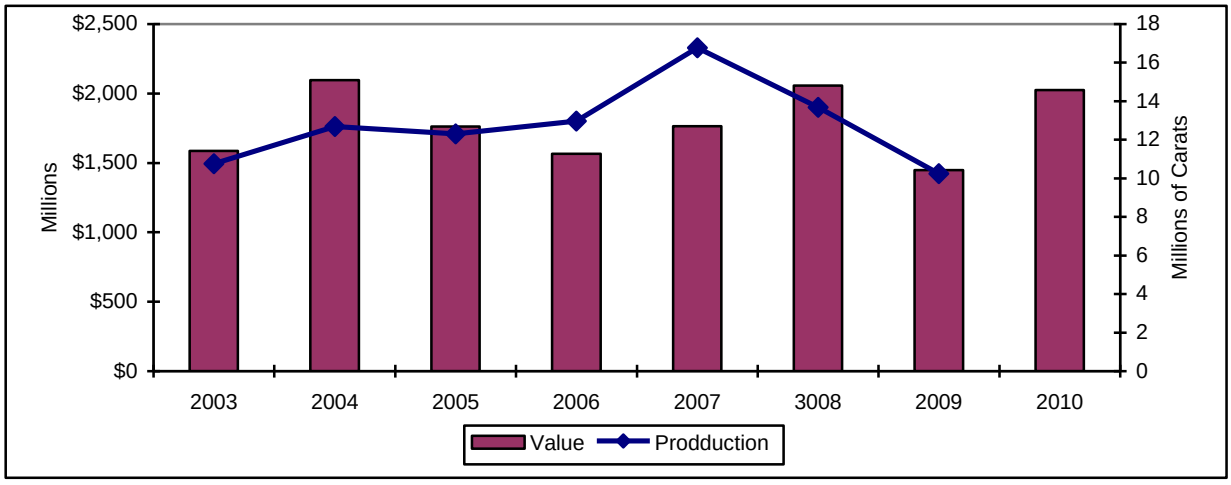
The recent study by Ozyer (2010) also concluded that there is low to moderate diamond potential along the northern edge and through the south-central portion of Ts'ude niline Tu'eyeta. This potential is found in an area of about 7,050 km^2. The sample density was insufficient to determine diamond potential for much of the area under the wetland areas in the central portion of the area. These areas are shown in Figure 3-23. While the potential for mineral development exists, the exact location of economically-viable deposits is unknown and will require extensive exploration to identify and delineate these deposits. It is possible that more than one diamond mine could be developed.

In terms of the reliability of the assessment of diamond potential, the NTGO classified Ts'ude niline Tu'eyeta as being E3 (low to moderate potential based on some information) for primary kimberlite diamonds and coal (in the wetland areas),

3.5.1 Development Potential and Timing

Over the period from 1999 to 2010, diamonds accounted for 93% of the total value of all mineral production in the NWT (NWT Bureau of Statistics, 2011b). Figure 3-24 shows that diamond production peaked in 2007, with production of 16.8 million carats. Although production and revenues declined in 2008 and 2009, which coincided with a period of global economic downturn, revenues from diamond sales climbed to $2,025 million in 2010.

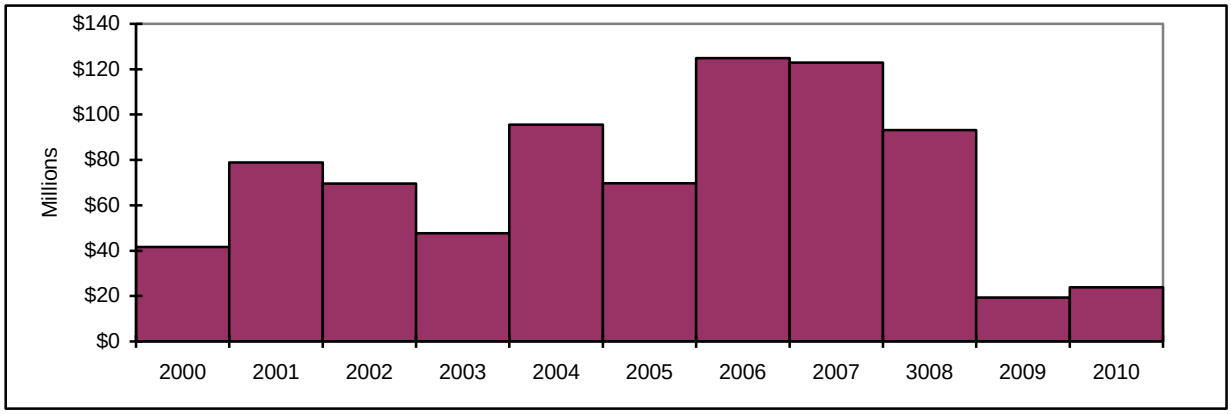
Figure 3-24: Diamond Production and Revenues in the NWT, 2003 to 2009



Source: NWT Bureau of Statistics (2011c)

The average value of diamond production in the NWT has ranged from a low of $105 per carat in 2007 to a high of $150 per carat in 2008. The recent global economic downturn was particularly hard on diamond production and sales, as demand for luxury goods has dropped dramatically. The decline in prices also led to a reduction in diamond exploration and appraisal activities. Figure 3-25 shows that in 2009 and 2010, expenditures on exploration amounted to less than $17 million per year, compared to more than $$122 million per year in 2006 and 2007.

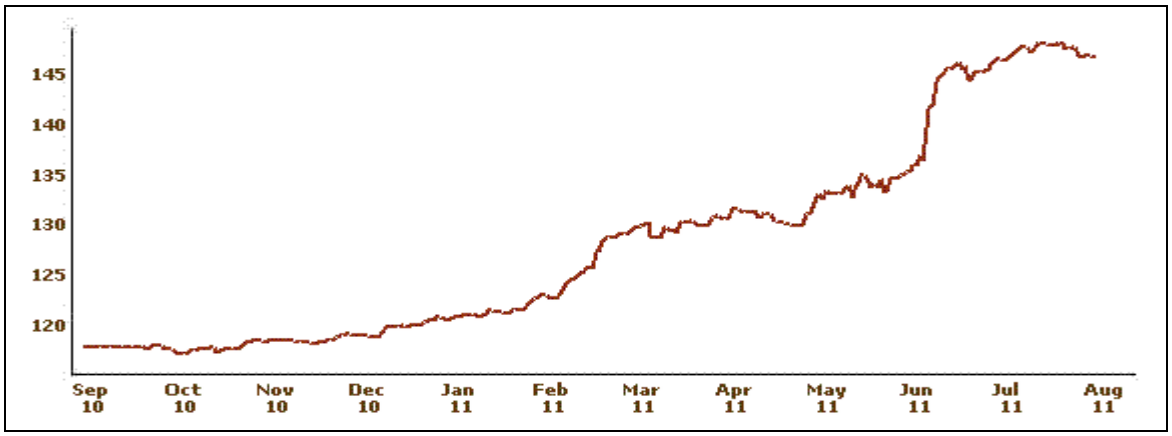
Figure 3-25: Value of Diamond Exploration and Deposit Appraisal Activities



Source: NWT Bureau of Statistics (2011b)

Since October 2010, diamond prices have risen rapidly (see Figure 3-26) as global economic conditions have gradually improved and consumers have resumed the purchase of luxury goods. However, diamond prices have recently begun to decline as a result of economic turmoil in Europe and the United States.

Figure 3-26: IDEX Polished Diamond Prince Index (September 2010 to August 2011)



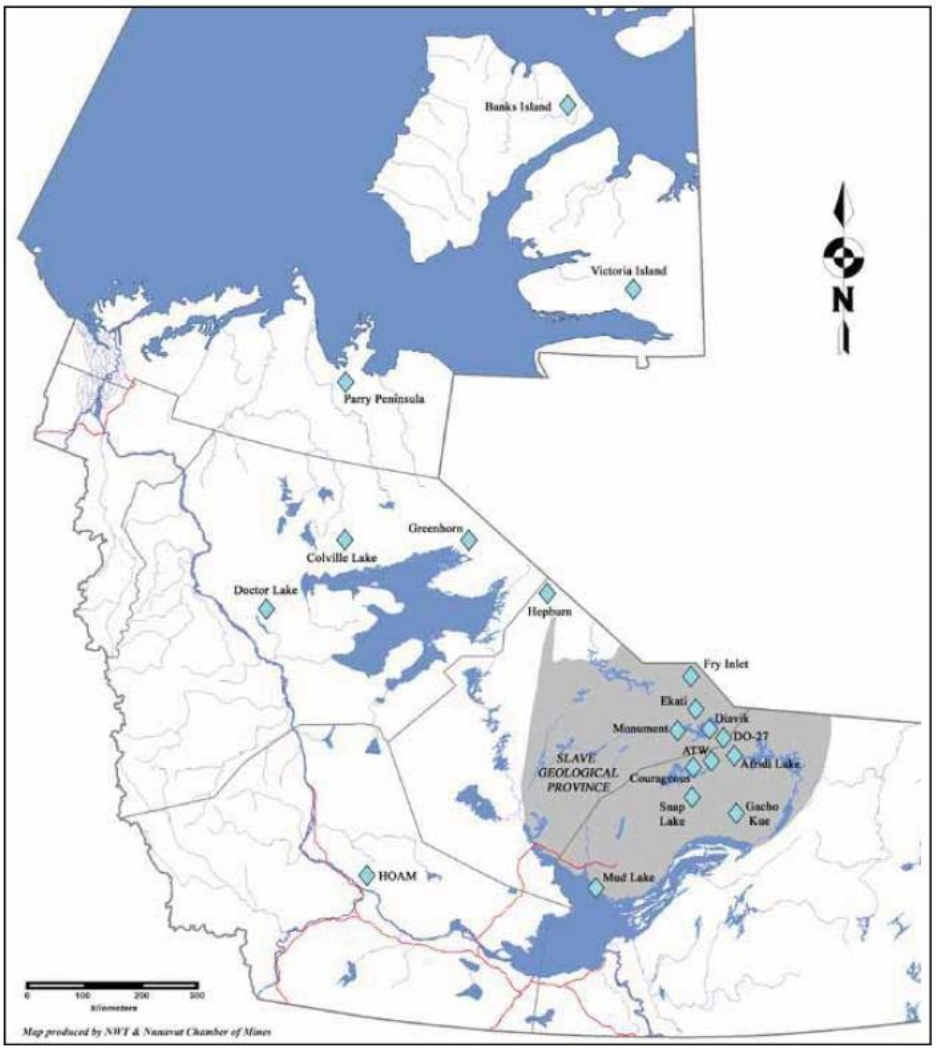
Source: IDEX 2011 (June 2004 = 100)

This recent volatility in world diamond prices and the limited amount of information about diamond potential in Ts'ude niline Tu'eyeta make it very difficult to predict the timing or extent of diamond development in the area.

3.5.2 Diamond Mine Development Scenario

Based on recent trends in exploration activities, it is unlikely that exploration for diamonds in Ts'ude niline Tu'eyeta will occur within the near future. According to 2008 information, 16 companies were actively involved in diamond exploration in the NWT (NWT & Nunavut Chamber of Mines, 2009). Ten of these companies were assessing diamond potential at locations in the Slave Geological Province which is the location of the three active diamond mines and the proposed diamond mine at Gahcho Kué. Thus, the focus of most diamond exploration continues to be at locations north of Great Slave Lake (see Figure 3-27).

Figure 3-27: Diamond exploration in the NWT, 2008



Source: NWT & Nunavut Chamber of Mines (2009)

The other six companies have been assessing diamond potential at seven locations in different parts of the NWT. The closest diamond exploration to Ts'ude niline Tu'eyeta is at Doctor Lake, northeast of Norman Wells. Drilling at this site identified some micro-diamonds in the Hillside kimberlite deposit. The results confirmed that Hillside is diamond bearing, making it the first reported diamond-bearing kimberlite discovered in the region west of Great Bear Lake (Diamond Exploration Inc. 2009). The next nearest exploration was at a location east of Great Bear Lake (the Greenhorn Project) and another at Colville Lake. Exploration at these two sites has consisted of diamond drilling and ground magnetic surveys and, to date, two diamondiferous kimberlites have been identified (Sanatana Resources Inc., no date).

There is no indication of when exploration for diamondiferous material in Ts'ude niline Tu'eyeta will commence. Release of the Ozyer (2010) could spur some interest in diamond exploration in the region and this could commence once the boundaries of the Ts'ude niline Tu'eyeta Protected Area have been finalized and accepted. However, given that only limited diamond exploration in the NWT is currently occurring outside the Slave Geological Province, it is reasonable to assume that exploration in Ts'ude niline Tu'eyeta will not commence until 2020.

If kimberlite pipes are located within Ts'ude niline Tu'eyeta, it is expected that they will be located within 5 years of exploration. This is consistent with the timelines for development of the Diavik and Snap Lake mines. This would be followed by 5 years of bulk sampling to determine whether development of the deposit(s) would yield an acceptable rate of return. If viable, the application and approvals process would require 5 years, followed by mine construction, which would require two years. This timeline would see mine production commencing in 2037. The Mackenzie Highway should be complete by then, and this will facilitate mine construction and operations compared to existing mines, which operate in remote locations and are only accessible by road during the winter months.

The size of the mine will depend on the extent of diamond resources that are discovered. A large mine, like Ekati, could process as much as 4.5 million tonnes mine or ore per year, while a smaller operation, such as Snap Lake, would process 0.9 million tonnes per year (Northwest Territories Industry Tourism and Investment, 2007a). For purposes of this analysis, it is assumed that one mine processing 1.0 million tonnes of ore would be developed. Mine operations are assumed to last 10 years, although this could be extended if multiple kimberlite pipes are discovered.

3.5.3 Costs of Development

It is expected that the costs of diamond exploration and development in Ts'ude niline Tu'eyeta would be about $7.50 per hectare of land under a mineral permit or claim ($750 per square kilometre).[24] These activities include geophysical and geochemical surveys, sampling and

[24] In 2007, mining companies spent $2.5 million was spent on activity related to exploration permits in 2007, $13.4 million related to claims, and $112.2 million on exploration and deposit appraisal, or a total of $128.1 million in the

diamond drilling. Assuming that all parts of Ts'ude niline Tu'eyeta that have low to moderate potential are claimed, the resulting cost would be about $5 million, or about $1 million per year. Bulk sampling activities to further evaluate the resources and determine the financial feasibility of a mine are assumed to cost $5 million per year for five years. Permitting and approvals are estimated to cost the equivalent of 5% of the project's capital cost. The capital cost of constructing the mine is estimated to be $750 million; this is half way between the actual cost of constructing the Snap Lake mine ($975 million) and the proposed cost of the Gahcho Kué project ($535 million).[25] The annual operating cost is estimated to be $120 million per year; this represents the average annual cost of operating the Snap Lake mine (DeBeers Canada Inc., 2011) and the average annual cost of the Gahcho Kué project (DeBeers Canada Inc., 2010). Based on these costs, an average yield of 3 carats of diamonds per tonne of ore would generate a 16% rate of return with a payback period of 10 years after the permitting process commences.

3.5.4 Impacts of Diamond Development on the NWT

The territorial impacts of constructing a diamond mine at Ts'ude niline Tu'eyeta have been estimated using recent economic multipliers for the NWT. Estimates of the potential economic impacts associated with exploration, bulk sampling and with permitting and approvals were calculated using multipliers for the professional, scientific and technical services industry (NWT Bureau of Statistics, 2011a). Estimates of the economic impacts of constructing the mine were calculated using the NWT multiplier for the construction industry. The effects of mine operations were estimated using the multiplier for the diamond mining industry. Based on the cost estimates provided in Section 3.5.3, the potential economic effects of developing a 1.0 million tonne per year diamond mine in the Ts'ude niline Tu'eyeta area are summarized in Table 3-9.

Table 3-9: Impact of Developing a Diamond Mine in the Ts'ude niline Tu'eyeta Area on the NWT Economy

		Exploration	Bulk Sampling	Permit-ting	Construction	Operations
Cost/Revenues (millions)		$5	$25	$38	$750	$1,200
Years		5	5	5	2	10
GDP (millions)	Total	$3	$16	$24	$345	$852
	Annual	$0.7	$3.3	$4.9	$172.5	$85.2
Labour Income (millions)	Total	$3	$13	$20	$248	$168
	Annual	$0.5	$2.6	$3.9	$123.8	$16.8
Direct and Indirect Employment (jobs)	Total	27	33	143	2,850	1,440
	Annual	5	7	29	1,425	144

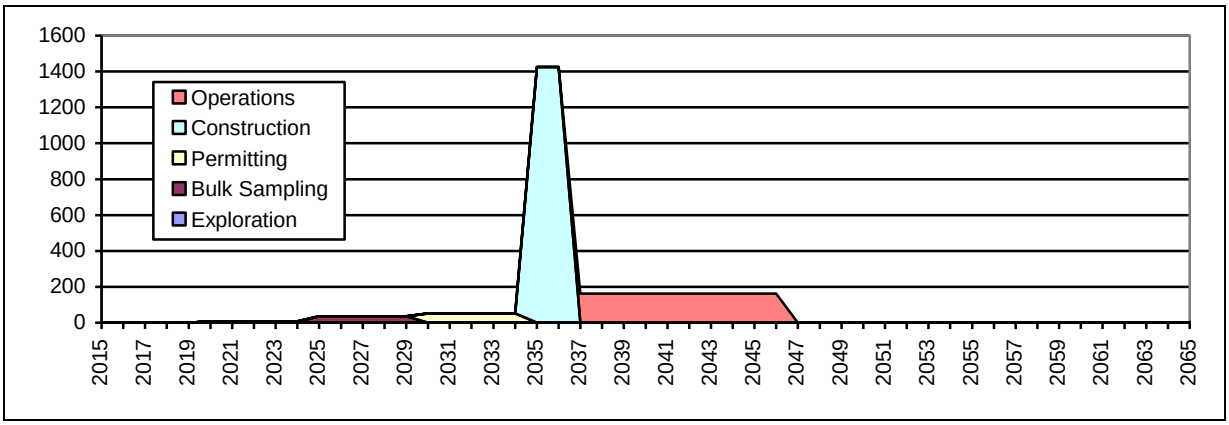
Northwest Territories (Northwest Territories Industry Tourism and Investment, 2008). In that same year 17.08 million hectares of land were subject to a mineral permit or claim. This suggests annual expenditures on exploration appear to amount to $7.50 per hectare.

[25] According to DeBeers Canada Inc. (2011) the capital cost to construct the Snap Lake mine was $975 million while the capital cost of the Gahcho Kué project was $535 million (2010).

Table 3-9 shows that the economic effects of mine development are relatively small during the exploration phase (about 5 jobs per year), increase slightly during the bulk sampling process (7 jobs per year) and during the permitting process (29 jobs). Mine construction will create a significant amount of employment (1,425 jobs per year) but employment will drop to 144 direct and indirect jobs per year during operations. The annual impacts of mine operation on total labour income in the NWT will amount to $18.9 million, with territorial GDP increasing by $95.9 million per year.

The overall effects of developing a diamond mine on employment in the NWT are shown in Figure 3-28. This shows that, once in operation, mine development would provide high levels of long term employment.

Figure 3-28: Direct and Indirect Employment Associated with a Diamond Mine in Ts'ude niline Tu'eyeta, 2015 to 2065



3.5.5 Opportunities for Local Employment

Much of the labour required for diamond exploration and bulk sampling, and for permitting and approvals is highly specialized and technical, and these skills are not generally available in the local labour force. Consequently, the most likely opportunities for the local employment during exploration will involve the provision of camps and catering, collecting samples, expediting materials into the field, providing other services, and working as general labourers. Residents of Fort Good Hope are expected to account for 10% of jobs during the first three phases of mine development. This would amount to 0.7 jobs per year during exploration 3.5 jobs per year during bulk sampling, and 5.3 jobs per year during permitting and approvals.

During mine construction, the creation of 1,425 jobs each lasting two years would severely strain the labour resources of the region and would require considerable importation of labour, goods, and services. As noted previously, the 2006 census shows that there were only 110 construction workers in the three communities closest to Ts'ude niline Tu'eyeta: 30 in Fort Good Hope, 55 in Norman Wells, and 25 in Tulita. Based on experience with mine developments in other areas, it

is expected that most of the construction trades people would be relatively specialized and would be brought into the region. Local people would be contracted to clear the site, provide the camp services, and operate equipment. As with other diamond mines in the NWT, it is expected that training and procurement policies would be implemented to increase opportunities for local residents. Thus, it is estimated that regional residents would account for 10% of the project workforce (about 140 people per year over the construction period). These would mostly be residents of Fort Good Hope (45) and Norman Wells (70). Thus, residents of Fort Good Hope are estimated to represent 3% of the total construction labour force.

For operations, all of the management and engineering labour and much of the processing and maintenance staff will have to be brought into the region because they require special skills that are not available in the regional workforce. As a result of corporate commitments to training and hiring of local residents and to procuring goods and services from local businesses, it is estimated that about 25% of the total workforce could be residents of Fort Good Hope. This represents 36 direct and indirect mining jobs.

3.5.6 Potential Environmental Concerns

The environmental issues associated with exploring for diamonds and constructing and operating a mine are similar to the issues for metals mines, with some exceptions. During exploration the concerns would relate to noise and localized loss of habitat during drilling; no road would be required. For construction and operation, the key environmental issues were summarized in a draft report on the environment effects of diamond mining (Environment Canada, 1993). These include loss of habitat, which could range from 75 hectares for an underground mine to 500 hectares or more for an open pit mine, disruption of drainage patterns, noise, and dust.

Some additional issues related to mine operation relate to management of the waste rock or tailings, and include salinity/nutrients in receiving waters, metals leaching into groundwater, waste rock disposal, and acid rock drainage and effects on aquatic life. Acid rock issues are generally less of an issue for diamond mines than for metal mines. As noted earlier, there is always the potential for breaches of tailings ponds and possible contamination of water bodies and land, the probability of failure is very low: about 1 in 10,000 (Hill et al., 2003). Thus, the annualized cost of a spill costing $25 million to clean up with an annual probability would be $2,500, and the net present value of this would be only $31,250 (using a 7.0% discount rate).

It is expected that, in order to obtain approval to construct a diamond mine anywhere in the region, an environmental assessment will have to be completed and a plan developed to ensure that any adverse environmental effects are minimized. A strategy for mine closure will also have to be developed and implemented to ensure that there are no ongoing environmental issues once the mine ceases operations.

3.5.7 Potential Benefits and Costs

For the GNWT, it is assumed that some exploration, construction and production employment would be incremental to expected future economy activity and could be counted as benefits. However, the employment effects shown in Figure 3-28 include both direct and indirect employment resulting from diamond development, and spin-off effects (indirect employment) are not normally included in a benefit-cost analysis. As noted previously, multiplier information for the NWT does not allow differentiation of direct and indirect effects so, for purposes of this analysis, it is assumed that direct employment accounts for 75% of the overall employment effects for the exploration and construction phases shown in Figure 3-28.

The territorial labour income benefits would generally follow the same pattern as in Figure 3-28 although the average annual labour income in the diamond industry ($116,667)[26] is higher than for workers doing exploration, bulk sampling and permitting and approvals ($74,286) or construction ($86,842). The actual amount of labour income that can be counted as a benefit will depend on the extent to which unemployed and underemployed labour is employed to construct and operated a lead-zinc mine. For workers doing short-term activities like exploration, bulk sampling, permitting and construction, they would likely be working on a similar project elsewhere in the NWT, if not in Ts'ude niline Tu'eyeta, so would otherwise be employed. Consequently, none of their income would be considered "new" income. However, employment income could be counted as benefits if any of the workers were otherwise unemployed or if the project results in new long-term jobs, such as during project operations. Thus, it is assumed that 15% of labour income associated with oil exploration and drilling is estimated to be incremental income earned by workers who would otherwise be unemployed or underemployed. This assumption is based on the observation that, in 2009, the NWT had an unemployment rate of 10.3%, although 16.5% of the labour force in the Sahtu Region and 28.3% of the labour force in Fort Good Hope were unemployed. As mining operations would generate new long-term employment, it is assumed that all associated labour income can be counted as a project benefit.

Production from a diamond mine will generate corporate taxes and retained profits for the NWT government and NWT-based companies. NWT corporate taxes have been calculated based on 5% of gross revenues[27] and would generate about $21.0 million per year. Total profits have been estimated based on 10% of gross revenues (or $42.0 million per year). However, it is assumed that diamond mines would consist of joint ventures between Canadian and foreign companies such that Canadian companies would retain 50% of profits ($21.0 million per year) and, of this, GNWT-based businesses would retain 20% (or about $4.2 million per year).

[26] Average income is estimated by dividing the expected direct and indirect labour income resulting from a $1 million in new industry activity by the new direct and indirect employment that would occur. Data are taken from the NWT Bureau of Statistics (2011a).

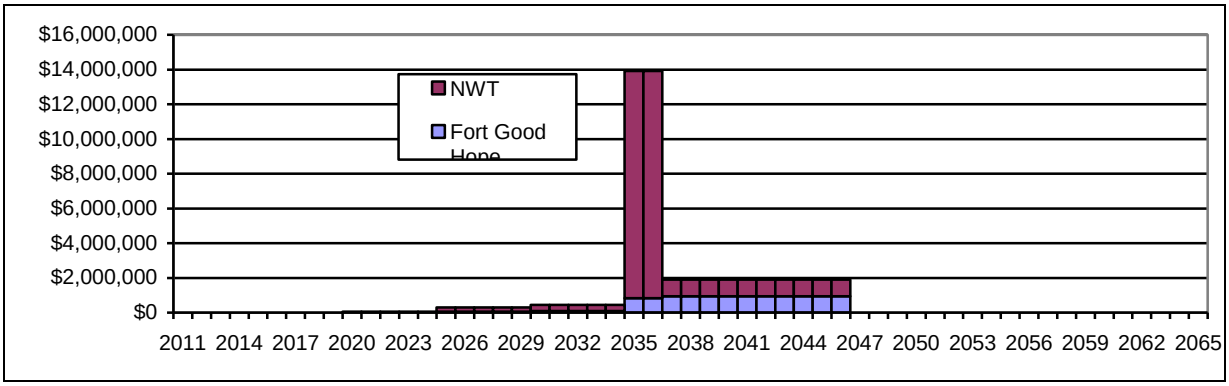
[27] Average NWT corporate taxes estimated for diamond mining were estimated to be 5% of gross revenues (GNWT 2000).

From a Canadian perspective, the incremental labour income benefits from diamond development would be the same as for the NWT. Diamond production is estimated to generate annual royalties of about $29.4 million and corporate income taxes of $46.2 million for the Federal Government.[28] It is also assumed that mining development would be undertaken by Canadian-based companies that would retain annual profits of $21.0 million.

It is assumed that residents of Fort Good Hope will account for 25% of total employment during operations, 10% during exploration, bulk sampling and permitting and approvals, and 3% during construction, based on the skill requirements for these activities and the current capabilities of the regional residents. With an unemployment rate of 28.3% in Fort Good Hope 2006, it is assumed that 30% of income earned by regional residents employed during exploration bulk sampling, permitting and approvals, and construction can be counted as new or incremental income. All of the income earned by residents of Fort Good Hope during mine operations is considered to be new income. In addition, some companies in Fort Good Hope are expected to provide goods and services needed to support natural gas development and their retained profits would also be a benefit. It is assumed that companies in Fort Good Hope would account for 10% of the retained profits of all GNWT-based businesses.

Figure 3-29 shows the incremental income stream for both Fort Good Hope and the NWT, assuming that all phases of developing a diamond mine – exploration, bulk sampling, permitting and approvals, mine construction and operations – actually proceed and that the mine has a 10-year operating life.

Figure 3-29: Incremental Labour Income Potentially Associated with Diamond Development in Ts'ude niline Tu'eyeta



3.5.8 Summary of Benefits and Costs

As noted previously, the Ozyer (2010) classified the potential of Ts'ude niline Tu'eyeta for primary kimberlite diamonds as being E3 (low to moderate potential based on some

[28] Information for the diamond industry (GNWT 2000) shows royalty payments of 7% of gross revenues and corporate federal taxes of 11%.

information). Given the uncertainty about the actual economic potential for diamond development in Ts'ude niline Tu'eyeta, project benefits and costs have been calculated assuming a 100% probability that exploration will occur, a 20% probability that the bulk sampling activities will occur, and a 10% probability that mines construction and operation would occur.

Based on these assumptions and the annual incremental labour income shown in, the net present value (NPV) of the future stream of incremental labour income associated with lead-zinc development in Ts'ude niline Tu'eyeta over the period to 2065 is estimated to be $1.1 million for the NWT, of which $0.21 million will accrue to residents of Fort Good Hope (assuming a discount rate of 7.0%). Thus, regional residents would account for about 15% of income benefits in the NWT. These values are summarized in Table 3-10.

Table 3-10: Present Value of Future Benefits Associated with a Diamond Mine in Ts'ude niline Tu'eyeta

Benefit	Undiscounted	Discounted (3.0%)	Discounted (7.0%)
NPV of Benefits for Canada (millions)			
Labour Income	$5.5	$2.6	$1.1
Royalties	$5.9	$1.9	$0.4
Canadian taxes	$9.2	$3.0	$0.7
NWT taxes	$4.2	$1.3	$0.3
Retained profits	$4.2	$1.3	$0.3
Total	$29.0	$10.2	$2.8
NPV of Benefits for NWT (millions)			
Labour Income	$5.5	$2.6	$1.1
NWT taxes	$4.2	$1.3	$0.3
Retained profits	$0.8	$0.3	$0.1
Total	$10.5	$4.3	$1.4
Percent of Canada	36%	42%	51%
NPV of Benefits for Fort Good Hope (millions)			
Labour Income	$1.28	$0.57	$0.21
Retained profits	$0.08	$0.03	$0.01
Total	$1.28	$0.60	$0.22
Percent of NWT	13%	14%	15%

Table 3-10 shows that, of the $2.8 million in benefits of diamond mine development in Ts'ude niline Tu'eyeta that accrue to Canada, 38% would be in the form of labour income ($1.1 million), 24% would be from Federal corporate taxes ($0.7 million), 15% would be from royalties ($0.4 million) and 11% would come from each of retained profits for Canadian companies and NWT taxes. About 51% of the benefits of diamond mine development in Ts'ude niline Tu'eyeta would accrue to the government and people of the NWT. Residents of Fort Good Hope are expected to account for 15% of the incremental labour income and other benefits experienced in the NWT.

3.6 Summary

While the results of the non-renewable resource assessments indicate that, although Ts'ude niline Tu'eyeta holds some potential for development, there is considerable uncertainty about if or when this development could occur and the potential magnitude of this development. While the studies by Drummond (2010) and Ozyer (2010) have determined that there are potential petroleum and mineral resources in the area, there is no information on the exact location or size of these resources, or whether the resources are economically or financially recoverable. However, based on available information, it is highly likely that, once the boundaries for a protected area have been established, there will be geophysical exploration work for both minerals and petroleum.

Development scenarios have been prepared for each of the five types of non-renewable resources known to have some potential in Ts'ude niline Tu'eyeta. These scenarios are based on best guesses about the timing and magnitude of the development that could occur. A summary of the assumptions used in each of the various scenarios is provided in Table 3-11. In general, it is assumed that:

- Oil development will proceed immediately because of the high price of oil and there is an existing means of transporting oil to southern markets.
- While exploration for natural gas will occur at the same time as oil exploration, development of these resources will be delayed until the Mackenzie Valley pipeline has been constructed and there is some unused capacity in the pipeline.
- Exploration for lead-zinc will commence immediately but mine construction is unlikely to occur unless significant resources are determined that can justify construction of a year-round access road.
- Exploration for copper will occur at the same time as for lead-zinc because the areas with potential are similar. Development of a copper mine is only likely if a road is built to support a lead-zinc mine, or the resources are sufficient to justify construction of an access road.
- Exploration for diamonds will be delayed (2020) because most exploration will continue in other parts of the NWT with better potential. Construction is unlikely unless resources are sufficient to justify the high costs of developing a mine.

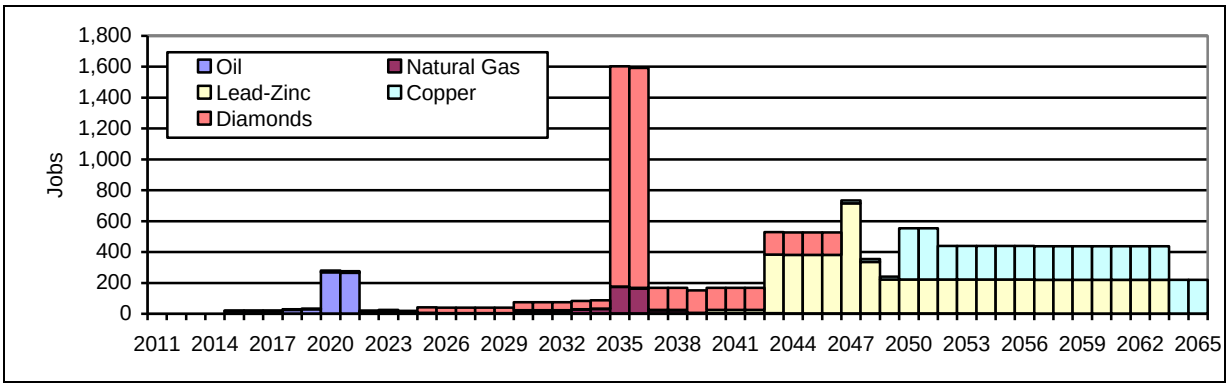
Table 3-11: Summary of Assumptions Use to Assess Potential Development of Petroleum and Mineral Development in the Ts'ude niline Tu'eyeta Area

		Oil	Natural Gas	Lead-Zinc	Copper	Diamond
Resource Potential		20.0 Million Barrels	213 Billion Cubic Feet	very high potential	moderate potential	low to moderate potential
Exploration	Start	2015	2030	2015	Included in lead-zinc exploration	2020
	Duration	9	9	25		5
	Cost (millions)	$51	$22	$11		$5
	Probability	100%	100%	100%	100%	100%
Bulk Sampling	Start	NA	NA	NA	NA	2025
	Duration					5
	Cost (millions)					$25
	Probability					20%
Drilling & Field Equipment	Start	2020	2033	NA	NA	NA
	Duration	4	3			
	Cost (millions)	$47	$44			
	Probability	100%	100%			
Permitting & Approvals	Start	NA	NA	2040	2040	2030
	Duration			3	3	5
	Cost (millions)			$9	$9	$38
	Probability			10%	10%	10%
Road Construction	Start	NA	NA	2043	Assume exists	NA
	Duration			5		
	Cost			$656		
	Probability			10%		
Project Construction	Start	2022	2035	2045	2045	2035
	Duration	2	2	2	2	2
	Cost (millions)	$135	$75	$175	$175	$750
	Probability	100%	100%	10%	10%	10%
Operation	Start	2021	2037	2049	2050	2037
	Duration	25	20	15	15	10
	Annual Cost (millions)	$2	$2	$44	$44	$120
	Probability	100%	100%	10%	10%	10%

3.6.1 Potential Labour Requirements

Based on the various assumptions it is possible to estimate the total direct and indirect employment requirements for all five types of development. These requirements are shown in Figure 3-30 and assume that all phases of development for all resources would proceed as planned. The largest labour requirements would occur during construction of major facilities, such as oil and gas pipelines and the three mine facilities (especially the diamond mine).

Figure 3-30: Incremental Labour Requirements Associated with Petroleum and Mineral Development in Ts'ude niline Tu'eyeta



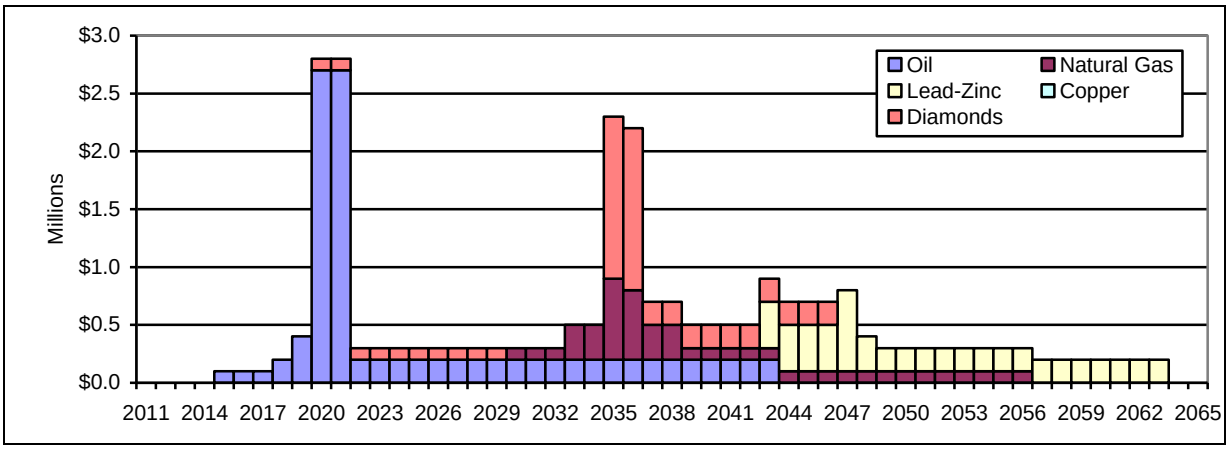
Overall, this development would provide less than 50 jobs per year until 2020, at which time oil pipeline construction would increase employment to about 200 jobs per year. Between 2022 and 2035, employment would be less than 100 jobs per year, but this would increase to about 1,600 jobs per year due to construction of the natural gas pipeline and the diamond mine. Between 2037 and 2042, employment would drop to about 130 jobs per year, but this would increase to between 400 and 600 jobs per year starting in 2043, once the lead zinc and copper mines are operating.

If all phases of development for all resources were actually to occur, the total capital investment would amount to $4.7 billion, would result in 16,000 person-years of direct and indirect employment in the NWT, and would increase GDP in the NWT by $2.2 billion. However, given the assumption that there is only a 10% probability that development of a lead-zinc, copper or diamond mine will actually occur, it is estimated that the total value of development in Ts'ude niline Tu'eyeta would be valued at $1.0 billion, resulting in 3,200 person-years of direct and indirect employment in the NWT, and increase GDP by $570 million.

3.6.2 Incremental Labour Income Benefits

The actual amount of employment benefits that can be attributed to this development can be estimated by combining the employment requirements in Figure 3-30 with the various assumptions about the probability of development (from Table 3-11**Error! Reference source not found.**) and making some assumptions about the extent to which unemployed and under-employed labour in the NWT will be hired for each phase of development. For all resources it is assumed that 15% of labour income associated with exploration, drilling, permitting and construction would consist of workers who would otherwise be unemployed or underemployed. Employment during the operational phase for each of the five resources is considered to be new employment. The resulting estimate of incremental annual labour income, which represents one measure of the benefits of resource development, is provided in Figure 3-31.

Figure 3-31: Incremental Labour Income Potentially Associated with Petroleum and Mineral Development in Ts'ude niline Tu'eyeta



This information can then be used to estimate the NPV of the incremental labour benefits associated with each type of non-renewable resource development in Ts'ude niline Tu'eyeta. These NPV estimates, calculated using discount rates of 7.0% and 3.0%, are summarized in Table 3-12, which also shows the undiscounted values for reference. Assuming a 7.0% discount rate, non-renewable resource development in Ts'ude niline Tu'eyeta will generate labour income with a NPV of $6.9 million in the NWT, with $2.5 million occurring in Fort Good Hope. These amounts increase to $13.4 million in the NWT and $4.7 million if a 3.0% discount rate is used.

Table 3-12: Present Value of Incremental Labour Income Associated with Non-Renewable Resource Development in Ts'ude niline Tu'eyeta

	Oil	Gas	Lead-Zinc	Copper	Diamond	Total
7.0% Discount Rate (millions)						
Fort Good Hope	$1.9	$0.3	$0.0	$0.0	$0.2	$2.5
NWT	$4.5	$0.8	$0.5	$0.0	$1.1	$6.9
Fort Good Hope %	42%	43%	8%	13%	20%	36%
3.0% Discount Rate (millions)						
Fort Good Hope	$3.0	$1.0	$0.2	$0.0	$0.6	$4.7
NWT	$7.1	$2.2	$1.4	$0.1	$2.6	$13.4
Fort Good Hope %	43%	44%	11%	13%	22%	35%
Undiscounted (millions)						
Fort Good Hope	$4.5	$2.2	$0.5	$0.0	$1.3	$8.5
NWT	$10.3	$5.0	$3.6	$0.4	$5.5	$24.7
Fort Good Hope %	44%	45%	13%	13%	23%	35%

Table 3-12 shows that the greatest potential labour income benefits for both the NWT and the local population (Fort Good Hope) will come from oil development. With a 7.0% discount rate, oil development will account for 65% of labour income in the NWT, with natural gas accounting

11%, diamond mining providing 16%, and lead-zinc and copper mining accounting for the balance (7%).

Table 3-12 also shows that the extent to which residents of Fort Good Hope would benefit from non-renewable resource development. The percentage of incremental labour income earned by local residents ranges from 42% of the NWT total for oil and 43% for natural gas development to 8% for lead-zinc development, 13% for copper development, and 20% for diamond development.

3.6.3 Royalties, Taxes and Profits

Non-renewable resource development in Ts'ude niline Tu'eyeta will also generate royalties and corporate income taxes for the Canadian Government and corporate taxes for the NWT government. Canadian, NWT and regional businesses will also generate profits that may be re-spent in the Canadian economy. The NPV of the royalty, tax and profit benefits associated with each type of non-renewable resource development, calculated using discount rates of 7.0% and 3.0%, are summarized in Table 3-13 which also shows the undiscounted values.

Table 3-13: Present Value of Royalties, Taxes and Retained Profits Associated with Non-Renewable Resource Development in Ts'ude niline Tu'eyeta

	Oil	Gas	Lead Zinc	Copper	Diamond	Total
7.0% Discount Rate (millions)						
Royalties	$4.2	$0.9	$0.3	$0.3	$0.4	$6.2
Canadian taxes	$7.6	$1.6	$0.5	$0.5	$0.7	$10.9
NWT taxes	$2.5	$0.5	$0.2	$0.2	$0.3	$3.8
Retained profits	$8.5	$1.8	$0.4	$0.4	$0.3	$11.4
Total	$22.9	$4.9	$1.4	$1.4	$1.7	$32.3
3.0% Discount Rate (millions)						
Royalties	$8.4	$3.3	$1.2	$1.2	$1.9	$16.1
Canadian taxes	$15.2	$5.9	$2.0	$2.0	$3.0	$28.0
NWT taxes	$5.1	$2.0	$0.9	$0.9	$1.3	$10.2
Retained profits	$16.9	$6.6	$1.8	$1.8	$1.3	$28.4
Total	$45.6	$17.7	$5.9	$5.9	$7.5	$82.6
Undiscounted (millions)						
Royalties	$15.0	$9.1	$3.9	$3.9	$5.9	$37.8
Canadian taxes	$27.0	$16.4	$6.1	$6.1	$9.2	$64.9
NWT taxes	$9.0	$5.5	$2.8	$2.8	$4.2	$24.2
Retained profits	$30.0	$18.2	$5.5	$5.5	$4.2	$63.5
Total	$81.0	$49.2	$18.3	$18.3	$23.5	$190.4

Table 3-13 shows that the Government of Canada will receive the majority of benefits of non-renewable resource development in Ts'ude niline Tu'eyeta. In combination, royalties and corporate tax payments to the federal government will account for 53% of the benefits identified

in Table 3-13, while retained profits will account for 35% and NWT corporate taxes will account for 12%.

3.6.4 Summary of Potential Benefits from Non-Renewable Resource Development

A summary of the net present value of Canadian, NWT and regional economic benefits associated with non-renewable resource development in Ts'ude niline Tu'eyeta is presented in Table 3-14. The table shows that, if all five types of non-renewable resource development proceed as assumed, the stream of future economic benefits will have a net present value of $39.2 million for Canada, based on a discount rate of 7.0%. Of these benefits, 33% will occur in the NWT ($13.0 million) while benefits to Fort Good Hope will amount to $2.7 million or 21% of the NWT benefits.

Table 3-14: Present Value of Economic Benefits Associated with Non-Renewable Resource Development in Ts'ude niline Tu'eyeta

	Oil	Gas	Lead Zinc	Copper	Diamond	Total
NPV of Benefits for Canada (millions) at 7.0%						
Labour Income	$4.5	$0.8	$0.5	$0.0	$1.1	$6.9
Royalties	$4.2	$0.9	$0.3	$0.3	$0.4	$6.2
Canadian taxes	$7.6	$1.6	$0.5	$0.5	$0.7	$10.9
NWT taxes	$2.5	$0.5	$0.2	$0.2	$0.3	$3.8
Retained profits	$8.5	$1.8	$0.4	$0.4	$0.3	$11.4
Total	$27.4	$5.7	$1.9	$1.4	$2.8	$39.2
NPV of Benefits for NWT (millions) at 7.0%						
Labour Income	$4.5	$0.8	$0.5	$0.0	$1.1	$6.9
NWT taxes	$2.5	$0.5	$0.2	$0.2	$0.3	$3.8
Retained profits	$1.7	$0.4	$0.1	$0.1	$0.1	$2.3
Total	$8.8	$1.7	$0.8	$0.3	$1.4	$13.0
Percent of Canada	32%	30%	43%	23%	51%	33%
NPV of Benefits for Fort Good Hope (millions) at 7.0%						
Labour Income	$1.9	$0.3	$0.0	$0.0	$0.2	$2.5
Retained profits	$0.2	$0.0	$0.0	$0.0	$0.0	$0.2
Total	$2.1	$0.4	$0.0	$0.0	$0.2	$2.7
Percent of NWT	24%	22%	6%	4%	15%	21%

The table shows that, for Canada, incremental labour income will only account for 18% of total benefits, with corporate taxes and royalties accounting for 43%. For the NWT, incremental labour income accounts for 53% of economic benefits and the importance of employment income effects increases to 92% for Fort Good Hope.

3.7 Socio-Economic Effects

The types of potential socio-economic effects that might occur for all five types of non-renewable resource development opportunities would be relatively similar, although the

magnitude of these effects will differ according to the scale of development and how these effects are managed. Development can have both positive and negative socio-economic effects.

Positive effects include employment and higher incomes for local and regional residents, increased capacity and educational levels as a result of training, higher self-reliance and self-esteem, regional economic diversification and increased economic stability, improved availability of consumer goods and services, and perhaps the development of infrastructure (roads, recreation centres, health facilities, etc.) that would not otherwise occur. Increased economic activity will also generate more revenues for the NWT government through taxes and royalties, with some of these revenues shared with regional and Aboriginal governments.

On the negative side, the higher incomes can lead to an increased incidence of substance abuse and associated problems like crime, violence and prostitution, especially if workers continue to maintain their permanent residence in another community. Long shifts and work rotations, which are common in remote areas, also create mental and physical stress, leading to a higher risk of accidents and can also strain family life (Gibson and Klinck, 2005). The permanent introduction of workers from outside the local communities can change the social structure of these communities and their demands for better quality housing can result in the creation of separate subdivisions that can effectively split a community. A sudden influx of workers with higher incomes can lead to inflationary pressures in communities and this may disadvantage vulnerable people living on fixed incomes. The introduction of workers and their families can result in more demands for social, educational and enforcement services as well as infrastructure (water, sewer, power) and the additional demands may strain the capacity of existing communities, resulting in more costs to regional or territorial governments and/or a reduction in the quality of services. And, when projects are no longer financially viable and operations end, the employment and income benefits also cease, resulting in potential social and other economic problems for communities.

Project proponents have developed two general approaches to addressing the socio-economic effects of development. The first approach, which relates specifically to development in more isolated areas or for very short-term projects, is to house all workers in a camp to be developed at or near the development site. This approach has been used to accommodate workers at the existing diamond mines in the NWT and Nunavut and for the oilsands development near Fort McMurray. The benefit of this approach is that potential adverse effects on nearby communities can be minimized. Workers are shuttled in and out of the work camps with minimal contact with local residents. This approach helps minimize problems related to substance abuse, crime and violence in the local communities by keeping the most of the workforce away from the community. It also means that the adverse effects associated with the cessation of project operations are minimized. However, housing workers in camps also means that the potential economic benefits to the local community are also minimized. Benefits to the community are limited to employment of those residents who have the appropriate skills to work on the project

or who can provide goods and services in a timely and cost-competitive manner. As noted in Phase 1 of the socio-economic assessment (InterGroup Consulting Ltd. 2009), most of residents of Fort Good Hope do not currently have the training necessary to work on any of the development projects except in a limited capacity: as labourers, land clearing, equipment operators, expediters, and camp operations and catering.

The other approach is to try to maximize project benefits to local communities by having the project workforce take up permanent or temporary residence in one or more nearby communities or to actually create a new community. This approach has been taken for pulp mills and coal mines in Alberta and British Columbia. This approach offers local communities the potential for significant economic and population growth, economic diversification, and improved services. For communities that would otherwise have limited development opportunities, the introduction of a large new workforce is very attractive. However, as noted above, the introduction of large numbers of new workers and their families can have a very disruptive effect on the structure and functioning of existing communities. Such problems can be particularly acute where the host communities were relatively homogeneous prior to development and, as noted in Phase 1 of the socio-economic study, 93% of the current regional population is Aboriginal. Housing workers in local communities also creates the potential for significant adverse effects when the project ceases operation and large numbers of local residents are no longer employed.

There is no single best approach for optimizing the socio-economic effects of resource development. It is up to individual communities to work with developers in advance of projects to agree on which approach is preferred and to establish the procedure for monitoring and managing any problems than may occur. There is increasing recognition that neither the proponent nor the community can address social or economic problems on its own; management of these problems is a shared responsibility. Thus, mechanisms like access and benefits agreements form a key step in having communities work with developers and governments to determine the terms and conditions under which development can proceed.

With respect to non-renewable resource development opportunities in Ts'ude niline Tu'eyeta, it is likely that the camp model will be used to accommodate most of the workers involved in the exploration phases of any petroleum or mineral development that occurs. There is no road access into the area and exploration activity occurs over a very short time period. For the construction phase, it is expected that a camp would be used to house workers constructing oil or gas pipeline facilities because of the short time period (two years), the very large construction labour requirements, and the small operational workforce. It is expected that the few workers directly involved in oil and/or gas operations would be housed in local communities, especially Norman Wells and, to a lesser extent Fort Good Hope. For construction and operation of a lead-zinc, copper or diamond mine, the camp model would also likely be used. Given the remote location of possible mines in Ts'ude niline Tu'eyeta, it is expected that workers would be housed in camps even when a permanent road to the mine has been constructed.

4.0 NO PROTECTION OPTION

Under the no protection option, it is assumed that all of the lands protected by the interim land withdrawal would revert to unprotected status, meaning that non-renewable resource development could be allowed to occur in all of the 15,000 km^2 that are currently subject to the interim withdrawal. There would be no formal protection of the land or biological resources in the area. However, as part of the approvals process, it is expected that developers would be required to implement various environmental management strategies that are designed to minimize adverse effects.

4.1 Non-Renewable Resource Development

When the area comes available for non-renewable resource development, it is expected that this development will occur as described in Section 3.0. This would involve exploration for oil and natural gas as well as mineral development. It is assumed that, if exploration proves successful, oil resources would be developed first followed by development of natural gas. In terms of mineral development, it is assumed that there is only a 10% probability that a lead zinc or copper mine would be developed, because of the high cost of creating year-round road access to the area. For diamonds, it is assumed that there is a 20% probability that the results of exploration warrant bulk sampling, and a 10% probability that a mine would actually be developed. Under this option, a total of $1,019 million would be invested and that this would generate 3,200 person- years of employment between 2015 and 2065, and that this would increase NWT GDP by $570 million. The resulting employment effects would be distributed over time as shown in Figure 4-1.

Figure 4-1: Estimated Direct and Indirect Employment in the NWT from New Non-Renewable Resource Development: No Protection Option

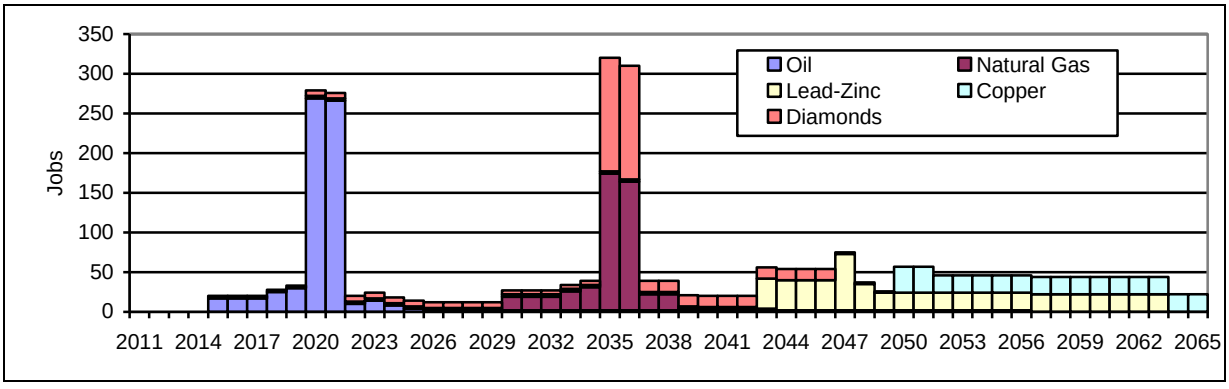


Figure 4-1 shows an initial flurry of activity in 2020 related to oil development and construction of a connector pipeline to Norman Wells, followed by another flurry of activity around 2035 related to natural gas development, and construction of a pipeline connection to the Mackenzie Valley Pipeline, as well as diamond exploration. There would be relatively low levels of employment during much of the forecast period because the labor requirements for oil and gas

and mineral exploration are quite small, and the labor requirements for oil and gas extraction are also quite small.

As described in Section 3.6, the economic benefits resulting from non-renewable resource development would be equivalent to a current value of $39.2 million for Canada (assuming a 7% discount rate), with $13.0 million of this occurring in the NWT, and $2.7 million occurring in Fort Good Hope (see Table 4-1).

Table 4-1: Present Value of Economic Benefits Associated with Non-Renewable Resource Development in Ts'ude niline Tu'eyeta: No Protection Option

	Undiscounted (millions)	3.0% Discount Rate (millions)	7.0% Discount Rate (millions)
Canada	$215.1	$96.1	$39.2
NWT	$61.7	$29.3	$13.0
Fort Good Hope	$9.8	$5.3	$2.7

If a lower discount rate is used (3.0%), the resulting values are higher: $96.1 million for Canada, of which $29.3 million will occur in the NWT and $5.3 million in Fort Good Hope.

4.2 Renewable Resources

If non-renewable resource development were to occur as proposed, it is expected that exploration activities and any resulting oil and gas or mineral development would result in land use disturbances that could adversely affect land and resource use in Ts'ude niline Tu'eyeta.

4.2.1 Extent of Land Disturbance

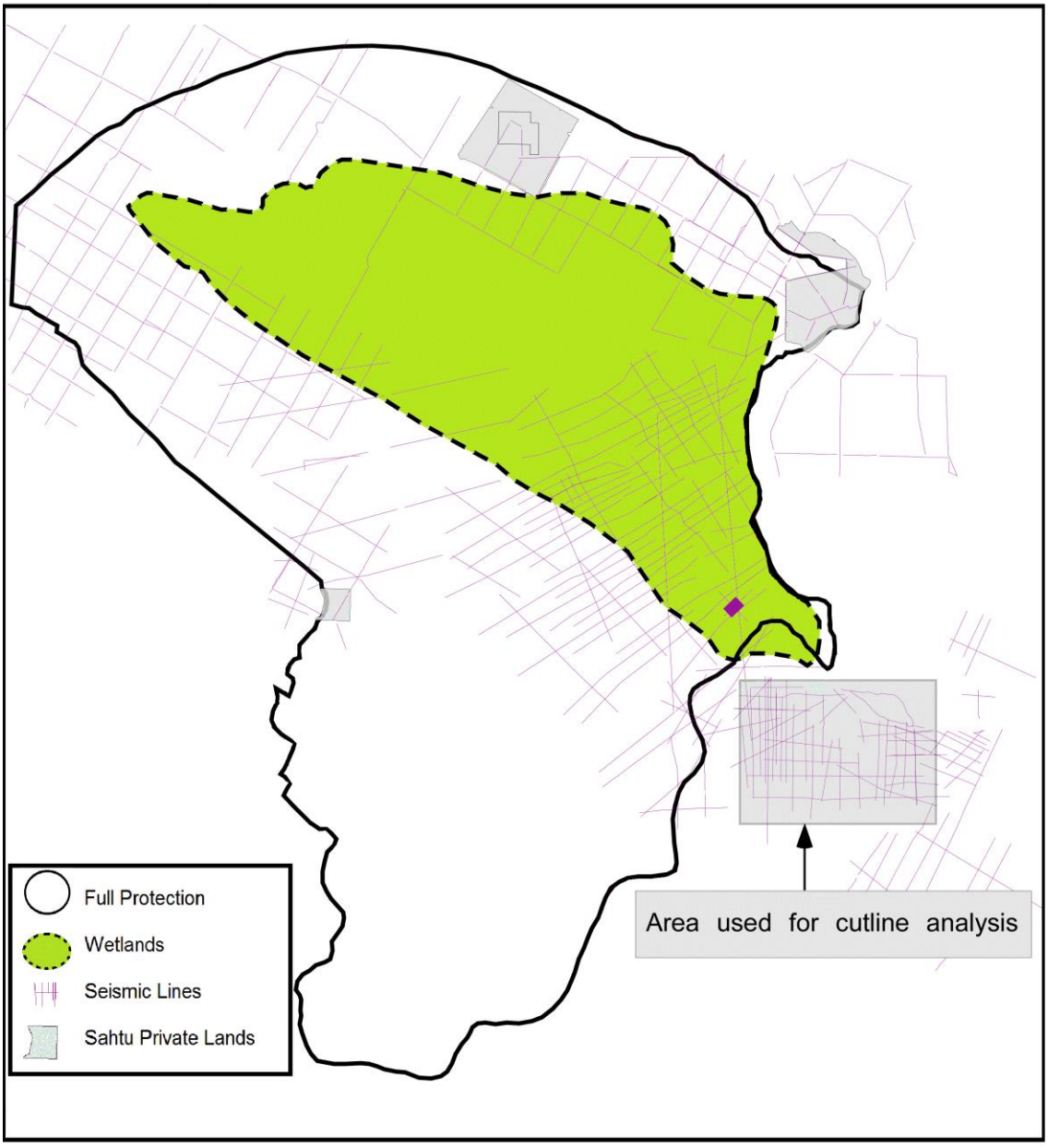
The greatest potential for land use disturbances is related to seismic exploration for oil and natural gas. The linear disturbances associated with seismic activity can directly result in habitat loss, cause habitat fragmentation, and create corridors that can be used by predators, humans and alternate prey. This has the potential to adversely affect animal and migratory bird populations as well as the human use of these resources.

The region in and around Ts'ude niline Tu'eyeta has already been disturbed to a small extent. According to Environment Canada (2011), 22% of the habitat for Woodland caribou in the northern portion of the NWT (an area of 191,540 km^2) has already been disturbed, either by fire during the period from 1970 to 2010 (18%) or by man-made disturbances (5%).[29] The information from Environment Canada suggests linear disturbances of about 19,154 km, or an average of 0.1 km/km^2. However, the level of disturbance in Ts'ude niline Tu'eyeta is even higher because of past oil and gas exploration activities. According to Nagy (2011) average seismic line densities in the Gwich'in-south Woodland caribou study area, which includes Ts'ude niline Tu'eyeta, was 0.41 km/km^2. GIS analysis suggests that there are currently about

[29] These two add to more than 22% because of overlaps between burnt areas and man-made disturbances.

3,273 km of seismic lines in Ts'ude niline Tu'eyeta, indicating an average disturbance of 0.22 km/km^{2}and, as shown in Figure 4-2 these are concentrated in the parts of the study area that has oil and gas potential, with limited seismic activity in the wetland areas and no seismic activities in the southern part of the withdrawal area.

Figure 4-2: Current Extent of Seismic Activity in Ts'ude niline Tu'eyeta



The extent to which future seismic work would add to the amount of linear land disturbance in the Ts'ude niline Tu'eyeta is difficult to predict, and will depend on the extent of seismic activity that occurs and the width of the seismic lines. However, it is possible to estimate future seismic activity in the study area based on the amount of extent of seismic development that has occurred

in areas on the east side of the Mackenzie River north of Norman Wells, where there is oil and gas development. This area is also shown in Figure 4-2. GIS interpretation of these areas suggests that there is 0.8 km/km^2 of linear disturbance.

For a land block of 86,750 ha, as was used in the assessment of potential oil and gas development, a disturbance factor of 0.8 km/km^2 suggests that there could be as many as 700 km of seismic lines. Based on the current density (0.22 km/km^2), each land block is estimated to currently have about 190 km of seismic lines. Thus, new oil and gas development is predicted to quadruple the number of seismic lines in the area, by creating 510 km of new seismic lines per land block. This would result in direct disturbance of between 90 and 255 ha of land per land block, depending on whether the seismic lines are 1.75 m or to 5 m wide. With the drilling of nine oil wells and eight gas wells, plus construction of 135 km of oil connector pipeline and 75 km of a gas connector pipeline, as assumed in the oil and gas development scenarios, this would result in the loss of another 227 ha of land, or about 17 ha per land block. Thus, under the oil and gas development scenarios, the total direct land disturbance would amount to between 110 ha and 270 ha per land block.

The additional direct land disturbances resulting from new seismic activity are relatively small; between 0.1% and 0.3% of each land block. However, the potential disturbance effects of seismic activity extend beyond the actual boundary of the line. If the actual zone of influence resulting from each seismic line was 10 m from the centre line, total habitat loss would be about 2% of the area; if the zone of influence was increased to 25 m., total habitat loss would amount to 5% of each land block.

4.2.2 Effects on Caribou

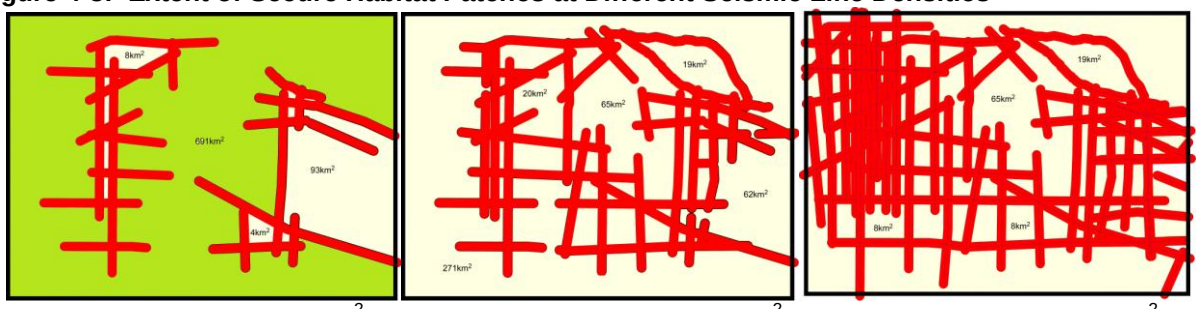
Woodland caribou are particularly susceptible to land-use disturbance. While seismic lines may result in a relatively small direct disturbance of the land, the resulting corridors provide access for predators and humans that may significantly limit the amount of secure caribou habitat in a specific area. The implications of linear disturbances on boreal caribou habitat were recently addressed by Nagy (2011) who used data from seven different study areas, two of which were located in Ts'ude niline Tu'eyeta: the Sahtu study area and the Gwich'in-south study area. Based on radio collar information, he observed that caribou in this area avoided seismic lines during most of the calving and early summer periods but also avoided them during late winter and breeding periods. He found that during calving and early summer periods, caribou in the Gwich'in south study area avoided areas that were less than or equal to 400 m distant from seismic lines. Based on this information, Nagy concluded that preferred secure habitats for Woodland caribou in the Gwich'in-south area consist of unburnt areas greater than 400 m from seismic lines.

As noted above, the existing landscape suggest that there are about 190 km of seismic line per land block (86,750 ha) of which 18% was burnt between 1970 and 2010. Based on GIS

modeling of the existing landscape, this suggests that there currently about 57,510 ha of preferred secure habitat for Woodland caribou in each land block, or about 66% of the total area. With the addition of another 510 km of seismic lines, the amount of preferred secure habitat for Woodland caribou decreases to 29,810 ha, or 34% of the total area. Because the additional seismic lines fragment the available habitat, the potential losses preferred secure habitat are not linearly related to the length of seismic lines in the area, but are actually exponentially related.

Thus, the potential adverse effects of additional seismic lines on Woodland caribou in Ts'ude niline Tu'eyeta could be significant. Nagy (2011) notes that Woodland caribou numbers were declining in those study areas that had the least amount of secure habitat in patches of greater than 500 km² and where predator and/or alternate prey species diversity was greatest. Thus, continued survival of Woodland caribou populations in Ts'ude niline Tu'eyeta will partially depend on maintaining secure habitat in patches of greater than 50,000 ha, which represents 58% of each land block. GIS modeling (see Figure 4-3) shows that, for a representative area with seismic line densities of (0.22 km/km^2), it is possible to have a secure habitat patch that exceeds 50,000 ha (500 km^2) but such patches may not be possible if the density of seismic lines densities were to increase to 0.40 km/km^2 and are not possible at a density of 0.80 km/km^2. Thus, the analysis suggests that while secure habitat patches of greater than 50,000 ha currently exist in Ts'ude niline Tu'eyeta, any additional seismic development may result in a significant decrease in the availability of such patches, and this would likely make is impossible for Woodland caribou to continue to survive in Ts'ude niline Tu'eyeta.

Figure 4-3: Extent of Secure Habitat Patches at Different Seismic Line Densities



Current Density (0.22 km/km^2) Increased density (0.40 km/km^2) Future Density (0.80 km/km^2)

This does not necessarily mean that the regional Woodland caribou population cannot be sustained by the available land base. Ts'ude niline Tu'eyeta, with an area of 15,000 km², represents 8% of potential habitat for the northern boreal caribou herd in the NWT (Environment Canada 2011). The more likely scenario is that caribou would no longer use Ts'ude niline Tu'eyeta because of the additional seismic disturbance, and would increase their utilization of other areas of secure habitat within their range. Consequently, while increased seismic activity may not affect the size or sustainability of Woodland caribou within their range (which includes Ts'ude niline Tu'eyeta), the redistribution of caribou within their range will adversely affect residents of Fort Good Hope, forcing them to travel to different areas outside Ts'ude niline Tu'eyeta to harvest Woodland caribou.

As noted in Section 2.1.2, residents of Fort Good Hope harvest small numbers of Woodland caribou: from 5 to 14 animals per year, with 58% being harvested in Ts'ude niline Tu'eyeta. These animals provide about 220 kg of meat with an annual replacement value of $2,825. However, it is possible that hunting pressures on these animals by residents of Fort Good Hope could increase in the future as a result of increasing restrictions on harvests of barren ground caribou in areas east of the Mackenzie River and this may not be possible in Ts'ude niline Tu'eyeta if seismic activity were to be allowed.

4.2.3 Effects on Other Renewable Resources and Use

In terms of potential impacts on other renewable resources, the seismic lines and other linear disturbances associated with oil and gas development are expected to increase access to the area, resulting in increased predation as well as increased hunting by residents of other communities. As a result, is estimated that disturbances associated with oil and gas development will result in a 5% decline in wildlife populations, and this will translate into 5% decline in the amount and value of country food (other than Woodland caribou) being harvested from Ts'ude niline Tu'eyeta. There is expected to be no change in the availability of fuel for subsistence use, but revenues from trapping are also predicted to decrease by 5%. In terms of recreation, the additional seismic activity is unlikely to affect total activity or expenditures, but residents of Fort Good Hope will have to travel farther to find undisturbed areas with equivalent values and so a 5% decrease in extra-market benefits is assumed. There is expected to be no change in tourism activity, as most current tourist activities occur on Mackenzie River or areas adjacent to Ts'ude niline Tu'eyeta.

Although much of the outfitting and guided hunting activity in the two outfitting zones occurs outside Ts'ude niline Tu'eyeta, there is concern that the linear disturbances associated with oil and gas development will lead to changes in the distribution and number of ungulates and increased access will lead to increased predation by wolves and increased hunting by resident hunters. As was noted in Section 2.2.2, these effects, combined visual disturbances to the land base, would seriously inhibit the ability of outfitters to continue to sustainably operate at current levels and could reduce gross revenues by half for one guide outfitter, or about $500,000 per year.

In terms of the ecological goods and services being provided by the area, it is expected that the ability of the area to sequester carbon would be reduced as a result of land clearing for seismic and other activities. This loss would be about 1%, based on the actual amount of land that would be cleared. However, these effects would be short term once new plants start to grow in the cleared areas. For migratory birds, it is expected that the disturbance associated with clearing seismic lines would result in a 5% loss of habitat that would reduce waterfowl numbers by 5% which, in turn, would decrease the value of migratory birds for hunting and bird watching by 5%.

The potential effects on cultural values could be large, although it is expected that, as a condition of land use permits, seismic activities and other activities that would disturb the land would not be allowed in the immediate vicinity of known cultural sites.

4.2.4 Summary of Effects on Renewable Resources

Based on the assumptions noted above, the total value of annual renewable resource benefits from Ts'ude niline Tu'eyeta, assuming that oil and gas and mineral development were allowed, would decrease by about 16% from current conditions. The annual benefits with no protection would be as shown in Table 4-2. It shows that, when compared to current conditions (Table 2-3), the annual benefits would drop by about $557,000 per year, with most of the decrease being related to guiding and outfitting. For most types of benefits, allowing development would only decrease annual benefits by about 5%, although this would increase to 7% for consumption of wildlife as a result of significant adverse effects on Woodland caribou.

Table 4-2: Summary of Annual Economic Benefits from Renewable Resources in Ts'ude niline Tu'eyeta: No Protection Option

Type of Benefit		Effect of Development	Low	High
Traditional Resource Use and Values	Consumption of fish	-5%	$7,800	
	Consumption of wildlife	-7%	$107,100	
	Native plants and berries	-5%	Unknown	
	Wood for fuel	None	$51,700	
	Recreation – expenditures	None	$24,800	$48,900
	Recreation – non-market benefits	-5%	$5,400	$10,700
Commercial Resource Use and Values	Trapping	-5%	$25,300	
	Outfitting and guided hunting	100%	$0	
	Tourism	None	$39,300	
	Arts and crafts	-5%	$18,000	
	Commercial forestry	None	Unknown	
Ecological Goods and Services	Drinking water	None	Unknown but small	
	Climate regulation	-1%	$2,648,300	
	Value of migratory waterfowl – hunting	-5%	$20,200	
	Value of migratory waterfowl – bird watching	-5%	$336,900	
Cultural Values		Unknown	Not Quantified	
TOTAL			**$3,284,800**	**$3,314,200**

The decrease in economic benefits from renewable resource development shown in Table 4-2 will not occur immediately. It is expected that the value of these benefits will start to decline starting in 2015 when exploration for oil is expected to commence, reaching the amounts shown in Table 4-2 by 2023. Based on this timing of effects the NPV of renewable resource use in Ts'ude niline Tu'eyeta would be as shown in Table 4-3. It shows that, for a discount rate of 7.0%, the NPV of benefits to Canada would be $9.4 million, of which residents of Fort Good

Hope would enjoy benefits of $4.5 million. Another $45.1 million in benefits would accrue to global residents in terms of carbon sequestration and migratory waterfowl. These benefits would be about $3.1 million less (5% less) than if current levels of renewable resource development were to continue through 2065. The NPV of benefits to Canada, residents of Fort Good Hope and globally would be higher if a lower discount rate were to be used, but the loss of renewable resource benefits would also be less.

Table 4-3: Present Value of Economic Benefits Associated with Renewable Resources in Ts'ude niline Tu'eyeta: No Protection Option

	Undiscounted (millions)	3.0% Discount Rate (millions)	7.0% Discount Rate (millions)
Fort Good Hope	$16.3	$8.2	$4.5
All of Canada	$23.2	$14.1	$9.4
Global	$165.5	$83.1	$45.1
TOTAL	**$188.8**	**$97.3**	**$54.5**

4.3 Total Economic Value

Under the no protection option there would be economic benefits from both renewable resource use and non-renewable resource development. The total economic value under this option can be estimated by adding the value estimates in Table 4-1 and Table 4-3. The results are shown in Table 4-4. It shows that, when using a 7.0% discount rate, Ts'ude niline Tu'eyeta would generate benefits with a net present value of $93.7 million over the period to 2065, of which 42% would come from non-renewable resource development.

Table 4-4: Present Value of Economic Benefits Associated with Ts'ude niline Tu'eyeta: No Protection Option

	Undiscounted	3.0% Discount Rate	7.0% Discount Rate
NPV of Benefits for All of Canada (millions)[30]			
Renewable Resources	$23.2	$14.1	$9.4
Non-Renewable Resources	$215.1	$96.1	$39.2
TOTAL	$238.3	$110.2	$48.6
NPV of Benefits for Fort Good Hope (millions)			
Renewable Resources	$16.3	$8.2	$4.5
Non-Renewable Resources	$9.8	$5.3	$2.7
TOTAL	$26.1	$13.5	$7.2
NPV of Global Benefits (millions)			
Renewable Resources	$165.5	$83.1	$45.1
NPV of Total Benefits (millions)			
Renewable Resources	$188.8	$89.6	$54.5
Non-Renewable Resources	$215.1	$96.1	$39.2
TOTAL	$403.9	$193.4	$93.7

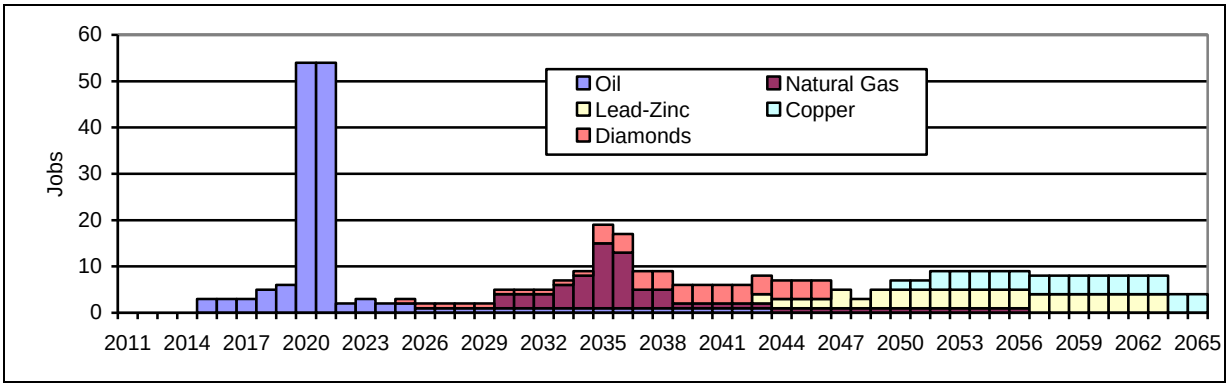
[30] Includes benefits for residents of Fort Good Hope.

For residents of Fort Good Hope, the NPV of future benefits from Ts'ude niline Tu'eyeta would total $7.2 million of which 38% would come from non-renewable resource development.

4.4 Effects on Fort Good Hope

The most important regional socio-economic effect arising from the baseline or no protection option is that non-renewable resource development would create jobs and wage employment for residents of Fort Good Hope. The number of these jobs over the forecast period is shown in Figure 4-4. Cumulatively, this amounts to 433 person-years of employment over about 50 years, or the equivalent of 8.5 jobs per year, although this would range from a high of 50 jobs in 2020 to less than 10 jobs per year for most of the forecast period. These numbers could increase, however, as a result of any economic and access agreements negotiated with non-renewable resource development companies.

Figure 4-4: Estimated Direct and Indirect Employment in Fort Good Hope from New Non-Renewable Resource Development: No Protection Option



The economic benefits of non-renewable resource development for Fort Good Hope were estimated to have a net present value of $2.7 million (assuming a 7.0% discount rate) although this would increase to $5.3 million if a smaller (3.0%) discount rate were used. About 90% of these economic benefits consist of labour income, with the balance being profits retained by local companies. The income generated by new employment would be equivalent to about $200,000 per year.

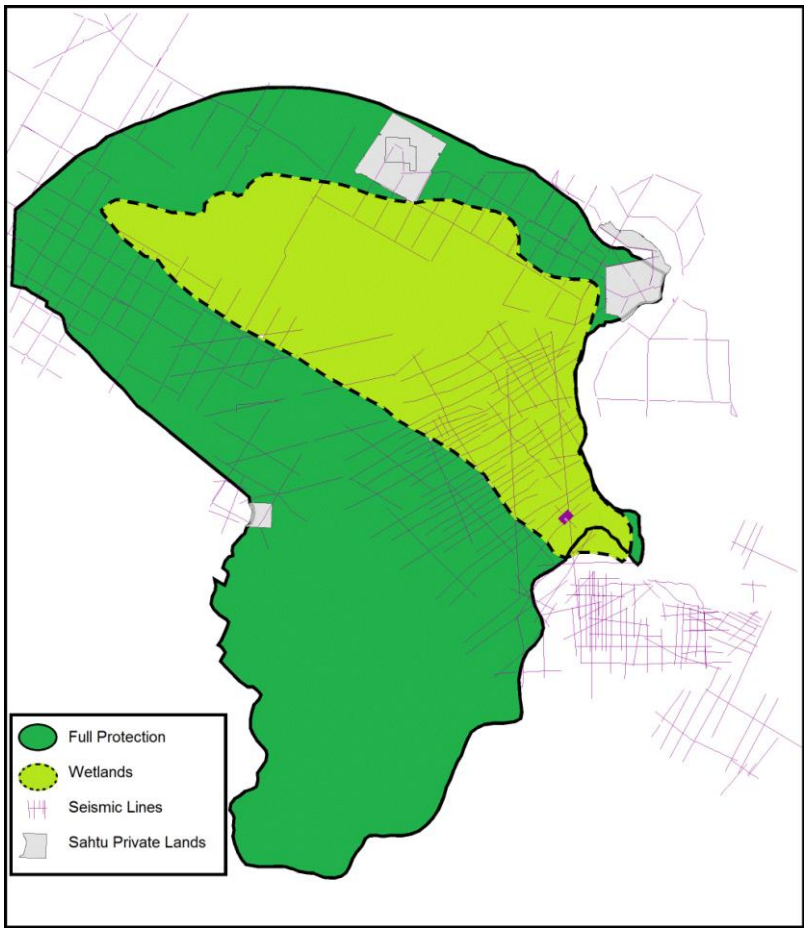
Local employment resulting from non-renewable resource development will have a small but important effect on socio-economic conditions in Fort Good Hope. In 2006, Fort Good Hope had a labour force of 275 people of whom 210 were employed, resulting in an unemployment rate of 23.6%. The creation of 10 new jobs would have the effect of reducing the local unemployment rate to 20.0% while the additional income would increase total income in the community by about 3%. While, the employment and income effects are relatively small at a community level, they will be important for those individuals and companies that directly benefit from non-renewable resource development, especially if they would otherwise have to leave the community to find equivalent wage employment.

On the other hand, non-renewable resource development in Ts'ude niline Tu'eyeta will affect the amount and value of food and income that residents of Fort Good Hope currently obtain from the area. As noted in Section 2.4.1, in 2009 fishing and hunting in Ts'ude niline Tu'eyeta provided 4.9% of the community's annual food supplies worth $123,800 per year and generated about $121,750 per year in income, or about 1.2% of the estimated total employment income in Fort Good Hope. Without protection, it is estimated that the resulting oil and gas development would result in losses of food valued at $9,000 per year, and income valued at $2,700 per year.

5.0 FULL PROTECTION OPTION

Under this option, all of the 15,000 km^2 of land temporarily withdrawn for the Ts'ude niline Tu'eyeta Candidate Protected Area would be designated as a National Wildlife Area and no non-renewable resource development activities would be allowed. Figure 5-1 shows a map of the protected area boundaries under this option.

Figure 5-1: Ts'ude niline Tu'eyeta Boundary Options: Full Protection



5.1 Non-Renewable Resources

Despite the apparent resource potential of the area, there would be no oil, gas, or mineral development within the National Wildlife Area. Thus, no employment or income benefits from non-renewable resource development would be possible.

5.2 Renewable Resources

Designation of the entire Ts'ude niline Tu'eyeta area as a National Wildlife Area would essentially protect all renewable resources and allow traditional and commercial resource use to continue as at present. With full protection, it is expected that Ts'ude niline Tu'eyeta would continue to provide the range of ecological goods and services currently being provided.

However, formal designation of the area as a National Wildlife Area will create two other types of ecological goods and services. As noted in Section 2.3.4, Canadians are willing to pay to protect landscapes because they benefit from knowing that these landscapes exist (existence values), that they can visit these areas in the future (option value) and these landscapes will be available to future generations (bequest value). Without formal designation of Ts'ude niline Tu'eyeta area as a National Wildlife Area, it is not clear that Canadians would be left with the option to visit the areas in the future or that the landscape will be available for future generations. Thus, it is estimated that Canadians could be willing to pay an average of $5.50 per household to formally designate Ts'ude niline Tu'eyeta as a National Wildlife Area. Based on the current population, this represents an existence value of $69.0 million, or $2.1 million per year in perpetuity, based on a discount rate of 3%%, or $4.8 million per year, based on a discount rate of 7.0%.

And, as noted in Section 2.3.2, there is also evidence that Canadians derive some measure of well-being from knowing that Woodland caribou continue to exist in various parts of the country and that they would be willing to pay to continue to conserve caribou. Without formal designation of Ts'ude niline Tu'eyeta area as a National Wildlife Area that would help protect Woodland caribou, these caribou populations may be at risk. Thus, creation of a National Wildlife Area will help ensure the survival of the Woodland caribou herd and will create and maintain existence values for caribou. Available information suggests that Canadian households would be willing to pay between $4.4 million and $21.3 million to protect the one herd in Ts'ude niline Tu'eyeta and that this is equivalent to an annual willingness to pay of between $131,700 and $637,700 (2010$), based on a discount rate of 3.0%, and between $308,000 and $1,491,000 based on a discount rate of 7.0%.

When these existence values are combined with economic benefits that are currently being generated by Ts'ude niline Tu'eyeta (Table 2-4), the resulting estimates of the economic benefits of establishing a national wildlife area would be as shown in Table 5-1. Table 5-1 shows that, when compared to the current benefits from renewable resources, as reported in Table 2-4, the economic benefits to residents of Fort Good Hope would remain unchanged. For residents of other parts of Canada, the economic benefits would increase from $7.5 million (assuming a 7.0% discount rate) to $89.3 million. The ecological goods and services global benefits would remain unchanged. In total, the net present value of economic benefits would increase from $57.5 million for current conditions (assuming a 7.0% discount rate) to $139.3 million if a National Wildlife Area is created; this is a 142% increase. If a lower discount rate is used (3.0%), the NPV of future economic benefits would increase from $106.4 million to $188.2 million.

Table 5-1: Economic Benefits from Renewable Resources in Ts'ude niline Tu'eyeta: Full Protection Option

Benefit	Undiscounted	Discounted (3%)	Discounted (7%)
NPV of Benefits to Fort Good Hope (millions)			
Sub-Total	$16.8	$8.4	$4.6
Percent of Total		3.3%	
NPV of Benefits to Other Canada (millions)			
Outfitting and Guided Hunting	$27.5	$13.8	$7.5
Existence value – Woodland Caribou	$12.8	$12.8	$12.8
Existence Value - Protected Area	$69.0	$69.0	$69.0
Sub-Total	$109.3	$95.6	$89.3
Percent of Total		37.2%	
NPV of Global Benefits (millions)			
Sub-Total	$167.8	$84.1	$45.5
Percent of Total		57.1%	
NPV of All Benefits (millions)			
Total	$293.9	$188.2	$139.3

5.3 Total Economic Value

Under the full protection option there would only be economic benefits from renewable resource use. The total economic value under this option is shown in Table 5-2. It shows that, when using a 7.0% discount rate, Ts'ude niline Tu'eyeta would generate benefits with a net present value of $139.3 million, all of which would come from renewable resource use and the provision of ecological goods and services. For residents of Fort Good Hope, the NPV of future benefits from Ts'ude niline Tu'eyeta would total $4.6 million.

Table 5-2: Present Value of Economic Benefits Associated with Ts'ude niline Tu'eyeta: Full Protection Option

	Undiscounted	3.0% Discount Rate	7.0% Discount Rate
NPV of Benefits for All of Canada (millions) [31]			
Renewable Resources	$126.1	$104.0	$93.8
Non-Renewable Resources	$0	$0	$0
TOTAL	$126.1	$104.0	$93.8
NPV of Benefits for Fort Good Hope (millions)			
Renewable Resources	$16.8	$8.4	$4.6
Non-Renewable Resources	$0	$0	$0
TOTAL	$16.8	$8.4	$4.6
NPV of Global Benefits (millions)			
Renewable Resources	$167.8	$84.1	$45.5
NPV of Total Benefits (millions)			
Renewable Resources	$293.9	$188.2	$139.3
Non-Renewable Resources	$0	$0	$0
TOTAL	$293.9	$188.2	$139.3

[31] Includes benefits for residents of Fort Good Hope.

5.4 Effects on Fort Good Hope

The main socio-economic implication of creating a National Wildlife Area at Ts'ude niline Tu'eyeta is that preclusion of non-renewable resource development would result in lost opportunities for wage employment. As noted in Section 4.3, non-renewable resource development is estimated to create 433 person-years of employment for residents of Fort Good Hope over the period from 2015 to 2065. This represents an average of 7.9 jobs per year and would generate an average of $192,400 per year in income. Without non-renewable resource development and the associated employment, it is expected that unemployment rates in the community will remain high (23.6% in 2006) and incomes will remain below the NWT average.

On the other hand, residents of Fort Good Hope will still be able to participate in traditional activities in Ts'ude niline Tu'eyeta, because the area can continue to provide food, fuel and medicinal plants, and generate some incomes through trapping and tourism. As noted in Section 2.4.1, in 2009 fishing and hunting in Ts'ude niline Tu'eyeta provided 4.9% of the community's annual food supplies and generated about $121,750 per year in income, or about 1.2% of the estimated total employment income in Fort Good Hope. In addition, preclusion of non-renewable resource development would help ensure that the cultural value of Ts'ude niline Tu'eyeta, which has not been quantified economic terms, would remain intact. Thus, the full protection option affords residents of Fort Good Hope with the opportunity to maintain the traditional and cultural importance of the area for current and future generations, but at the expense of some wage employment opportunities.

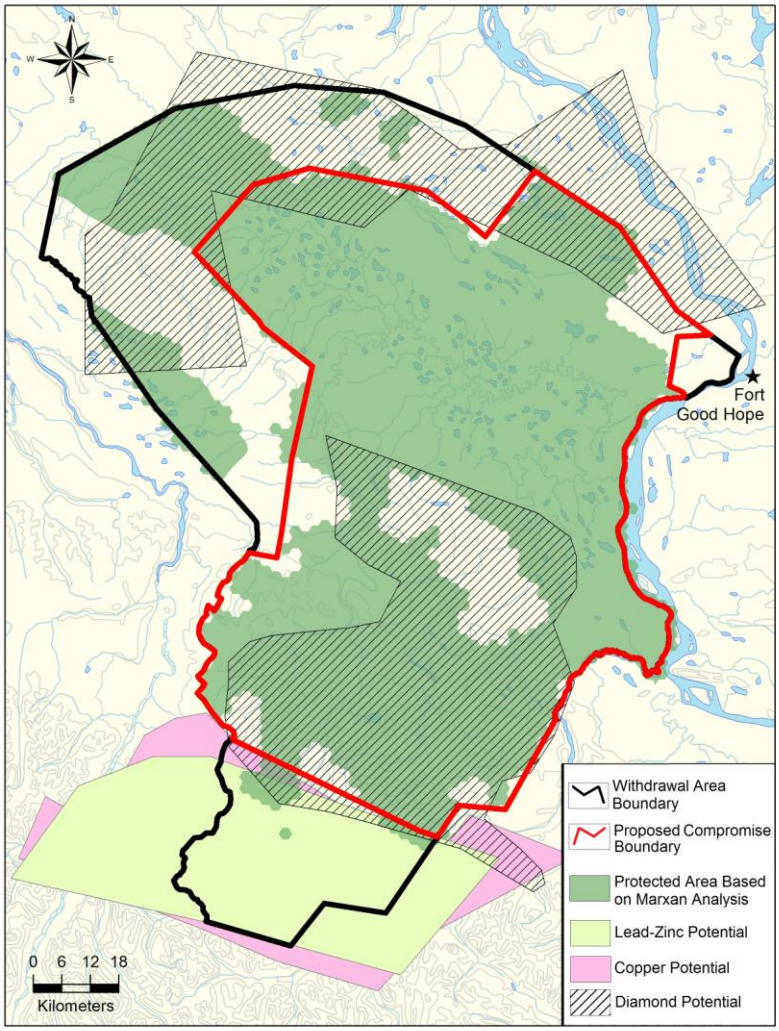
6.0 COMPROMISE BOUNDARY OPTION

An alternate boundary option was identified by the Ts'ude niline Tu'eyeta Working Group. This boundary option was identified based on a combination of Marxan analysis, the heat map described in Figure 2-14 and through internal discussions. The Marxan analysis compared available information about the location of potential oil, gas, and mineral deposits with selected conservation targets to determine which parts of the candidate protected area could be excluded from the proposed National Wildlife Area so as to allow development without significantly compromising conservation objectives. This option represents a compromise boundary option.

6.1 Description

The boundaries of the National Wildlife Area proposed by the Working Group are shown in Figure 6.1.

Figure 6-1: Proposed Ts'ude niline Tu'eyeta Boundary: Compromise Option



The proposed protected area would be about 10,100 km^2 in size and would include most of the wetland areas as well as 76% of the Ramparts River drainage but only 43% of the Ontaratue River drainage along the northern boundary of the withdrawal area. The eastern slopes of the Mackenzie Mountains would not be included in the National Wildlife Area.

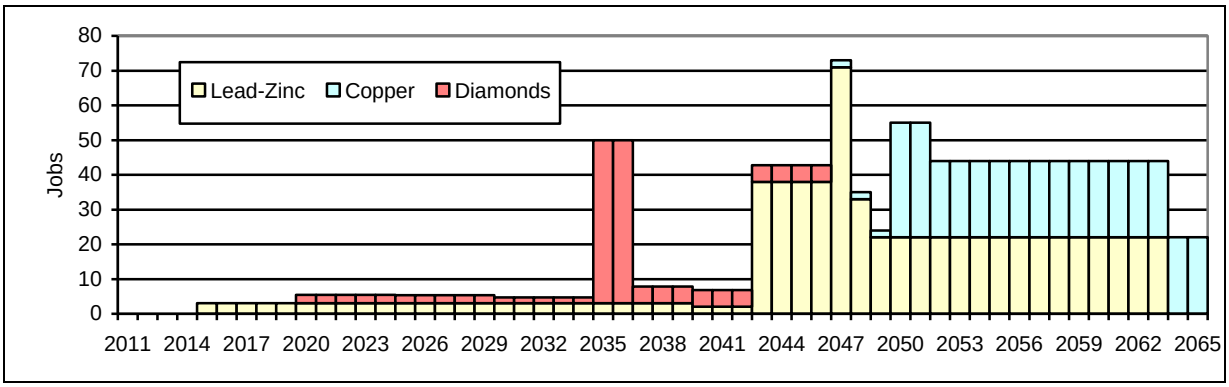
6.2 Non-Renewable Resources Development

Non-renewable development under the compromise option would largely be limited to mineral development. With the proposed boundaries, about 68% of the quarter grids that have 80% of the recoverable oil reserves would be situated inside the National Wildlife Area (see Figure 3-1) and could not be developed. Similarly, about 75% of the recoverable natural gas reserves would be situated in the National Wildlife Area (see Figure 3-9). The areas left outside the National Wildlife Area have relatively low oil and gas potential and given the costs and risk associated with drilling it is unlikely that companies would undertake exploration activities in these areas. In addition, even if one or two wells might prove successful, it is unlikely that the discovered reserves would be sufficient to warrant the costs of constructing connector pipelines to Norman Wells (oil) or the Mackenzie Valley pipeline (gas). Thus, based on the location of the proposed National Wildlife Area boundaries under the compromise option, it is unlikely that any oil or gas development will occur in those parts of the withdrawal area outside the protected area.

For mineral development, it is expected that lead-zinc and copper development will occur as described in Section 3.0 because most of the area with potential for these resources would be located outside the National Wildlife Area. Thus, it is assumed that there would be exploration for lead-zinc and copper. However, because of the high cost of creating year-round road access to the area, it is assumed that there is only a 10% probability that a lead zinc or copper mine would be developed. For diamonds, about one-third of the area with diamond potential will be situated outside the proposed National Wildlife Area. As a result it is assumed that expenditures on diamond exploration would be reduced by two-thirds, and that the probabilities of bulk sampling and mine development would be reduced accordingly.

Under this option, a total of $350 million would be invested and that this would generate 1,360 person- years of employment between 2015 and 2065, and that this would increase NWT GDP by $151 million. The resulting employment effects would be distributed over time as shown in Figure 6-2. There would be relatively low levels of employment during the early part of the forecast period because the labour requirements for mineral exploration are quite small. Labour requirements would increase in 2035 associated with bulk sampling for diamonds. While there would be large labour requirements associated with constructing and operating mines, the estimates in Figure 6-2 assume that there is only a 10% probability that mining would actually occur.

Figure 6-2: Estimated Direct and Indirect Employment in the NWT from New Non-Renewable Resource Development: Compromise Option



The economic benefits resulting from mineral development would be equivalent to a net present value of $4.2 million for Canada (assuming a 7% discount rate), with $1.6 million of this occurring in the NWT, and $0.1 million occurring in Fort Good Hope (see Table 6-1).

Table 6-1: Present Value of Economic Benefits Associated with Mineral Development in Ts'ude niline Tu'eyeta: Compromise Option

	Undiscounted (millions)	3.0% Discount Rate (millions)	7.0% Discount Rate (millions)
Canada	$50.1	$16.7	$4.2
NWT	$15.2	$5.5	$1.6
Fort Good Hope	$1.2	$0.4	$0.1

If a lower discount rate is used (3.0%), the resulting values are higher: $16.7 million for Canada, of which $5.5 million will occur in the NWT and $0.4 million in Fort Good Hope.

6.3 Renewable Resources

Without oil or gas development, the extent of land use disturbances would be limited to the mineral exploration and development in those parts of Ts'ude niline Tu'eyeta outside the National Wildlife Area. Based on the expected activities for lead-zinc, copper and diamond development, it is assumed that there would only be a 1% reduction in wildlife populations, and this will translate into 1% decline in the amount and value of country food being harvested from Ts'ude niline Tu'eyeta. Similar 1% decreases are assumed for revenues from trapping and extra-market benefits.

As proposed mining activity will occur in the upland areas that support outfitting and guided hunting activity in the two outfitting zones, it expected that the resulting disturbances and increased access effects will reduce gross revenues by half for one guide outfitter, or about $500,000 per year. However, because it was assumed that there is only a 10% probability that mining will actually occur, the resulting loss of revenues to guide-outfitters would only be $50,000.

In terms of the ecological goods and services being provided by the area, it is expected that there would be no change in carbon sequestration or migratory bird populations. In addition, establishment of a National Wildlife Area would result in the same existence values for Woodland caribou and for a protected area that would occur under the full protection option.

Based on these assumptions, the total value of annual benefits from renewable resources under the compromise option would decrease by about 1% from the full protection option. Once the effects of mineral development have occurred, it is estimated that the annual benefits under the compromise option would be as shown in Table 6-2.

Table 6-2: Summary of Annual Economic Benefits from Renewable Resources in Ts'ude niline Tu'eyeta: Compromise Option

Type of Benefit		Effect of Development	Low	High
Traditional Resource Use and Values	Consumption of fish	-1%	$8,100	
	Consumption of wildlife	-1%	$114,400	
	Native plants and berries	-1%	Unknown	
	Wood for fuel	None	$51,700	
	Recreation – expenditures	None	$24,800	$48,900
	Recreation – non-market benefits	-1%	$5,600	$11,200
Commercial Resource Use and Values	Trapping	-1%	$26,300	
	Outfitting and guided hunting	-10%	$450,000	
	Tourism	None	$39,300	
	Arts and crafts	-1%	$18,800	
	Commercial forestry	None	Unknown	
Ecological Goods and Services	Drinking water	None	Unknown but small	
	Climate regulation	None	$2,675,000	
	Value of migratory waterfowl – hunting	None	$21,300	
	Value of migratory waterfowl – bird watching	None	$354,600	
	Existence values for Woodland caribou	Increase	$384,300	$896,000
	Existence values for a protected area	Increase	$2,071,300	$4,830,000
Cultural Values		Unknown	Not Quantified	
TOTAL			**$6,245,500**	**$9,545,600**

Table 6-2 shows that, when compared to the full protection option (Table 5-1), the annual benefits from renewable resources would drop by about $51,900 per year, with most of the decrease being related to guiding and outfitting. Compared to current conditions (Table 2-3), the annual benefits would increase by between $2.4 million and $5.7 million because of the existence values associated with creating a protected area and protecting Woodland caribou.

The potential effects on cultural values are assumed to be minimal because 93% of cabins and camps, 100% of burial sites, and 98% of places with Aboriginal names would be situated inside the National Wildlife Area.

The decrease in economic benefits from renewable resource development shown in Table 6-2 will not occur immediately. It is expected that the value of these benefits will start to decline starting in 2015 when exploration for mineral resources is expected to commence, reaching the amounts shown in Table 6-2 by 2045. Based on this timing, the NPV of renewable resource use in Ts'ude niline Tu'eyeta would be as shown in Table 6-3. It shows that, for a discount rate of 7.0%, the NPV of benefits to Canada would be $93.6 million, of which residents of Fort Good Hope would enjoy benefits of $4.6 million. Another $45.5 million in benefits would accrue to global residents in terms of carbon sequestration and migratory waterfowl. These benefits would be about $0.2 million less (0.2%) than would occur under the full protection option, but would be $81 million higher than the benefits from current renewable resources.

Table 6-3: Present Value of Economic Benefits Associated with Renewable Resources in Ts'ude niline Tu'eyeta: Compromise Option

	Undiscounted (millions)	3.0% Discount Rate (millions)	7.0% Discount Rate (millions)
Fort Good Hope	$16.8	$8.4	$4.6
All of Canada	$124.2	$103.3	$93.6
Global	$167.8	$84.1	$45.5
TOTAL	**$292.0**	**$187.4**	**$139.1**

The NPV of benefits to Canada, residents of Fort Good Hope and globally would be higher if a lower discount rate were to be used. The benefits to residents of Fort Good Hope under the compromise option would be nearly identical to the benefits under the full protection option because the losses in potential renewable resources and associated uses would be small.

6.4 Total Economic Value

Under the compromise boundary option there would be economic benefits from renewable resource use and mineral resource development. The total economic value under this option is shown in Table 6-4. It shows that, when using a 7.0% discount rate, Ts'ude niline Tu'eyeta would generate benefits from both renewable resources and non-renewable resource development. These benefits would have a net present value of $143.4 million, of which 96% would come from renewable resources, while mineral development would only account for 4%. For residents of Fort Good Hope, the NPV of future benefits from Ts'ude niline Tu'eyeta would total $4.6 million, with 98% coming from renewable resources.

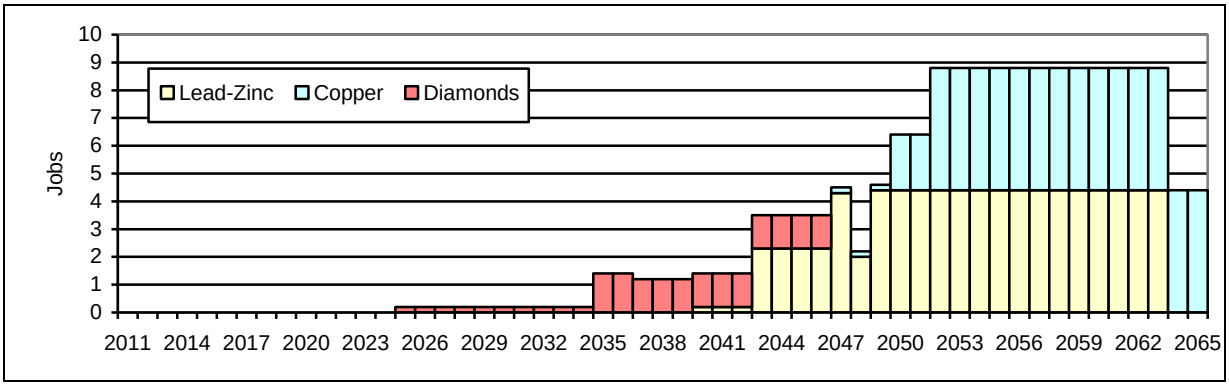
Table 6-4: Present Value of Economic Benefits Associated with Ts'ude niline Tu'eyeta: Compromise Option

	Undiscounted	3.0% Discount Rate	7.0% Discount Rate
NPV of Benefits for Canada (millions) [32]			
Renewable Resources	$124.2	$103.3	$93.6
Non-Renewable Resources	$50.1	16.7	$4.2
TOTAL	$174.3	$120.0	$97.8
NPV of Benefits for Fort Good Hope (millions)			
Renewable Resources	$16.8	$8.4	$4.6
Non-Renewable Resources	$1.2	$0.4	$0.1
TOTAL	$18.0	$8.8	$4.7
NPV of Global Benefits (millions)			
Renewable Resources	$167.8	$84.1	$45.5
NPV of Total Benefits (millions)			
Renewable Resources	$292.0	$187.4	$139.1
Non-Renewable Resources	$50.1	$16.7	$4.2
TOTAL	$342.1	$204.1	$143.3

6.5 Effects on Fort Good Hope

The compromise boundary option would allow residents of Fort Good Hope to continue using most of Ts'ude niline Tu'eyeta for traditional and others uses, but mineral development in those parts of Ts'ude niline Tu'eyeta outside the National Wildlife Area would provide some jobs and wage employment for community residents. The number of these jobs over the forecast period is shown in Figure 6-3.

Figure 6-3: Estimated Direct and Indirect Employment in Fort Good Hope from New Non-Renewable Resource Development: Compromise Option



Cumulatively, this amounts to 164 person-years of employment over about 50 years, or the equivalent of 3.0 jobs per year, although this would range from a high of 8.8 jobs during the period from 2052 to 2063, but less than 5 jobs per year for most of the forecast period. These

[32] Includes benefits for residents of Fort Good Hope.

numbers could increase, however, as a result of any economic and access agreements negotiated with non-renewable resource development companies

On the other hand, residents of Fort Good Hope will still be able to participate in traditional activities in Ts'ude niline Tu'eyeta, because it will continue to provide food, fuel and medicinal plants, and to generate some incomes through trapping and tourism. Under the compromise option, the annual value of these benefits would be equal to 99% of the current situation, with the annual loss being about $1,900.

7.0 SUMMARY AND RECOMMENDATIONS

7.1 Description of Boundary Options

Table 7-1 provides a comparison of the no protection option and the two boundary options for National Wildlife Area for Ts'ude niline Tu'eyeta. It shows that, under the full protection option, the proposed National Wildlife Area would be 14,859 km^2 in area, but this would be reduced to 10,047 km^2 (68%) under the compromise option. While the full protection option would protect all of the traditional and commercial resource use and values and maintain the production of ecological goods and services, the petroleum and mineral resources of the area would not be developed. Under the no protection option, petroleum and mineral development would be allowed, and the resulting land uses are expected to compromise the ability of the area to continue to provide the full range of renewable resources that benefit residents of Fort Good Hope, other parts of Canada and globally. While the compromise boundary option protects the balance of renewable resources in Ts'ude niline Tu'eyeta, some mineral development would be allowed in those parts of Ts'ude niline Tu'eyeta that are situated outside the National Wildlife Area.

7.2 Non-Renewable Resource Development

Chapter 3.0 summarizes the nature, extent and timing of non-renewable resource development that could occur in Ts'ude niline Tu'eyeta in the absence of protection. It concludes that:

- oil exploration and development valued at $243 million will proceed immediately because of the high price of oil and there is an existing means of transporting oil to southern markets.
- natural gas exploration and development valued at $178 million will be delayed until the Mackenzie Valley pipeline has been constructed and there is some unused capacity in the pipeline.
- lead-zinc exploration and development valued at $145 million will commence immediately but mine construction is unlikely to occur unless significant resources are determined that can justify the construction of a year-round access road.
- copper development valued at $84 million will occur at the same time as for lead-zinc development but a mine is only likely if a road is built to support a lead-zinc mine, or the resources are sufficient to justify construction of an access road.
- diamond exploration and development valued at $368 million will be delayed (2020) because most exploration will continue in other parts of the NWT with better potential. Mine construction is unlikely unless resources are sufficient to justify the high costs of developing a mine.

Table 7-1: Comparative Assessment of Boundary Options for the Proposed Ts'ude niline Tu'eyeta National Wildlife Area

				Full Protection	Compromise Option	No Protection	Full Protection	Compromise Option	No Protection
Type of Benefit		**Data**	**Units**	**Spatial Assessment**			**Percent of Total**		
Traditional Resource Use and Values	Consumption of fish	Known Fish harvesting sites	Catch (1998-2003)	1,787	1,605	0	100%	90%	0%
	Consumption of wildlife	Known Woodland caribou harvest areas	Kills (1998-2003)	10	7	0	100%	70%	0%
		Known moose harvest areas	Kills (1998-2003)	143	129	0	100%	90%	0%
	Native plants and berries	Potential Plant harvest areas	km^2	0.25	0.25	0	100%	100%	0%
	Wood for fuel	Potential Plant harvest areas	km^2	0	0	0	100%	100%	100%
Commercial Resource Use and Values	Trapping	Traplines	% of trails	100%	93%	0%	100%	93%	0%
	Outfitting and guided hunting	Known Dall Sheet harvest areas	km^2	174	0.25	0	100%	0%	0%
		Guiding areas	km^2	3,317	2,037	0	100%	61%	0%
	Commercial forestry	Potential Plant harvest areas	km^2	70	40	0	100%	57%	0%
Ecological Goods and Services	Drinking water	Ontaratue River	km^2	4,105	1,769	0	100%	43%	0%
		Ramparts River	km^2	10,753	8,226	0	100%	76%	0%
	Existence value – Woodland Caribou	Distribution of northern mountain caribou	km^2	3,199	1,917	0	100%	60%	0%
		Distribution of boreal caribou (north)	km^2	11,659	8,120	0	100%	70%	0%
	Climate regulation	Net Biome Productivity	Tonnes of carbon/ year	159,080	107,563	0	100%	68%	0%
	Migratory waterfowl	Wetlands	km^2	4,656	4,533	0	100%	97%	0%
Cultural Values		Cabins and Camps	Sites	92	86	0	100%	93%	0%
		Heritage Sites	Sites	2	1	0	100%	50%	0%
		Burial sites	Sites	8	8	0	100%	100%	0%
		Aboriginal place names	Sites	123	121	0	100%	98%	0%
		Archaeological sites	Sites	5	2	0	100%	40%	0%
Hydrocarbon Resources	Natural Gas	Undiscovered Recoverable	Billion cubic feet	0	54	213	0%	25%	100%
	Oil	Undiscovered Recoverable	Million barrels	0	3.9	20.0	0%	20%	100%
Mineral Resources	MVT Lead -Zinc	Potential	km^2	0	1,166	1,166	0%	100%	100%
	Copper	Potential	km^2	0	1,227	1,227	0%	100%	100%
	Diamond	Potential	km^2	0	2,553	7,043	0%	36%	100%
Sahtu Private Lands			km^2	0	0	442	0%	100%	100%
TOTAL AREA			km^2	**14,859**	**10,047**	**0**	**100%**	**68%**	**0%**

While oil and gas development is expected to proceed as proposed, there is only a 10% probability that a lead-zinc, copper or diamond mine will actually be developed because of the high costs of development and the uncertainty about actual resource potential.

None of this development would be allowed under the full protection option. However, under the compromise option, most of the areas with higher oil and gas potential would be inside the National Wildlife Area and given the high costs of exploration and the relatively small oil and gas reserves outside the National Wildlife Area, it is expected that there would be no oil or gas exploration. The areas with higher lead-zinc and copper potential would be located outside the National Wildlife Area and such development is assumed to proceed as proposed. However, only 36% of the area with diamond potential would be located outside the National Wildlife Area so it is assumed that diamond development would proceed at one-third the level that would occur under the no protection option.

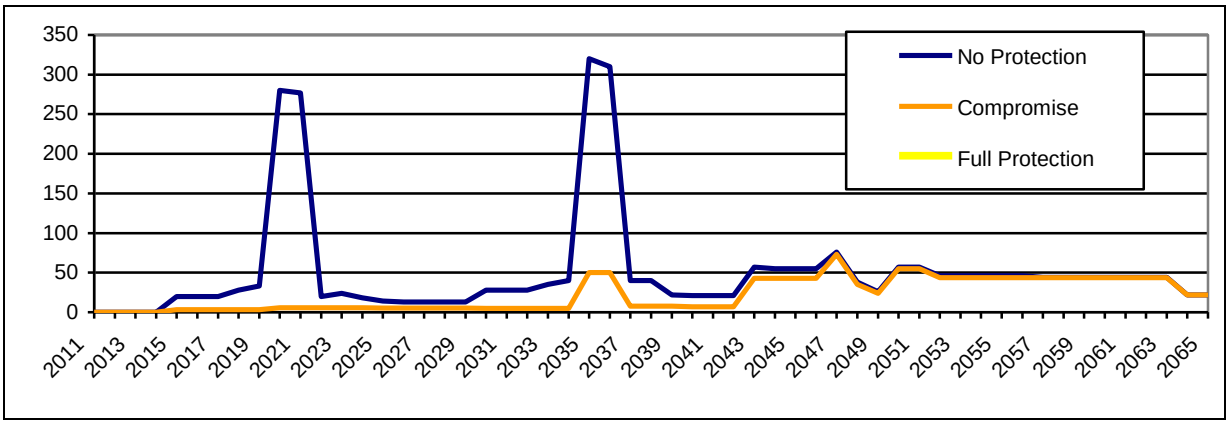
Based on these assumptions, the extent and economic impacts of non-renewable resource development under the three options are summarized in Table 7-2. It shows that non-renewable resource development under the compromise option would be equivalent to about 35% of the full potential under the no protection option.

Table 7-2: Non-Renewable Resource Development and Impacts for the Boundary Options

	No Protection Option	Compromise Option	Full Protection Option
Cost (millions)	$1,019	$350	$0
Direct and Indirect Impact on NWT GDP (millions)	$570	$150	$0
Direct and Indirect Employment in the NWT (person-years)	3,200	1,360	0
Direct and Indirect Labour Income (millions)	$240	$80	$0

The timing and magnitude of direct and indirect employment resulting from non-renewable resource under the boundary options is shown in Figure 7-1.

Figure 7-1: Summary of Direct and Indirect Employment in the NWT for the Three Development Options



It shows that, under the no protection option, there would be major burst of employment activity in 2020 associated with construction of an oil pipelines and again in 2035, as a result of constructing a gas pipeline mine development. For the compromise option, the employment effects are much lower initially because there is no oil or gas development but match the no protection option after 2048 when lead-zinc and copper development is predicted to occur.

The economic benefits resulting from non-renewable resource development under the boundary options have been estimated in terms of the net present value (NPV) of benefits during the period from 2011 to 2065, calculated using various discount rates. The benefits include employment income for workers who would not otherwise be employed, corporate profits, royalty payments, and corporate taxes. The resulting benefit estimates are summarized in Table 7-3. It shows that, when the highest discount rate is used (7.0%), the NPV of non-renewable resource development benefits for all of Canada under the no protection option is $39.2 million, but this drops to $4.2 million under the compromise option; this amount is equivalent to 11% of the benefits under the no protection option.

Table 7-3: Net Present Value of Future Benefits from Non-Renewable Resource Development for the Boundary Options

Location	Discount Rate	No Protection Option (millions)	Compromise Option (millions)	Full Protection Option (millions)
Canada	Undiscounted	$215.1	$50.1	$0
	3.0%	$96.1	$16.7	$0
	7.0%	$39.2	$4.2	$0
NWT	Undiscounted	$61.7	$15.2	$0
	3.0%	$29.3	$5.5	$0
	7.0%	$13.0	$1.6	$0
Fort Good Hope	Undiscounted	$9.8	$1.2	$0
	3.0%	$5.3	$0.4	$0
	7.0%	$2.7	$0.1	$0

7.3 Renewable Resource Implications

Ts'ude niline Tu'eyeta is an important natural area that has been used by residents of Fort Good Hope for traditional harvesting of fish and wildlife for food, as well as for commercial activities such as trapping. It is a sacred place. It also provides important waterfowl and wildlife habitat and supports populations of species at risk that are important to local residents and all Canadians. Estimates of the economic benefits being generated by Ts'ude niline Tu'eyeta under current conditions have been generated using available information on the use and values of the area for local, territorial, Canadian and global residents. These estimates are in the range of $3.8 million to $3.9 million per year, but are considered conservative because they do not include the cultural value of the area. This includes about $0.3 million in benefits to residents of Fort Good Hope in terms of the value of food being harvested and revenues generated through trapping, tourism and the sale of arts and crafts. Another benefit for Canadians is $0.5 million in annual income that

comes from guided hunting and outfitting that occurs in the area. However, the majority of the economic benefits being generated are experienced by people living outside Canada in the form of migratory birds (hunting and bird watching are valued at $0.4 million) and climate regulation through carbon sequestration, valued at $2.7 million.

If all or parts of Ts'ude niline Tu'eyeta are designated as a National Wildlife Area, two other types of benefits will occur. Canadians value protected areas and they value Woodland caribou, and have indicated a willingness to pay to have protected areas and to protect caribou. Under the full protection option, the annual benefits from the Ts'ude niline Tu'eyeta National Wildlife Area would be expected to increase to between $6.3 million and $9.6 million, based on willingness to pay to protect Wood land caribou ($0.4 million to 0.9 million) and willingness to create protected areas ($2.1 million to $4.8 million).

If Ts'ude niline Tu'eyeta is not protected and non-renewable resource development is allowed to occur, the resulting exploration activities will result in land disturbances that will adversely affect renewable resources and their associated benefits. The greatest concern relates to the creation of seismic lines. Although seismic lines have already been cut through much of the area (at a density of about 0.22 km of seismic line per km^2), this is expected to increase to 0.8 km/km^2 of linear disturbance, based on seismic line density in other nearby locations in Mackenzie Valley. While the additional seismic lines will result in very small amounts of land actually being disturbed (less than 1% of the area), the effects of these disturbances extend beyond the area actually cleared. It is estimated that there would be a 5% reduction in habitat for most game species and for migratory birds, and the resulting values would be reduced accordingly. For Woodland caribou, which prefer habitats that are greater than 400 m from open areas and are larger than 500 km^2, the additional seismic activity would eliminate most of the available Woodland caribou habitat in Ts'ude niline Tu'eyeta, and residents of Fort Good Hope would no longer be able to hunt this species. In addition, the development of seismic lines would result in increased access for resident hunters and would change the wilderness character of the area, resulting in a major loss of business for guide-outfitters.

Under the compromise boundary option, the extent of land use disturbances would be much less because non-renewable resource development would be limited to mineral development outside much of the wetland areas. It is assumed that these activities would result in a 1% reduction in wildlife populations, and this will translate into 1% decline in the amount and value of country food and fur bearing animals being harvested from Ts'ude niline Tu'eyeta. The resulting disturbances and increased access effects are assumed to reduce gross revenues for one guide outfitter by 10%. There would be no effect on migratory bird populations. However, by designating part of Ts'ude niline Tu'eyeta as a National Wildlife Area, the resulting willingness to pay to create a protected area and to protect a Woodland caribou herd would result in an overall increase in the annual benefits being generated by the area.

The NPV of future benefits from renewable resources under the boundary options is provided in Table 7-4. It shows that, for the highest discount rate, the total benefits from the full protection option and the compromise option would be nearly $94.0 million for all Canadians, of which $8.4 million in benefits would be experienced by residents of Fort Good Hope. Once the benefits of migratory birds and carbon sequestration are added, the total benefits increase to about $188 million, for both of these options. Under the no protection option, the total benefits are much lower: about $9.4 for Canada of which $4.5million would be experienced by residents of Fort Good Hope.

Table 7-4: Net Present Value of Future Benefits from Renewable Resources for the Boundary Options

Location	Discount Rate	No Protection Option (millions)	Compromise Option (millions)	Full Protection Option (millions)
Canada	Undiscounted	$23.2	$124.2	$126.1
	3.0%	$14.1	$103.3	$104.0
	7.0%	$9.4	$93.6	$93.8
Fort Good Hope	Undiscounted	$16.3	$16.8	$16.8
	3.0%	$8.2	$8.4	$8.4
	7.0%	$4.5	$4.6	$4.6
TOTAL	Undiscounted	$188.8	$292.0	$293.9
	3.0%	$97.3	$187.4	$188.2
	7.0%	$54.5	$139.1	$139.3

7.4 Total Economic Value

The total economic value of Ts'ude niline Tu'eyeta under the three boundary options can then be determined by combining the information on non-renewable resource values (Table 7-3) with the information on renewable resources (Table 7-4). The results are provided in Table 7-5.

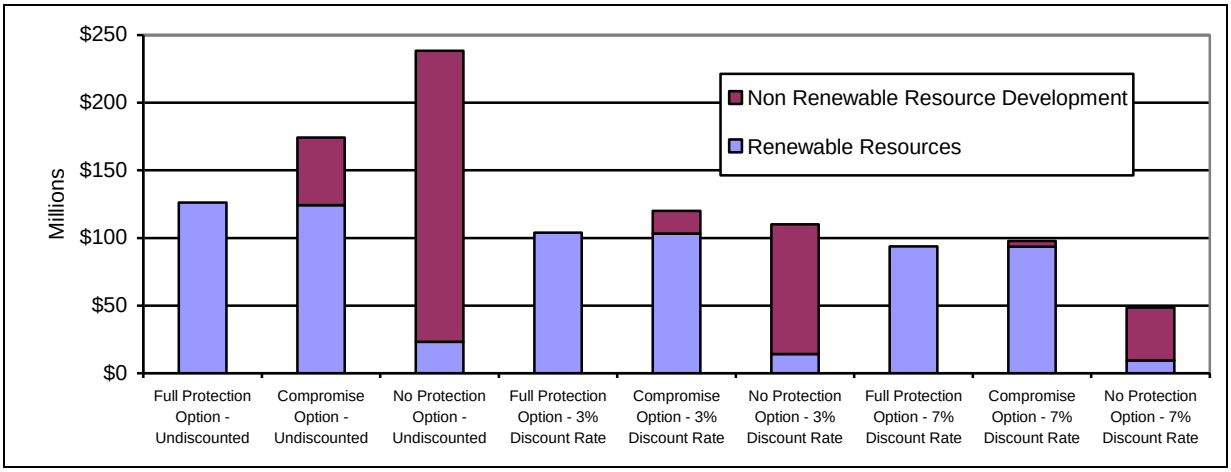
Table 7-5: Net Present Value of Future Benefits for the Boundary Options

Location	Discount Rate	No Protection Option (millions)	Compromise Option (millions)	Full Protection Option (millions)
Canada	Undiscounted	$238.3	$174.3	$126.1
	3.0%	$110.2	$120.0	$104.0
	7.0%	$48.6	$97.8	$93.8
Total (including outside Canada)	Undiscounted	$403.9	$342.1	$293.9
	3.0%	$193.4	$204.1	$188.2
	7.0%	$93.7	$143.3	$139.3

Table 7-5 shows that, for Canada, the compromise option provides the highest values (the shaded areas) of the three options when future values are discounted (also see Figure 7-2). At a 7.0% discount rate, the benefits from both the compromise option and the full protection option are

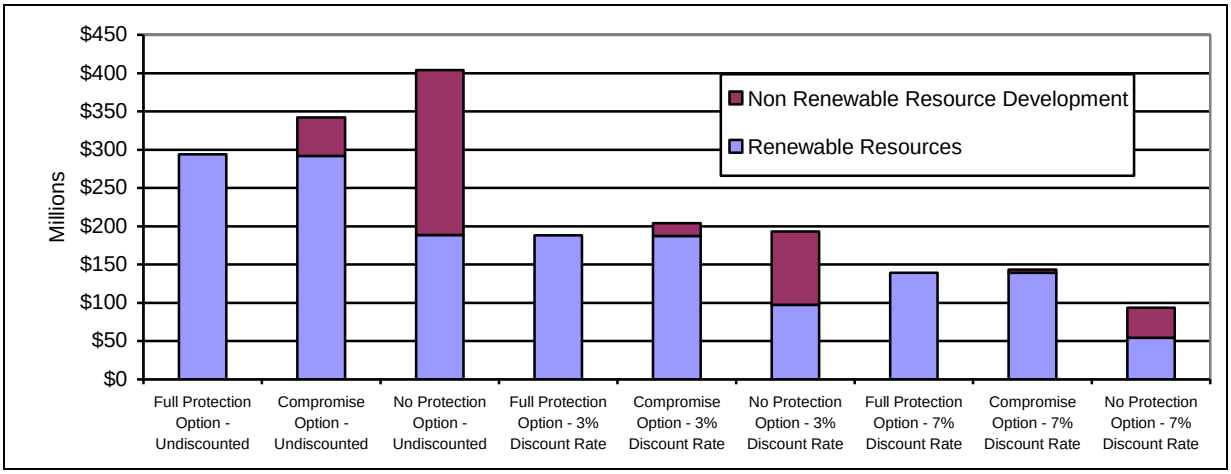
twice the benefits from the no protection option. However, for the 3.0% discount rate, the benefits of the compromise option are only 9% greater than for the no protection option, and the benefits from the no protection option are 6% greater than for the full protection option. Figure 7-2 also shows that the composition of the benefits under the three options is quite different. For the 7.0% discount rate, non-renewable resource development accounts for 81% of benefits under the no protection option but only 4% of benefits under the compromise option. For the 3.0% discount rate, non-renewable resource development accounts for 87% of benefits under the no protection option and 14% of benefits under the compromise option.

Figure 7-2: Present Value of Future Benefits of Boundary Options for Canada



Similar results occur when all benefits are considered, including benefits for people living outside Canada (through migratory birds and carbon sequestration). At the 7.0% discount rate, the benefits from both the compromise option and the full protection option are about 50% greater than the benefits from the no protection option. However, the composition of the total benefits (including those for people outside Canada) under the three options is quite different when compared to the benefits for Canada (Figure 7-2). Figure 7-3 shows that, for the 7.0% discount rate, non-renewable resource development accounts for only 42% of total benefits under the no protection option but only 3% of total benefits under the compromise option. For the 3.0% discount rate, non-renewable resource development accounts for 50% of benefits under the no protection option and 14% of benefits under the compromise option.

Figure 7-3: Present Value of Total Future Global Benefits of Boundary Options



A summary of the economic evaluation of boundary options for a National Wildlife Area at Ts'ude niline Tu'eyeta is provided in Table 7-6. The economic evaluation compares the economic benefits of creating a protected area using both the full protection and compromise option against the base case, which was chosen to be the no protection option. Economic performance was measured in terms of the ratio of benefits with protection to the benefits with no protection (benefit/cost ratio) and in terms of the net change in benefits that would occur.

Table 7-6: Economic Evaluation of the Boundary Options for Ts'ude niline Tu'eyeta

Location	Discount Rate	No Protection Option (millions)	Compromise Option (millions)	Full Protection Option (millions)
Benefits for Canada				
Benefit/Cost Ratio	Undiscounted	1.00	0.73	0.53
	3.0%	1.00	1.09	0.94
	7.0%	1.00	2.01	1.93
Net Benefit (millions)	Undiscounted	$0.0	-$64.0	-$112.2
	3.0%	$0.0	$9.8	-$6.2
	7.0%	$0.0	$49.2	$45.2
Total Benefits				
Benefit/Cost Ratio	Undiscounted	1.00	0.85	0.73
	3.0%	1.00	1.06	0.97
	7.0%	1.00	1.53	1.49
Net Benefit	Undiscounted	$0.0	-$61.7	-$110.0
	3.0%	$0.0	$10.8	-$5.2
	7.0%	$0.0	$49.6	$45.7

Table 7-6 shows that, from a Canadian perspective, establishing a National Wildlife Area under the compromise option would have the highest benefit/cost ratio when using discounted values and would yield net benefits of between $9.8 million and $49.2 million. The full protection scenario would be preferred to the no protection option only when using a discount rate of 7.0%, which places less weight on future values.

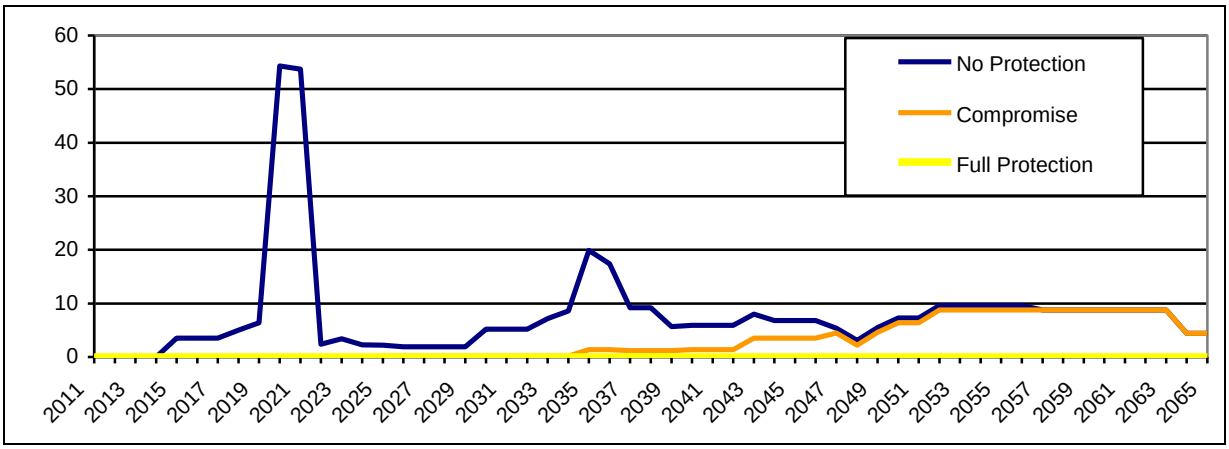
From a global perspective, Table 7-6 shows that establishing a National Wildlife Area under the compromise option would also have the highest benefit/cost ratio when using discounted values and would yield net benefits of between $10.8 million and $49.6 million. The full protection option would also be preferred to the no protection option when a discount rate of 7.0% is used.

7.5 Effects on Fort Good Hope

For residents of Fort Good Hope, Ts'ude niline Tu'eyeta currently generates economic benefits of about $306,000 per year from fish and wildlife harvested for food, animals trapped for income, recreation, and revenues from tourism the production and sales of arts and crafts. This value does not include the cultural value of the landscape. Continued use of the landscape over the next 50 years is predicted to have a net present value of between $4.6 million (7.0% discount rate) and $16.8 million (undiscounted) (see Table 7-4). Designation of all of Ts'ude niline Tu'eyeta as a National Wildlife Area would ensure that these economic benefits are maintained.

Without the area being protected, it is expected that oil and gas and mineral development would provide some employment opportunities and income for local residents and businesses. This employment would amount to 433 person-years over about 50 years, or the equivalent of 8.5 jobs per year, and the net present value of the additional income would amount to between $2.7 million (7.0% discount rate) and $9.8 million (undiscounted) (see Table 7-3). The number of new jobs that would occur over the forecast period is shown in Figure 7-4.

Figure 7-4: Summary of Direct and Indirect Employment in Fort Good Hope for the Three Development Options



The land disturbances associated with non-renewable resource development are expected to reduce the availability of fish and game, resulting in the annual benefits from Ts'ude niline Tu'eyeta dropping to $294,000 per year, a decrease of $12,000 per year. These losses would reduce the NPV of benefits from traditional and commercial use of the area by residents of Fort Good Hope to between $4.5 million (7.0% discount rate) and $9.8 million (undiscounted) over the same period. Compared to the full protection option, these losses are very small.

Under the compromise option, the lower levels of non-renewable resource development would result in fewer jobs: 164 person-years of employment over about 50 years (see Figure 7-4), or the equivalent of 3.0 jobs per year. The economic benefits from this would also drop to between $0.1 million (7.0% discount rate) and $1.2 million (undiscounted) (see Table 7-3). However, with less land disturbance from development, there will be less impact on traditional and commercial use of the area, such that the annual benefits from the area would only drop by about $1,900 per year to $304,000 per year. The net present value of these future benefits of traditional and commercial use by residents of Fort Good Hope would essentially remain the same as for the full protection option, ranging from between $4.6 million (7.0% discount rate) and $16.8 million (undiscounted) (see Table 7-4).

Table 7-7 shows the net present value of combining the future non-renewable resource values (Table 7-3) with future renewable resource values (Table 7-4) for each of the boundary options. It shows that, regardless of whether or not discounting is used, the incremental income benefits from employment in non-renewable resource development more than offset the predicted declines in benefits from renewable resources such that the no protection option always generates the highest total benefits for residents of Fort Good Hope. These results are also shown in Figure 7- 5.

Table 7-7: Net Present Value of Future Benefits for the Boundary Options for Fort Good Hope

Discount Rate	No Protection Option (millions)	Compromise Option (millions)	Full Protection Option (millions)
Undiscounted	$26.1	$18.0	$16.8
3.0%	$13.5	$8.8	$8.4
7.0%	$7.2	$4.7	$4.6

Figure 7- 5: Present Value of Total Future Benefits of Boundary Options for Fort Good Hope

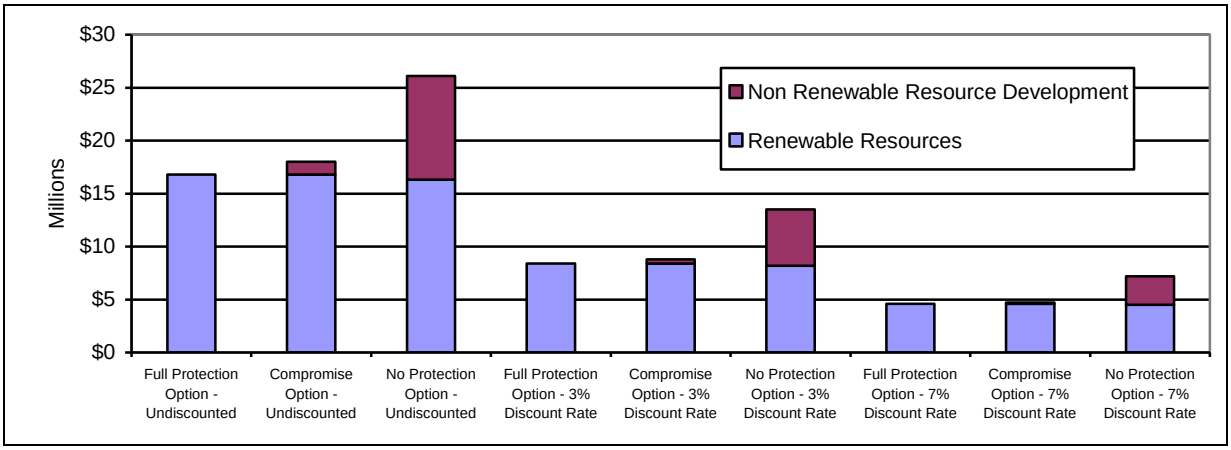


Table 7-8 shows that, when compared to the no protection option, the establishment of a National Wildlife Area at Ts'ude niline Tu'eyeta, regardless of whether the area is fully or

partially protected, would always have a benefit cost ratio of less than 1.0 for residents of Fort Good Hope, and would result in net costs of between $2.5 million (7.0% discount rate) and $8.1 million to $9.2 million (undiscounted), depending on the extent of the area being protected.

Table 7-8: Economic Evaluation of the Boundary Options for Residents of Fort Good Hope

Location	Discount Rate	No Protection Option (millions)	Compromise Option (millions)	Full Protection Option (millions)
Benefit/Cost Ratio	Undiscounted	1.00	0.69	0.65
	3.0%	1.00	0.65	0.63
	7.0%	1.00	0.65	0.64
Net Benefit (millions)	Undiscounted	$0.0	-$8.1	-$9.2
	3.0%	$0.0	-$4.7	-$5.1
	7.0%	$0.0	-$2.5	-$2.6

The analysis in Table 7-8 suggests that, based on quantified economic benefits and costs, the residents of Fort Good Hope would be economically better off without any protection for Ts'ude niline Tu'eyeta, as the new jobs and income associated with non-renewable resource development would more than offset the losses associated with reductions in fish and wildlife populations and land use disturbances. However, this economic assessment does not take into consideration the cultural values, social values and attachment to the land that would be at risk under the no protection option. Another way of interpreting the results in Table 7-8 is that either of the protection options would be better for community if the cultural and social values that they place on the landscape are concluded to be greater than the comparative economic advantages of the no protection option.

Ultimately, the selection of the best boundary option for Ts'ude niline Tu'eyeta will depend on the socio-economic effects that are associated with each of the options. While the no protection option has the greatest potential to create new employment and income, it also has the highest potential for positive and negative socio-economic effects. The underlying problem is that, as people earn more money and thereby have the means to improve their quality of life, they can also afford to indulge in behaviours that can cause social and economic problems for themselves and others, and may also reduce their participation in traditional land uses and their attachment to the land. Thus, the no protection option, which would allow the full range of resource development, provides the greatest potential economic benefits and also has the greatest potential for creating social and economic problems. Limiting resource development to some parts of the land base, as would occur under the compromise option, would provide lower levels of new employment and income, but would also have less potential to generate severe social and economic issues. On the other hand, the danger in precluding all non-renewable resource development in Ts'ude niline Tu'eyeta is that this may limit regional economic development opportunities for local residents. Without the creation of additional employment and income for Fort Good Hope, many of the existing social and economic problems in the region, such as low

educational attainment and large percentages of households in core need, will continue and may worsen over time.

7.6 Uncertainties and Issues

There are many uncertainties inherent in undertaking this type of analysis. To begin, the assessment of the benefits that residents of Fort Good Hope and the NWT derive from Ts'ude niline Tu'eyeta relies on information about renewable resource use and values that is known to be incomplete, especially in terms of actual use of the area. In addition, there is even less information about the spatial distribution of these activities within Ts'ude niline Tu'eyeta. Despite these problems, this analysis has used whatever information is available to describe the use and value of Ts'ude niline Tu'eyeta. The heat maps that were developed to show areas of high use and importance were validated for discussions with the community and serve as a reasonably reliable description of spatial information.

The second challenge is to develop reasonable non-renewable resource development options given the uncertainties related to the extent of oil and gas and mineral resources in the area as well as the range of complex factors that will determine if and when such development actually occurs. There are many factors that will affect future development in the area and, to the extent possible, the options presented in this report attempt to focus on those factors that are likely to be of greatest importance, those being commodity prices, the cost of development, and the ease with which commodities could be transported to market. The current isolation of Ts'ude niline Tu'eyeta will prove to be a major constraint to future non-renewable resource development. It is unlikely there will be any development in the region until such time as the Mackenzie Valley pipeline has been completed and there is year round road access. As a result, it is only possible to make a best guess about future resource development based on the extent of resources believed to be in the area as well as the costs of extracting those resources. Available information suggests that, for oil and gas, the recoverable reserves are, generally speaking, too small to be economically produced. That conclusion is supported by the amount of seismic activity is already occurred, and the number of dry wells that have been drilled. That is not to say that there will be no oil and gas development; available information suggests that it may be a challenge to locate and extract oil and gas reserves that are financially viable. However, the only way of confirming resource potential in Ts'ude niline Tu'eyeta would be to allow the area to be fully explored, but such activities could significantly and adversely affect the very resources that the community of Fort Good Hope believes to be of great importance.

The third challenge is to try to predict the extent to which any non-renewable resource development that does occur will provide employment and income for residents of Fort Good Hope. At present, residents do not appear to have the skills related to oil and gas and mineral development, so that the there may be little opportunity for them to participate in any development that does occur. Based on experience with other resource projects in remote communities, there are initially limited opportunities for individual or corporate participation in

development. This can change quickly, however. Communities can take the initiative to develop benefits agreements that will create opportunities for local residents to acquire the training or resources they need to be able to take advantage of any employment activities that occur. However, until such time as the benefits agreement is in place, resource industries typically bring in the experts they need to do the job, leaving little opportunities for local residents.

A fourth challenge is to look forward and determine what landscapes may look like in the future, with or without development. Climate change is affecting the landscape, especially in the Canadian North, and this may result in long-term changes in the landscape, the range and distribution of plants and animals, biological productivity, and the incidence of fire. Changes in all of these could affect the ability of Ts'ude niline Tu'eyeta to continue to support the residents of Fort Good Hope as they have in the past. Climate change may improve productivity, and create additional opportunities for resource harvesting. However, with the higher incidence of fire, the resulting losses of habitat could adversely affect land use and resource harvesting. In addition, demographic changes in the community may also affect future use of Ts'ude niline Tu'eyeta. Future levels of use will depend on whether the current generation continues to participate in the traditional and cultural use of the landscape to the same extent as their parents or their grandparents, and whether they pass these interests on to future generations. It is challenging to even speculate on what the future will bring, but all or partial protection of Ts'ude niline Tu'eyeta will at least provide current and future residents of Fort Good Hope with the option of participating in these activities, whereas opening the area to development may preclude these opportunities.

One final challenge is to predict the extent to which non-renewable resource development, if allowed, would adversely affect the existing landscape and the functionality of its ecosystems. While predictions can be made based on evidence in areas where non-renewable resource development has already occurred, it is not clear that these same effects would occur in Ts'ude niline Tu'eyeta because its ecosystems may be less resilient to change. In addition, the regulatory regime for non-renewable resource development in that area could be quite different from the regimes in other areas, possibly providing better levels of protection. The only way of addressing this challenge would be to undertake a more detailed ecological assessment of the potential effects of non-renewable resource development possibly as part of the ecological assessment required by the PAS process. Another option would be to undertake a sensitivity analysis to determine the point at which changes in the landscape would result in environmental costs that exceed the economic benefits associated with non-renewable resource development.

There is no easy way to address all these methodological issues and information gaps. The only approach involves clearly laying out all of the assumptions and data sources used in the analysis so that the readers can fully understand the strengths, weaknesses, and implications of the study

and its findings so that they can draw their own conclusions about the future of Ts'ude niline Tu'eyeta.

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