

**SOCIO-ECONOMIC ASSESSMENT OF EDÉHZHÍE CANDIDATE
PROTECTED AREA**

**VOLUME 2: SOCIO-ECONOMIC ASSESSMENT OF DEVELOPMENT
OPTIONS**

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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 Edézhíe Candidate Protected Area, an area of about 26,000 square kilometres in the Dehcho Region, and has commissioned this study to assess the potential social and economic impacts on the surrounding communities of Fort Simpson, Fort Providence, Wrigley, Jean Marie River, Whatí and Behchokò. This study is presented in two volumes. Volume 1 provides an overview of current socio economic conditions in the study area. This volume, Volume 2, describes the potential social and economic effects of four development options for Edézhíe, ranging from the status quo (no permanent protection for any of the area) to full protection of the entire area.

Potential Development Opportunities

The Edézhíe area is seen as important natural area, featuring important waterfowl and wildlife habitat, characteristic landforms and populations of species at risk. The area is seen as a “food basket”, especially when there are shortages of game in the Mackenzie Valley, and residents of all six communities have a long history of using the area for subsistence hunting, fishing and gathering other food and resources. The residents of the region have long wished to have the important watersheds of the Willowlake, Horn and Rabbitskin rivers legally protected. However, Edézhíe also has some potential to support economic development. Preliminary investigations suggest that there are oil and gas deposits in the area and there may be some economically viable zinc and diamond resources. At the present time it is not known if or when resource development will ever occur in the area or the size or location of this development if it were to occur.

To assist the public and decision makers understand the potential implications of different types of development, it is necessary to make some assumptions about what this development could look like. These assumptions are summarized in Table 1. These descriptions were developed in consultation with the NWT and Nunavut Chamber of Mines, the NWT GeoScience Office, the Canadian Wildlife Service, and Indian and Northern Affairs Canada (INAC). These assumptions represent best guesses based on very limited knowledge. Better understanding of the development potential will only come after the boundaries of the protected area have been established and exploration is allowed in areas that have not been protected.

In summary, Table 1 shows that mineral development is more likely to occur in the near future than oil and gas development because of a lack infrastructure (natural gas pipeline) or small reserves (oil). While all four opportunities would initially provide low levels of employment (measured in terms of person years (PYs)) during exploration and high levels of employment during construction, zinc and diamond mining would provide much higher levels of operating employment. The potential for employment of local residents is higher for mineral and diamond development, especially during construction.

Table I: Assumptions about Resource Development Potential in the Edézhíe Area

Attribute	Oil	Gas	Minerals	Diamonds
Resource Potential	Potentially 0.5 million barrels 0.1% of current reserves in NWT Exact volumes and locations unknown	Potentially 233 billion cubic feet 0.3% of current discovered reserves in NWT Exact volumes and locations unknown	Moderate potential for lead-zinc. Could be more than one mine Use 1000 ton per day mine (Prairie Creek mine proposal) as example	Unknown potential Could be more than one mine Use an example ranging from 0.5 million carats/year (Jericho Mine) to 2.4 million carats/year (Snap Lake) Could be larger
When	Exploration: 2020 Construction: Unlikely Operation: Unlikely	Exploration: 2020 Construction: 2025 Operations: 2027	Exploration: 2010 Construction: 2020 Operations: 2022	Exploration: 2010 Construction: 2020 Operation: 2025
Duration	Exploration: 5 years Construction: 2 years Operation: 20 years	Exploration: 10 years Construction: 2 years Operations: 10 years	Exploration: 5 years Construction: 2 years Operations: 10-20 years	Exploration: 5 years Construction: 2 years Operations: 10-20 years
Cost	Exploration: \$55 million Construction: \$175 million	Exploration: \$220 million Construction: \$175 million	Exploration: \$50 million Construction: \$167 million	Exploration: \$50 million Construction: \$120 million to \$1,000 million
Gross Revenues	\$42 million (\$100/barrel)	\$350 million	\$40 million/year	\$75 to \$275 million/year
Economic Impact	Exploration: 200-320 PYs Construction: 630 PYs Operations: 1.5 PYs/year	Exploration: 790-1,280 PYs Construction: 630 PYs Operations: 10 PYs/year	Exploration: 180 to 290 PYs Construction: 600 PYs Operations: 200 PYs/year	Exploration: 180 to 290 PYs Construction: 150 to 750 PYs Operations: 65 to 300 PYs/year

It should be noted that many of the areas of greatest potential for oil, gas zinc and perhaps diamonds are in the same general locations within the Edézhíe Candidate Protected Area, notably the area around Willow Lake, and that these locations also have some of the highest cultural and traditional use values.

Potential Development Scenarios

The Edézhíe Working Group has identified three possible boundary options for the Edézhíe area in addition to the status quo. These scenarios are described in Table 2.

Table II: Summary of Development Scenarios

Scenario	Description	Protected Area		Conservation Features Included	Non-Renewable Resources Potential
		Area (km ²)	% of Current Area		
1	Status Quo	0	0%	0%	100%
2	Minimum Bounded Area	10,565	42%	74%	88%
3	Conservation/ Economic Compromise	16,588	66%	92%	71%
4	Full Land Withdrawal	25,230	100%	100%	0%

Each of these scenarios would allow a slightly different mix of resource developments to occur. The nature of this development, and the potential environmental and territorial and regional effects associated with each scenario is summarized in Table 3.

Table III: Summary of Potential Employment Effects in the NWT Associated with Non-Renewable Development in the Edézhzié Area

Resource	Indicator	Scenario			
		Status Quo	Minimum Bounded Area	Conservation/ Economic Compromise	Full Land Withdrawal
Non-Renewable Resources					
Oil	Production	\$0	\$0	\$0	\$0
Natural Gas	Total Production (20 yrs)	\$350 million	\$260 million	\$350 million	\$0
Zinc-Lead Mine	Annual Production	\$40 million	\$40 million	\$12 million	\$0
Diamonds	Annual Production	\$175 million	\$140 million	\$190 million	\$0
Renewable Resources					
Caribou	Critical habitat protected	0%	90%	100%	100%
	Habitat Blocks Protected	0	29	32	47
Moose	Habitat Blocks Protected	0	4	11	20
Watersheds	Reaches at Risk	All at risk	Upper Horn Lower Willowlake Rabbitskin	Upper Horn Lower Willowlake Lower Rabbitskin	None
Traditional Use Areas at Risk	Very High Density	100%	4%	2%	0%
	High Density	100%	13%	8%	0%
	Moderate Density	100%	30%	13%	0%
Tourism	Destination Visitation	None	Low	Moderate	Low
	Features at Risk	All	Upper and lower Willowlake River Rabbitskin River	Upper and lower Willowlake River Lower Rabbitskin River	None
Research	Conservation Features Protected	0%	74%	92%	100%
Territorial Socio-Economic Effects					
Employment (person-years)	Peak	780	685	475	1
	Long-term	400	360	170	1
Income	Increased Annual Earnings (millions)	\$28	\$25	\$12	\$0
Regional Socio-Economic Effects					
Employment (person-years)	Peak	200	165	115	1
	Long-term	140	125	60	1
Income	Increased Annual Earnings (millions)	\$9.8	\$8.7	\$4.3	\$0
Population	Potential In-migration	100 workers	90 workers	45 workers	0

Although the status quo scenario provides the greatest potential for economic development in the region, many of the renewable resources that are used by regional residents for traditional or other purposes may be at risk. While measures to minimize these risks will be included as part of the terms and conditions in approvals issued for mineral or petroleum development, some of the key areas of development interest coincide with areas of great cultural importance and traditional use. The other scenarios adopt increasing levels of protection that limit economic development potential, resulting in less employment and income for regional residents, but enhance protection of environmental and renewable resources. However, prohibiting development in the entire Edézhzié area may prove economically regressive because, without some other forms of additional economic development in the region, social and economic conditions could deteriorate.

The scenarios with the greatest potential to create new employment and income also have the highest potential for both positive and negative socio-economic effects. 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. The potential for such problems is highest for the status quo scenario, but precluding all non-renewable resource development has some disadvantages because without the creation of some additional employment and income in the region, 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.

Summary

Each of the potential development scenarios has its own suite of potential benefits and costs. Scenarios that offer either full protection or open all of the area to development tend to maximize the benefits of either protection or development at the expense of the other. On the other hand, scenarios that propose some combination of development and protection potentially provide the broadest range of benefits for regional residents. Opening Edézhzié to some non-renewable resource development will affect traditional uses in two ways. First, the environmental disturbances associated with non-renewable resource development may limit the capacity of Edézhzié to continue to sustain traditional uses although the magnitude of the effects will depend on the actual location of this development and the relative importance of traditional uses at these locations. Second, by offering more regional residents with an opportunity to participate in a wage economy, non-renewable resource development may cause a decline in the number of people who are able to continue to participate in traditional uses, thereby reducing the need to retain some areas for traditional uses. It will be up to each community to decide how best to balance the competing needs of traditional land uses and economic development now and in the future.

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1.0 INTRODUCTION

In 1999, studies were initiated to advance the Horn Plateau, Mills Lake and Horn River as candidate protected areas that would benefit Deh Cho First Nations. Local communities wanted to have these areas protected for its ecological and cultural values. Subsequent discussions with the communities and the Canadian Wildlife Service (CWS) led to an agreement to have CWS sponsor the Edézhíe area as a protected area under the *Canadian Wildlife Act*. The Edézhíe area is 25,224 square kilometres in area and is located mostly in the Dehcho region of the Northwest Territories (NWT). It is located north of the Mackenzie River and is surrounded by the communities of Fort Providence, Jean Marie River, Fort Simpson, Wrigley, Whatí and Behchokò. Residents of Fort Simpson recognize the importance of the Horn plateau as the source of most watersheds in the region and as a source of food during times of scarcity in the Mackenzie valley. Residents of Fort Providence consider the Mills Lake and lower Horn River areas to be important food sources. The Horn Plateau is also a traditional use area for the communities of Whatí and Behchokò, which are part of the Tlicho First Nation. In response to local concerns, the Cabinet of Canada issued an Order in Council in 2002 that prevented any land dispositions being issued for a five-year period in what is termed the Edézhíe Candidate Protected Area. This has since been extended to October 31, 2008.

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 Edézhíe, a Working Group has been established. This group consists of representatives from CWS, Fort Simpson, Wrigley, Jean Marie River, Fort Providence, Rae/Edzo (now Behchokò), Whatí, GNWT, World Wildlife Fund, Ducks Unlimited Canada, Canadian Petroleum Producers, and the NWT and Nunavut Chamber of Mines. As part of Step 5 of the PAS process, the Working Group issued the terms of reference for a socio-economic assessment of the Edézhíe Candidate Protected Area in 2007. This report was prepared in response to the terms of reference.

1.1 Objectives

The terms of reference for the socio-economic assessment

1. Develop socio-economic profiles using indicator statistics for each of the six surrounding communities
 - Develop consistent data baselines
 - Describe information specific to Edézhíe
 - Identify socio-economic data gaps and develop a strategy to address these gaps
2. Calculate Total Economic Value of Edézhíe based on available information
3. Assess socio-economic effects for the surrounding communities, the southern NWT, the entire NWT and for Canada of three scenarios:
 - National Wildlife Areas with current boundaries
 - National Wildlife Area with modified boundaries
 - No formal protection
4. Produce a plain language report and present information to stakeholders, communities and First Nations

Items 1 and 2 were to be provided in Volume 1 of the final report; item 3 was to be addressed in Volume 2.

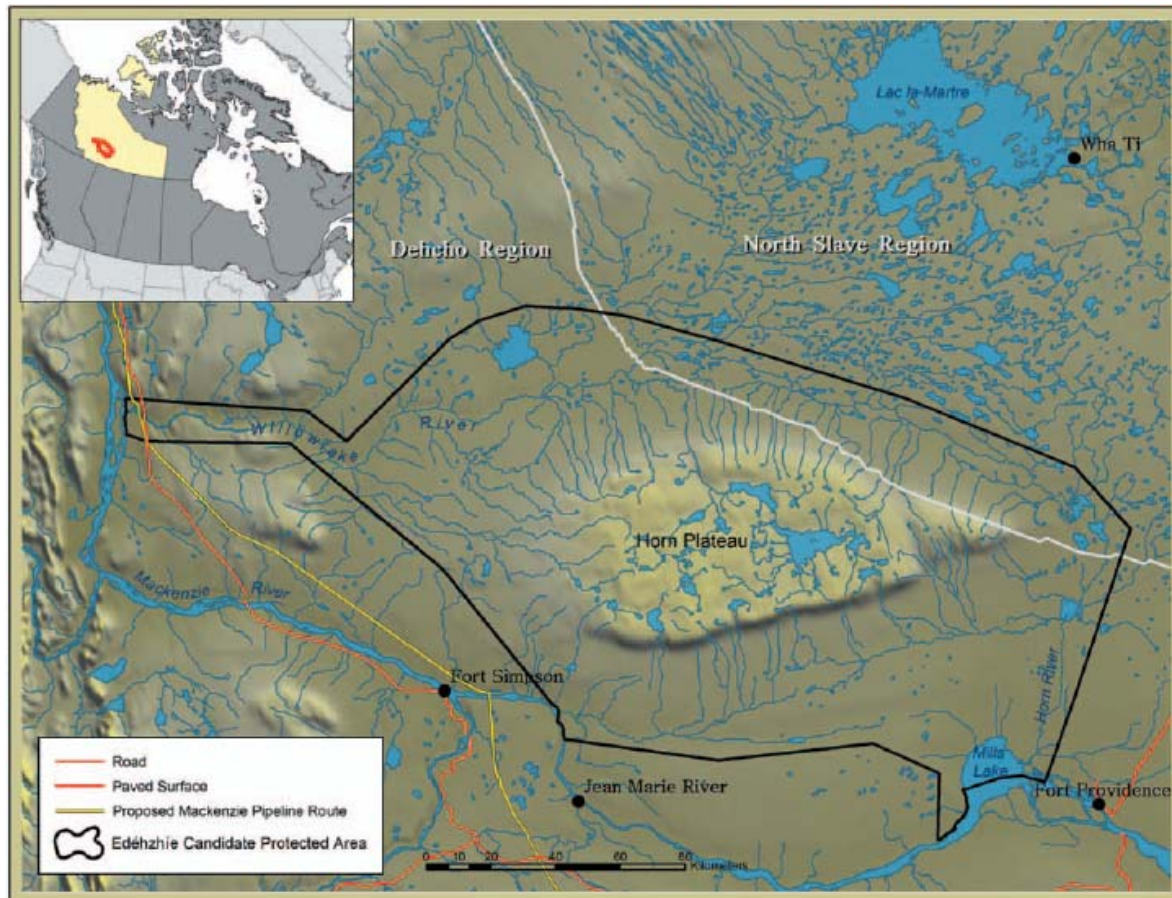
1.2 Study Area

A map of the Edézhíe Candidate Protected Area is provided in Figure 1-1. The Horn Plateau is of ecological significance for a number of reasons (EBA Engineering Consultants, 2006):

1. It supports several species at risk, including threatened species (boreal woodland caribou, wood bison, peregrine falcon) and species of special concern (wolverine and short-eared owl)
2. It contains three International Biological Program (IBP) sites.
3. Mills Lake is considered a “key migratory bird terrestrial habitat site” by the CWS.
4. It provides the source waters for three drainages that are of importance to the subsistence economies and culture of surrounding communities.
5. It contains almost the entire Horn Plateau ecoregion.

The area also has oil, gas, mineral and forestry development potential that could contribute to the regional economy.

Figure 1-1: Proposed Edézhíe Candidate Protected Area



Source: NWT PAS (no date).

1.3 Methodology

1.3.1 Approach

The general approach 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.

This study uses this same approach, with Volume 1 summarizing the baseline socio-economic conditions while Volume 2 describes the potential for development and the resulting socio-

economic effects. However, in the absence of specific development proposals, Volume 2 examines generic development scenarios that are patterned after similar existing or proposed projects for which some information does exist. There is some danger using this approach because the nature of development that ultimately may occur 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.

1.3.2 Development Scenarios

The Terms of Reference call for the assessment and evaluation of three development scenarios:

1. The designation of the Edézhzhíe as a National Wildlife Area with current boundaries intact;
2. The designation of Edézhzhíe as a National Wildlife Area with boundaries modified due to resource development potential (maximum 25% area lost); and,
3. No formal protection of Edézhzhíe.

As the study evolved, it has become apparent that Scenarios 1 and 2 actually consisted of a number of development opportunities for various parts of Edézhzhíe, including mining and oil and gas development, and that land withdrawals of more than 25% as stated in Scenario 2 were plausible. Consequently, the study first examined a number of development opportunities, assessed the extent to which these opportunities would be possible under the various three development scenarios, and then assessed the potential socio-economic effects associated with each scenario.

As noted above, the development opportunities proved to be challenging because no specific development projects have been proposed for Edézhzhíe; only the potential for development has been assessed. To describe potential effects, the study employed a generic approach that either used existing or proposed developments as analogues. This approach was used for assessing mineral and diamond potential. Alternatively, crude approximations of the costs of development and associated revenues were assembled using publicly available information for the mining and oil and gas sectors in the NWT. These estimates were prepared to illustrate the potential effects of resources development in Edézhzhíe and should not be interpreted as being an accurate portrayal of resource development potential.

1.3.3 Assessment of Socio-Economic Effects

Once the various development opportunities were described in terms of costs and revenues, the potential economic effects on employment and economic activity in the NWT were calculated using current information on economic multipliers (Northwest Territories Bureau of Statistics, 2007). 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 intensity ratios are usually less than one. The intensity ratios used in this analysis are as follows:

Table 1-1: Economic Multipliers used in the Northwest Territories (Northwest Territories Bureau of Statistics, 2007)

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	0.73	0.10	1.2
Mining (except oil and gas extraction)	0.73	0.10	1.3
Diamond mining	0.73	0.08	1.1
Other metal ore mining	0.64	0.34	5.1
Oil and gas extraction	0.76	0.06	0.6
Support activities for mining and oil and gas extraction	0.77	0.70	5.8
Pipeline Transportation	0.89	0.06	0.8
Construction	0.44	0.36	3.6
Retail Trade	0.74	0.59	13.6
Arts, entertainment and recreation	0.61	0.43	14.0
Accommodation and food services	0.66	0.43	12.0

The 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.

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 regional effects is very difficult and requires interpreting what percentage of territorial effects would occur within the six communities. 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.

1.3.4 Overall Approach

The third objective of this study was to assess the socio-economic effects for the surrounding communities, the southern NWT, the entire NWT and Canada for three different development scenarios. These scenarios ranged from no formal protection (completely open to development) to formal protection of the entire area as a National Wildlife Area (closed to development) to allowing development in some parts of the area.

This assessment proved to be very problematic because of lack of information about the location and extent of resource development that might be expected to occur in the near future. While there is some potential for mineral and oil and gas development, it is nearly impossible to describe the socio-economic effects of this development without making various assumptions about the scale and location of potential development.

Thus, identification of development scenarios consisted of a two-step process. The first step consisted of describing the most likely potential development opportunities in terms of potential location, timing, scale, cost, and revenues based on available information. These opportunities were developed in consultation with the NWT and Nunavut Chamber of Mines, the NWT GeoScience Office, the Canadian Wildlife Service, and INAC. A summary of the development opportunities was prepared for presentation to the communities to support their deliberations on proposed boundary options for the Edézhíe Candidate Protected Area. These opportunities are described in Section 2.0.

The second step involved preparing development scenarios that combined one or more of these development opportunities based on preliminary estimates of what areas would be included or excluded from the proposed National Wildlife Area. These development scenarios were intended to demonstrate the relative advantages and disadvantages of each of the various opportunities. The scenarios are presented in Section 3.0.

Over time, it is expected that the assumptions about resource development in the Edézhíe Candidate Protected Area will ultimately prove wrong. These assumptions represent best guesses based on very limited knowledge about what mineral and oil and gas resources may exist in Edézhíe. Better information will only be possible by opening up the area for exploration activities that may ultimately delineate economically-viable reserves. However, more exploration will not be undertaken until there is agreement regarding the boundaries of the protected areas.

2.0 POTENTIAL DEVELOPMENT OPPORTUNITIES

For purposes of identifying potential development scenarios for the Edézhíe Candidate Protected Area, it is necessary to describe potential oil and gas and mineral development in the region. These descriptions were developed by using existing information 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?

The following sections attempt to answer these questions for oil, gas, mineral, and diamond developments based on available information. As the socio-economic issues are similar to all types of development, a generic assessment of these issues is provided in Section 2.1.6.

2.1 Oil Development

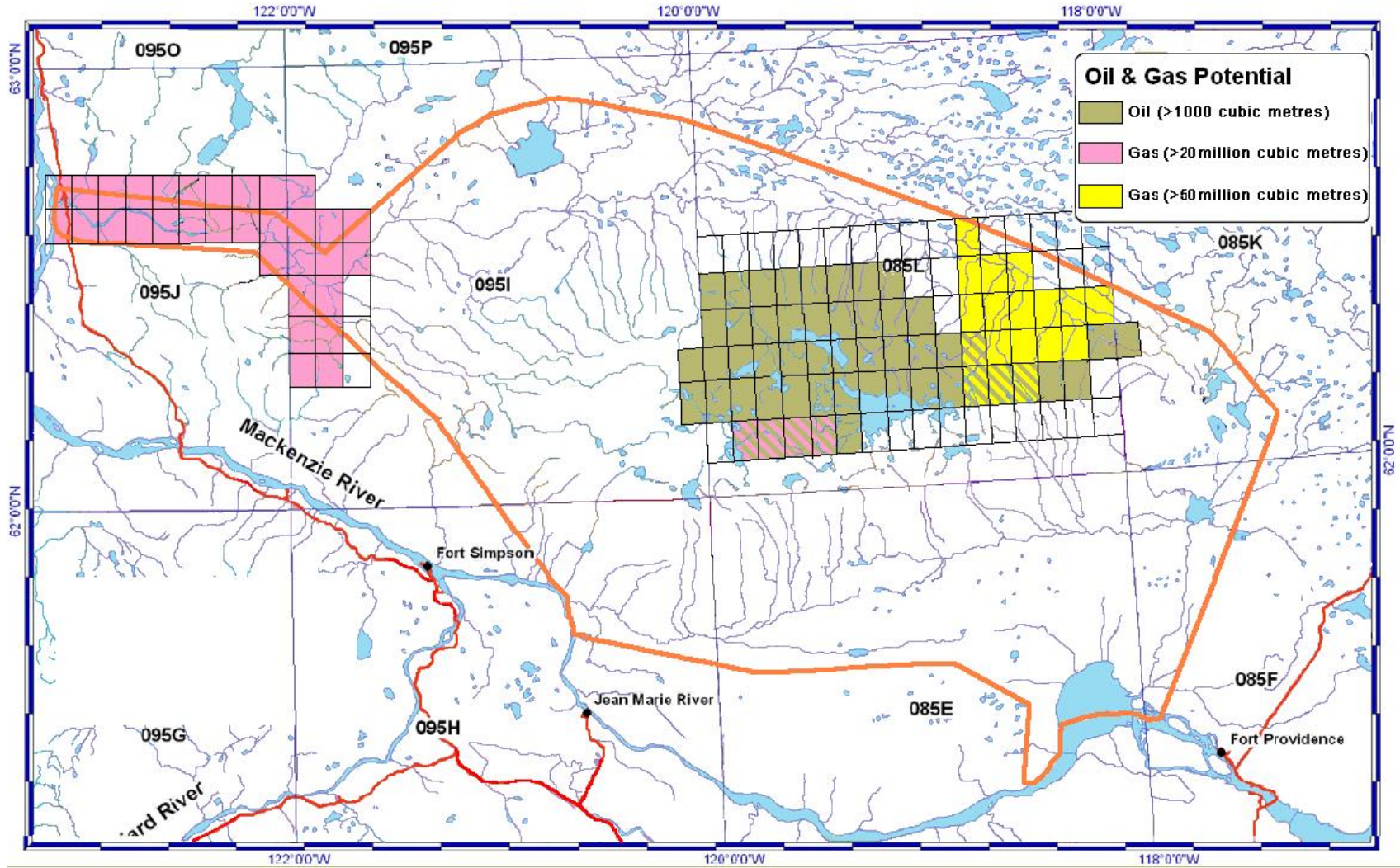
2.1.1 Resource Potential

According to the recent study by Morrow (2008) there are estimated to about 80,000 cubic metres (m^3) (0.5 million barrels) of undiscovered recoverable oil within the boundaries of the Edézhíe Candidate Protected Area. According to Morrow (2008), this relatively small amount is contributed only by one play, the Lower Cretaceous sandstone play beneath Horn plateau". In preparing his assessment Morrow relied heavily on a previous report by Drummond (2004) who estimated petroleum potential for individual quarter grids in the Edézhíe area. 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 location of the 52 quarter grids with the largest potential oil reserves (more than 1000 m^3 of oil) is shown in Figure 2-1. The highest potential for oil is on the top of the Horn Plateau in an area surrounding Willow and Hornell lakes. While there another 47 quarter grids in the area that are believed to have some potential for oil, this potential is less than 1000 m^3 per quarter grid and as low as 11 m^3 per quarter grid.

2.1.2 Timing of Development

It is unlikely that the potential oil deposits in the Edézhíe area will be delineated or explored any time soon. The total oil volumes underlying Edézhíe are very small. Total conventional oil reserves in the NWT in 2006 were estimated to be 363 million barrels (CAPP, 2007), so the deposits in Edézhíe would amount to only 0.1% of current reserves.

Figure 2-1: Location of Oil and Gas Reserves in the Edézhíe Candidate Protected Area



Source: Adapted from Morrow (2008)

Notes: Oil and gas 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 km².

Most current exploration is focused in or around existing oil reserves that are being developed at Norman Wells to the north and in the Cameron Hills to the south. Very few new oil wells are being drilled; none were drilled in the NWT or Yukon in 2005 or 2006, and only between one and six wells were drilled each year between 1999 and 2004 (CAPP, 2007).

The Edézhzhíe area has seen little exploratory work to date (40 wells have been drilled) and is considered to have not been adequately tested by drilling (Morrow 2008). Based on present day exploration and economic risk factors, the Edézhzhíe area is considered to have a high exploration risk, (Morrow 2008), despite the hydrocarbon shows from drilling completed to date.

The one positive factor affecting oil development is the infrastructure to transport the oil to southern markets does exist. An oil pipeline was constructed between Norman Wells and Zama in the early 1980s, and it passes close to Wrigley and Fort Simpson, and actually passes through the Edézhzhíe Candidate Protected Area. The pipeline has three pumping stations with an average throughput of 4800 m³ (30,000 barrels) per day but has spare capacity, and throughput could be increased substantially by augmenting compression (INAC, 1995). As of 2006, throughput had decreased to 19,000 barrels per day (CAPP, 2007).

Given that oil production from the Norman Wells field is declining (NWT Bureau of Statistics, 2008a) and that there will be an interest in maintaining throughput in the pipeline, it is reasonable to assume that oil exploration in Edézhzhíe could commence in earnest in about 2020. This would involve seismic work, some drilling of exploratory wells and perhaps the construction of a temporary or permanent road. However, given the relatively low expected oil reserves in the area, the high exploration risk, and the high costs of drilling, it is unlikely that any drilling would ever occur. On the assumption that some drilling does occur and that oil is found, construction of access roads, a gathering pipeline and related production facilities could commence in 2025 with production commencing in 2027. 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.

2.1.3 Costs of Development

The cost of exploring for oil reserves in the Edézhzhíe area is estimated to be about \$55 million, based on \$10 million in geological and geophysical exploration and drilling five wells at a cost of \$9 million each. These costs are based information from CAPP (2008) related to net cash expenditures of the petroleum industry in the NWT and Arctic Islands for 2006 and the number of wells and metres drilled. Over the last 25 years, the average cost per well drilled in the NWT amounted to \$8.6 million in 2007 dollars, or \$4800 per metre, with an average depth of 1800 metres. Over the same period average spending on geological and geophysical exploration amounted to 24% of annual drilling costs. Thus, it is reasonable to expect that future wells will cost \$9 million to drill and that geological and geophysical exploration cost about \$2 million per well.

If drilling identified economically viable oil reserves, it is estimated that the cost of constructing a 175 kilometre gathering pipeline, pumping facilities and a tie in to the Norman Wells oil pipeline

would be about \$175 million, based on an average cost of \$1 million per kilometre of pipeline. There are very few examples in the NWT that show the cost of 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 costs \$44 million in 1999. When adjusted for inflation, this translates into an average cost of \$1 million per kilometre.

Assuming that drilling does occur and that it proves economically viable to extract all 0.5 million barrels of oil from Edézhzié, the resulting resource revenues would be about \$42 million, assuming an average world price of \$100 per barrel and adjusting for the costs of transporting oil from the NWT to markets in the United States. In 2006, the value of crude oil shipped from the NWT averaged \$50.71 per barrel (NWT Bureau of Statistics, 2008b), although the average Canadian price was \$66 per barrel (Statistics Canada, 2007). This suggests transportation margins and other costs for oil produced in the NWT amounted to about \$16 per barrel. On this basis, a world oil price of \$100 per barrel would suggest gross revenues of \$84 per barrel for oil produced in the NWT. The expectation of \$42 million in oil revenues is very liberal however, given that reserves are spread over a large area and would likely require more than five wells, such that only a small portion of the 0.5 million in oil reserves would actually be recovered. At current prices (\$100 per barrel) the costs of exploration and pipeline construction are more than five times the gross value of the estimated oil reserves.

2.1.4 Impacts of Oil Development on the NWT

The territorial impacts of oil development in the Edézhzié area were estimated using the most recent economic multipliers from the GNWT. A range of estimates of employment for exploration and development for oil were calculated using multipliers for the construction industry (low) and for support activities for mining and oil and gas extraction (high). The estimates of the economic impacts of pipeline construction were calculated using the NWT multiplier for the construction industry. The economic impacts of operations were estimated using the multiplier for the oil and gas extraction industry. Based on the costs and revenues described in Section 2.1.1.3, the resulting impacts on the economy of the NWT are summarized in Table 2-1.

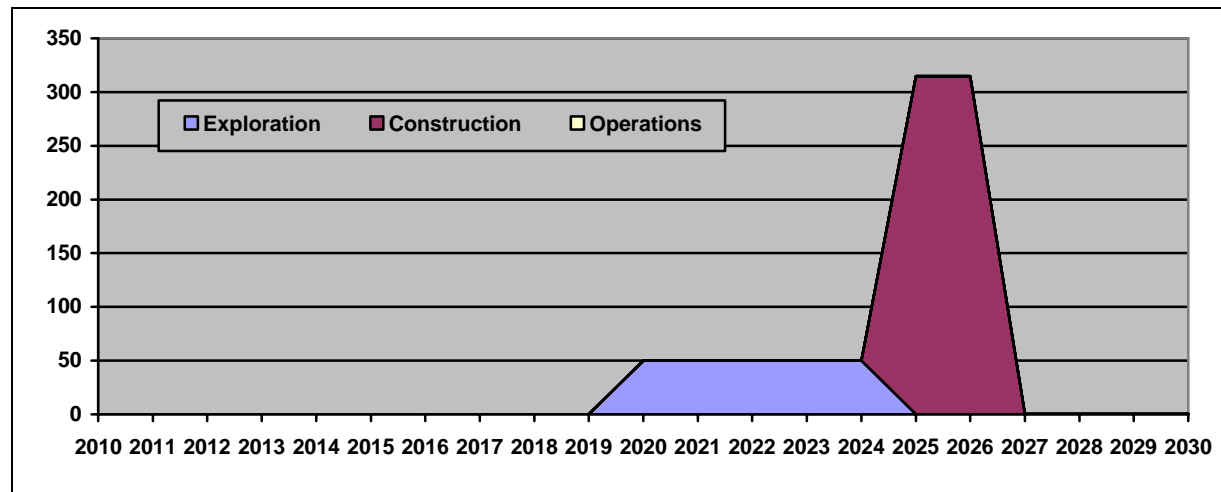
Table 2-1: Impact of Oil Development in Edézhzié on the Economy of the NWT

		Exploration	Construction	Operations
Cost/Revenues (millions)		\$55	\$175	\$42
Years		5	2	20
GDP (millions)	Total	\$24-\$42	\$77	\$36
	Annual	\$5-\$9	\$39	\$2
Labour Income (millions)	Total	\$20-\$39	\$63	\$3
	Annual	\$4-\$8	\$32	0.2\$
Direct and Indirect Employment (person-years)	Total	200-320	630	25
	Annual	40-64	315	1.25

The table shows that oil development would produce a relatively small increase in employment in the NWT (between 20 and 64 person-years) for the initial five years of exploration.

Employment would increase dramatically for the two years of pipeline and facilities construction, and then drop to only about one-person-year for year during the operations period. During operations, labour requirements are limited to monitoring pipeline operations and doing routine maintenance work. The overall effect of oil development on employment in the NWT is shown in Figure 2-2. However, based on the known oil reserves in Edézhzié, it is unlikely that the construction and operations phases would actually occur.

Figure 2-2: Direct and Indirect Employment Associated with Oil Development in Edézhzié



2.1.5 Opportunities for Local and Regional Employment

Oil development is unlikely to generate major employment or business opportunities for local or regional residents. Much of the work involved in exploration and pipeline construction is highly specialized or technical and the small amount of short-term activity likely to occur in Edézhzié is unlikely to encourage regional residents to train for these specialized jobs. Thus, local and regional residents are expected to work as labourers during exploration, help with any land clearing, and provide various services (food, accommodation, etc.) to the exploration crews. Local and regional residents are expected to provide the same range of services during construction: general labourers, right of way clearing, camps and catering, and other services. During exploration and construction, local and regional workers might account for 20% of the total labour requirements. Project operations will create the equivalent of only 1.25 new jobs in the region, most likely in Fort Simpson, and may require specialized skills that are not currently found in the region.

2.1.6 Potential Environmental Concerns

Oil development has the potential to create a number of environmental issues. These are summarized below and are based on current experience with 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. 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. 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. The oil industry has developed a standard suite of practices that are designed to minimize these effects and provide compensation where required. For Edézhíe, the greatest concerns relate to the fragmentation of habitat which can subject caribou populations to increased predation, and the potential for erosion and potential contamination of some of the headwater areas for streams that originate on the Horn Plateau.

2.2 Natural Gas Development

2.2.1 Resource Potential

According to the recent study by Morrow (2008) there are estimated to about 6.6 billion m³ (233 billion cubic feet) of undiscovered recoverable natural gas within the boundaries of the Edézhíe Candidate Protected Area. There is believed to be some natural gas in all of the quarter grids covering Edézhíe. However, the 18 quarter grids with the highest natural gas potential (more than 50 million m³ per quarter grid) are shown in Figure 2-1 and collectively they account for 19% of the estimated gas reserves in Edézhíe. These quarter grids are located in an area northeast of Willow Lake and are believed to also have the highest oil potential. Another 28 quarter grids are believed to have high natural gas potential (more than 20 million m³ per quarter grid). Four of these quarter grids are located immediately west of Willow Lake in an area with some oil potential. The other 24 quarter grids are located at the far west end of the Edézhíe Candidate Protected Area. The potential recoverable natural gas in Edézhíe is equivalent to 0.3% of the current discovered reserves in the NWT.

2.2.2 Timing of Development

It is unlikely that the natural gas deposits in the Edézhíe 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, the most likely candidate pipeline is the proposed Mackenzie Gas Project, as this pipeline parallels the Mackenzie River and actually passes through part of the Edézhíe area. The current proposal for the pipeline is to have construction completed by 2015 so that proven reserves in the Mackenzie Delta owned by partners in the Project can be moved to market. The potential for meeting this deadline is not known and will depend on the outcome of the Panel responsible for reviewing the Project and world natural gas prices which will need to be on the order of \$8 per Mcf in order to make the project financially viable. For purposes of this assessment, it is assumed that the pipeline will commence operations in 2015. Any delays could result in the window for development of natural gas resources in Edézhíe being pushed farther into the future.

A recent assessment of the Mackenzie Gas Project for the GNWT (Wright Mansell Research Ltd. 2007) suggests 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 suggests 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 examines two additional cases which assume that additional discoveries will be made in the later years of the project and will allow the pipeline to continue to operate near capacity after 2027 or 2028 when production from known reserves will start to decline.

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, it is unlikely that gas from the Edézhíe area would be of interest until after 2027, suggesting development is at least 20 years away. However, this date is optimistic given that the expected volumes of gas at Edézhíe are relatively small and that other parts of northern Canada are likely to have a greater natural gas potential. A more realistic assessment for developing natural gas in Edézhíe might be 25 or 30 years into the future.

For purposes of this analysis, it assumed that exploration for natural gas would commence in 2020, with construction of the natural gas gathering system in 2025, and operations starting in 2027. It is expected that the parts of Edézhíe with the highest gas potential would be explored and developed first. While high heating costs in local communities may spur interest in finding and developing alternative fuel sources like natural gas, as has happened in Inuvik (Enbridge Inc., 1999), it is unlikely to occur in Edézhíe given the costs of building a pipeline and the relatively small regional market.

2.2.3 Costs of Development

It is estimated that natural gas exploration in the Edézhíe area will cost \$220 million. This is based on drilling 10 wells at a cost of \$9 million each and conducting \$40 million in geological and geophysical exploration. Natural gas development is more likely to occur than oil development because the potential resource availability is much higher and appears to be more concentrated in three key areas within Edézhíe, increasing the likelihood that economically viable reserves can be identified and produced. Assuming that these wells are successful, another \$175 million will be required to construct a natural gas gathering pipeline system that would tie in to the Mackenzie Gas Project pipeline. If all natural gas resources were to be successfully extracted, the 6.6 billion m³ (0.223 Tcf) of natural gas in Edézhíe would have an estimated value of about \$1.8 billion, based on an average price of \$8 per thousand cubic feet (Mcf). However, the more realistic assumption is that only the 1.3 billion m³ in the northeast corner of Edézhíe would be developed and this would have a value of \$350 million. These revenue estimates do not include inflation of real price changes that may occur between now and 2027 when production from Edézhíe is likely to commence. Production is assumed to occur over 20 years.

2.2.4 Impacts of Natural Gas Development on the NWT

The territorial impacts of natural gas development in the Edézhíe area were also estimated using the most recent economic multipliers from the GNWT. A range of estimates of employment for exploration and development for natural gas were calculated using multipliers

for the construction industry (low) and for support activities for mining and oil and gas extraction (high). The estimates of the economic impacts of pipeline construction were calculated using the NWT multiplier for the construction industry. The economic impacts of natural gas operations were estimated using the multiplier for the oil and gas extraction industry. Based on the costs and revenues described in Section 2.1.2.3, the resulting impacts on the economy of the NWT are summarized in Table 2-2.

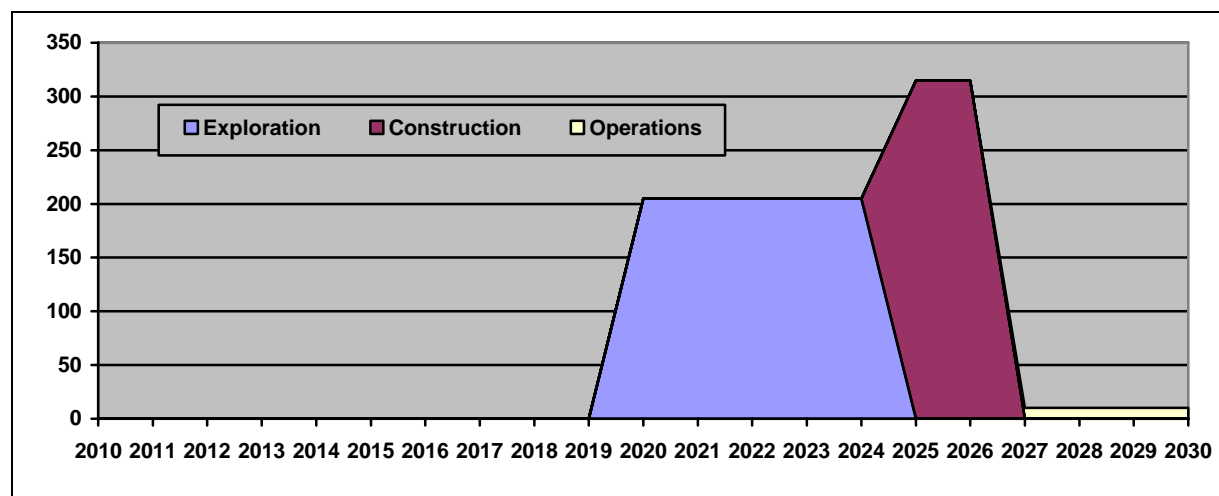
Table 2-2: Impact of Natural Gas Development in Edézhíe on the Economy of the NWT

		Exploration	Construction	Operations
Cost/Revenues (millions)		\$220	\$175	\$350
Years		5	2	20
GDP (millions)	Total	\$100-\$170	\$77	\$300
	Annual	\$20-\$35	\$39	\$15
Labour Income (millions)	Total	\$80-\$155	\$63	\$21
	Annual	\$15-\$30	\$32	\$1
Direct and Indirect Employment (person-years)	Total	790-1280	630	210
	Annual	160-255	315	10

Table 2-2 shows that the overall economic effect of natural gas development in Edézhíe would be similar to but larger than the economic effects of the oil industry. There would be a moderate increase in employment in the NWT (between 160 and 255 person-years) for the six years of exploration, increase to 315 person-years for each of the two years of pipeline and facilities construction, and then drop to about 10 person-years per year during operations.

The overall effect of natural gas development on employment in the NWT is shown in Figure 2-3. This clearly shows that after an initial flurry of economic activity during exploration and construction, natural gas development will create very little long term employment.

Figure 2-3: Direct and Indirect Employment Associated with Natural Gas Development in Edézhíe



2.2.5 Opportunities for Local Employment

As was the case for oil development, exploration and development of natural gas reserves in the Edézhzhíe area are also unlikely to generate major employment or business opportunities for local or regional residents. Again, much of the work involved in exploration and pipeline construction is highly specialized or technical and short-term. This means that few if any local or regional residents will be qualified for this work and the development phases are too short to encourage regional residents to train for these specialized jobs. For these reasons the best opportunities for employment of local and regional residents are as labourers during exploration, land clearing, camps and catering to exploration and drilling crews, and in various other service industries. For the exploration and construction phases, up to 20% of total employment will involve local and regional workers. With operation of the gas pipeline and compressor stations lasting at least 20 years, the best opportunities for local and regional workers would relate to monitoring, maintenance and administration, but would involve only 5 new jobs. It is expected that most of the employment related to natural gas operations would also be centered in Fort Simpson.

2.2.6 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 greatest concerns for Edézhzhíe relate to the fragmentation of key caribou habitat.

2.3 Mineral Development

2.3.1 Resource Potential

The recent study by Mills (2008) determined that there is a moderate potential for lead-zinc deposits along the south facing escarpment of the Edézhzhíe Candidate Protected Area, and along the east and west sides of the Horn Plateau. These areas of moderate potential are delineated in Figure 2-4. This assessment was based on samples of heavy mineral concentrates, stream sediments, and water that were collected in 2003 and 2005. The study also determined that there was low to moderate potential for uranium beneath the Horn Plateau with high uncertainty. There was low potential for deposits of copper or gold. 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. There is the potential that more than one mine could be developed.

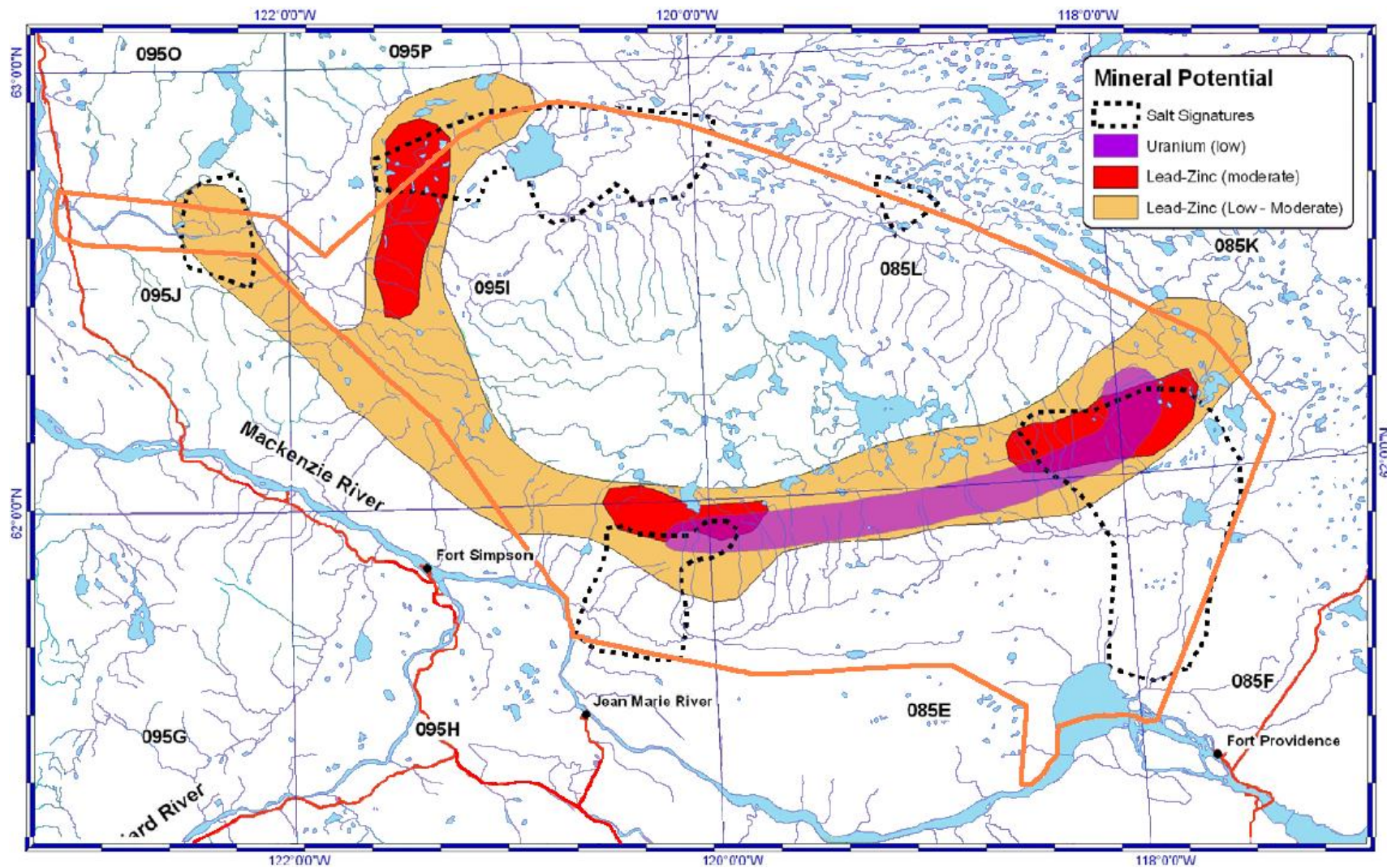
2.3.2 Timing of Development

Given that the studies of mineral capability have only recently been completed and that the area is considered to have, at best, moderate capability for lead-zinc and uranium, it is very difficult to predict when or even if mineral development would occur. It is expected that, within the NWT, the areas with the highest capability would be developed first, with areas like Edézhíe being investigated and developed at a later time. It should be noted that, at present, the NWT does not have an operating zinc-lead mine although re-opening the Prairie Creek, which is located within the same region, is being pursued. Interest in re-opening the Prairie Creek mine has been precipitated by recent increases in base metal prices and it is possible that these higher prices may raise interest in more mineral exploration and development of the surrounding region.

The NWT is also home to the world's largest undeveloped zinc deposit at Howard's Pass in the Sahtu Region. Development of this site has been stalled by lack of physical infrastructure (power and roads) and metallurgical complexity. It is expected that development of the Mackenzie Valley pipeline will resolve some of the infrastructure constraints and facilitate development of the Howard's Pass deposit as well as other mineral deposits in the region.

It is expected that exploration for minerals in the region will commence once the boundaries of the Edézhíe Protected Area have been finalized and accepted. Thus, exploration could commence as soon as 2010, 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 estimated that the construction of an operating mine in the Edézhíe area would not be possible until 2020. This date is predicated on five years of exploratory drilling and delineation of ore bodies and another five years to conduct the requisite environmental studies, obtain all the necessary permits, and negotiate an agreement with the Deh Cho. Construction of an access road and the processing and other facilities would take about two years, such that operations could start in 2022. For this assessment it is assumed that only one of the known lead-zinc deposits would be mined at any one time.

Figure 2-4: Summary of Mineral Potential in the Edézhíe Candidate Protected Area



Source: Adapted from Mills (2008)

2.3.3 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, or 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. Assuming that about half of the proposed Edézhíe area would be made available for exploration, this translates into annual spending of \$9.4 million per year. Assuming that exploration in the Edézhíe area would occur over 5 years, total exploration costs are estimated to be about \$50 million.

The ultimate costs of developing the mineral resources in Edézhíe 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. For want of better information, the Prairie Creek zinc–lead mine offers a suitable analogue for estimating the costs of mine construction and mineral development in Edézhíe. The Prairie Creek mine would be similar to a mine in Edézhíe for a number of reasons:

- The ore body being mined includes cavity infill sulphides (MVT) which are similar to the deposits found in the northwest corner of the Horn Plateau.
- 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), construct an all-weather road, and rely on diesel generated electric power.
- It is located in the Deh Cho region of the NWT and would draw labour and resources from the same communities that would be called upon to supply a mine in Edézhíe.
- The developer (Canadian Zinc Corporation) negotiated an agreement with the Deh Cho First Nation and a similar agreement would have to be negotiated for mine development in Edézhíe.

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 2007, construction of a similar sized mine is estimated to cost \$167 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 Edézhíe 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 \$40 million per year.

2.3.4 Impacts of Mineral (Zinc) Development on the NWT

The territorial impacts of constructing a mine at Edézhíe have been estimated using the most recent economic multipliers for the NWT. Estimates of employment for exploration and development were calculated using NWT multipliers for construction (low) and support activities for mining and oil and gas extraction (high). Estimates of the economic impacts of constructing a mine 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. Based on the cost estimates provided in Section 2.1.3.3, the potential economic effects of developing a 1,000 ton per day lead-zinc mine in the Edézhíe area are summarized in Table 2-3.

Table 2-3: Impact of Developing a Zinc Mine in the Edézhíe Area on the Economy of the NWT

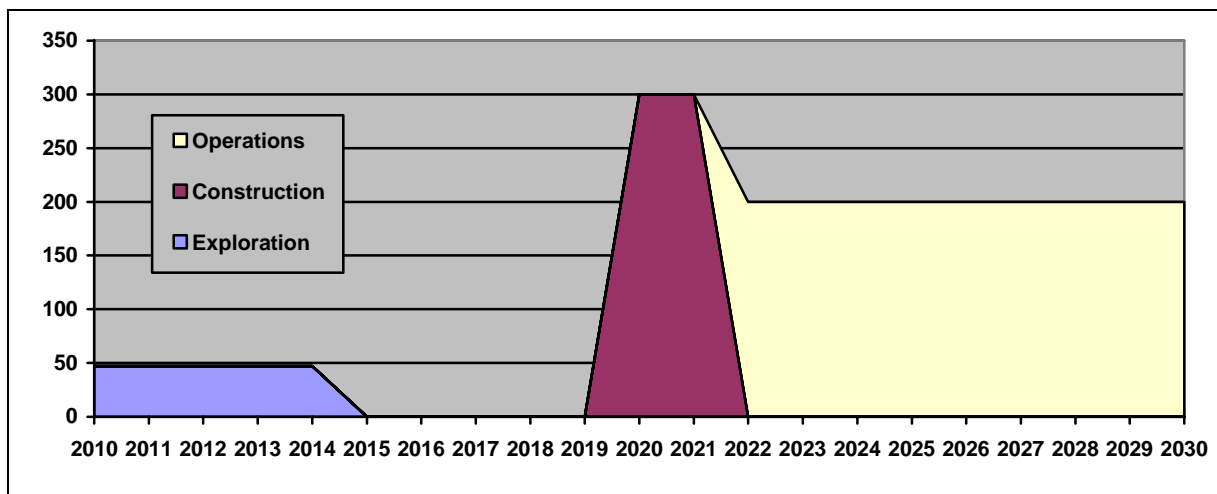
		Exploration	Construction	Operations
Cost/Revenues (millions)		\$50	\$167	\$40
Years		5	2	10-20
GDP (millions)	Total	\$22-\$40	\$73	\$26
	Annual	\$4-\$8	\$37	
Labour Income (millions)	Total	\$18-\$35	\$60	\$14
	Annual	\$4-\$7	\$30	
Direct and Indirect Employment (person-years)	Total	180-290	600	200
	Annual	36-58	300	

Table 2-3 shows that the economic effects of mine development are relatively small during the exploration phase, increase substantially during construction and then remain high during operations. The economic impacts of mine development during exploration and construction are similar to that of oil development, but the operational effects are nearly 200 times greater because mining is much more labour intensive.

During operations, annual costs of \$40 million will create the equivalent of about 200 direct and indirect jobs. This means that, in addition to the 150 jobs directly at the mine (as per the Prairie Creek mine), another 50 person-years of employment will be created in those sectors of the NWT economy that will provide goods and services needed for mine operation. Impacts on total labour income will amount to \$14 million, with territorial GDP increasing by \$26 million per year.

The overall effects of developing a zinc mine on employment in the NWT are shown in Figure 2-5. This clearly shows that, once in operation, mine development would provide high levels of long term employment. The lag in activity between exploration and construction reflects the five years needed to completed environmental assessments and obtain the required approvals.

Figure 2-5: Direct and Indirect Employment Associated with a Zinc Mine in Edézhíe



2.3.5 Opportunities for Local Employment

As was the case for oil and gas development, much of the labour required for mineral exploration is highly specialized and technical, and these skills are not generally available in the local labour force. Local labour and businesses will be called upon to provide camps and catering, collect samples, expediting materials into the field, provide other services and serve as general labourers where required.

During construction, the creation of 600 person-years of construction over two years would severely strain the labour resources of the region and would require some importation of labour, goods, and services. In 2006 there were only 190 construction workers in the entire region, with 50 in Fort Simpson and 35 in Fort Providence. 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, build an access road, provide the camp services, and operate equipment. For the proposed mine, it is estimated that regional employment would amount to 60 people per year over the construction period. These would mostly be residents of Fort Simpson and Fort Providence. Based on average employment income per person-year, this would translate into increased regional labour income of up to \$5.0 million per year of construction.

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. Regional residents are predicted to account for one third of the processing component of the workforce (10 people). The number of regional residents employed on the mining side of the operations will depend on whether it is open pit or underground, 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 regional residents could account for another 20 positions in mine operations. Based on these assumptions it is expected that 30 regional residents could be directly employed at the

mine. Based on the high ratio of non-basic jobs (sales and service) to basic jobs (goods producing) for the major communities in the region, it is possible that indirect project employment could account for another 40 person-years of employment. The additional regional income resulting directly and indirectly from mine operations would total about \$4 million per year. Almost all regional effects from operating the mine would occur in Fort Simpson and Fort Providence.

2.3.6 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 Edézhíe, the loss of habitat could be much greater. 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 Edézhíe area, may not be a problem there either, but the possibility of acid rock cannot be conclusively be ruled out. Other environmental problems associated with metals mining included 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.

2.4 Diamond Development

2.4.1 Resource Potential

The recent study by Mills (2007) also assessed the potential for diamonds in the Edézhíe Candidate Protected Area. This assessment involved determining the presence of kimberlitic indicator minerals (KIMs) in stream sediment samples and in surface samples. The assessment

determined that KIMs were present in some of the samples and one diamond was found. Based on a chemical analysis, it was concluded that the KIMs in the Edézhíe area are unlike other known kimberlitic sources in the Slave region of the NWT, suggesting that there is a new, undiscovered kimberlitic source either within or near the Edézhíe area. The exact locations of these KIMs or whether they actually contain any diamond deposits that are economically viable are not known. A map showing the distribution of KIMs found in surface samples is provided as Figure 2-6.

Given the uncertainty about actual diamond potential in Edézhíe, it was decided to base the assessment of potential costs and economic impacts on information from existing diamond mines in the NWT and Nunavut. Table 2-4 summarizes the size and status of five diamond mines and shows the potential range of development that could occur. Revenues are estimated based on an average cost of \$114 per carat (GNWT 2006). For purposes of this analysis, the Jericho mine was selected to show the level of development associated with a small operation while the Snap Lake example was chosen as a large example. While there is some potential that an even large mine on the scale of Diavik could be developed, it is equally possible that no economically-viable diamond deposits are ever developed in Edézhíe.

Table 2-4: Actual and Proposed Diamond Production in the NWT

Mine	Output (millions carats)	Status	Revenues (millions)
Diavik	8.27	Actual 2005	\$942
Ekati	4.03	Actual 2005	\$459
Gacho Kué	3.0	Proposed estimated	\$342
Snap Lake	2.4	Operating – estimated	\$274
Jericho	0.5	Suspended – estimated	\$75

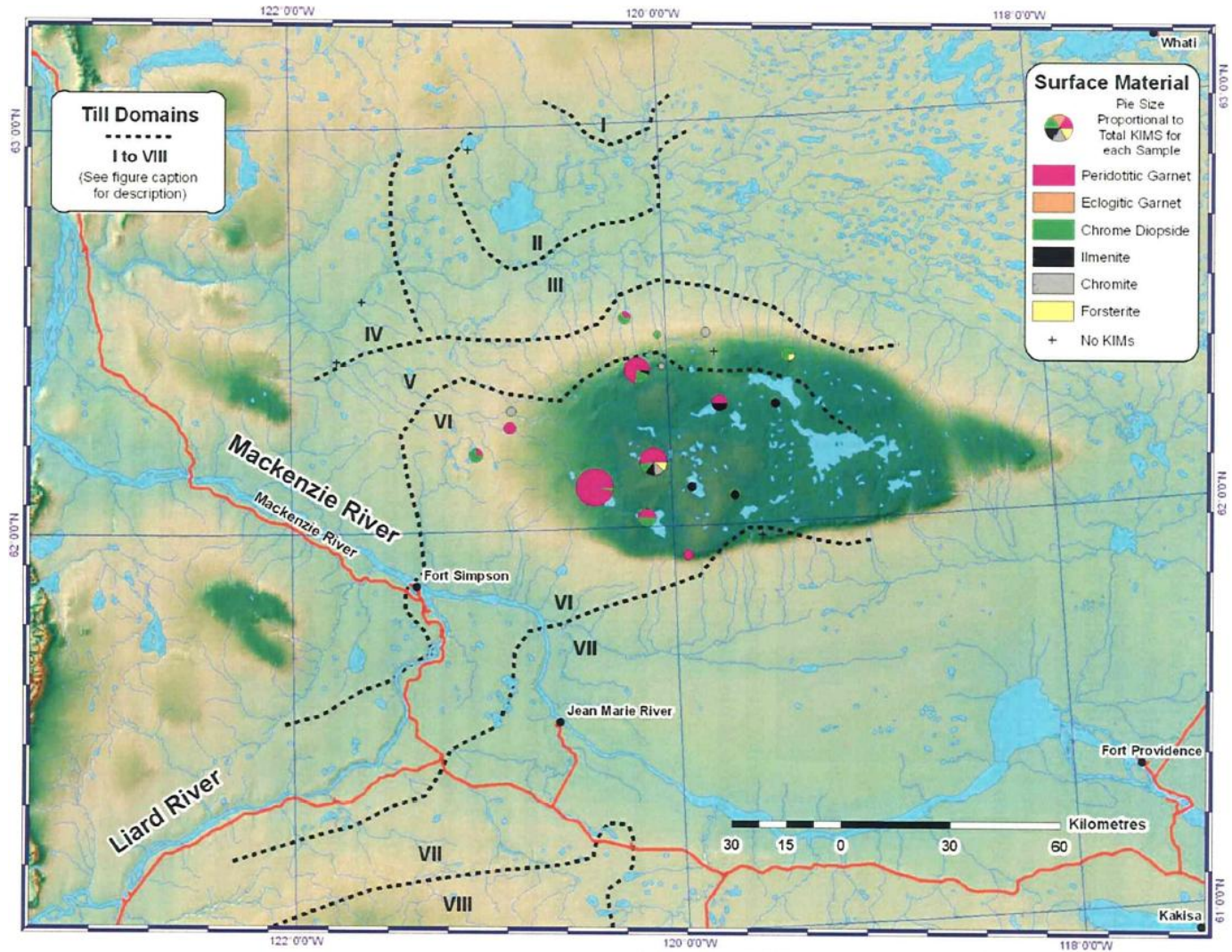
Source: Northwest Territories Industry Tourism and Investment, 2007a

It should be noted that a diamond mine at Edézhíe would be much less isolated than most of the existing mines and could be less expensive to construct and operate. In addition, operations may use different work rotations than mines where the entire workforce has to be flown in.

2.4.2 Timing of Development

There is no indication of when the source of the diamondiferous material found in Edézhíe will be identified and delineated. Most of the current diamond development in the NWT is currently occurring in the Slave Region and it is not clear what preconditions will need to exist before the industry starts to examine other parts of the NWT for potential diamond-bearing material. Olivut Resources Ltd. is actively exploring for diamonds around the Edézhíe Candidate Protected Area and has some claims in the area that predate the interim land withdrawal. Olivut has indicated that with the new information on KIMs produced by Mills (2008) and once the boundaries of the protected area have been established, there is likely to be considerable interest in further exploration in the region.

Figure 2-6: Summary of Mineral Potential in the Edézhíe Candidate Protected Area



Source: Mills (2008)

Given the large capital commitments and the infrastructure necessary to develop a diamond mine, it is expected that, in the near future, most new development will continue to occur in the Slave Region. The Snap Lake mine opened in 2007, and the Gacho Kué mine is expected to commence operating in 2012. Development in the Edézhíe would likely commence with exploration activities starting in 2010 and would take five years to complete. Once the kimberlite source has been identified and delineated, the environmental approvals process and mine construction would take another five years, suggesting that construction of diamond resources might start in 2020 with operations commencing in 2025.

2.4.3 Costs of Development

It is expected that the costs of diamond exploration and development in Edézhíe will be the same as for other mineral exploration. This would involve geophysical and geochemical surveys, sampling and diamond drilling, with an estimated cost of \$50 million metal spread over five years.

The cost of construction will depend on the ultimate size of the mine. Information from the NWT and Nunavut Chamber of Mines (Ryan Silke, pers. comm.) indicates that construction costs could range from \$120 million (Jericho mine) to \$1,000 million (Snap Lake). Construction would include constructing a road to the site, land clearing, removal of overburden, and building a camp, processing, maintenance and power facilities.

Annual operating costs will ultimately depend on the methods used to mine the kimberlite (most existing operations use a combination of surface and sub-surface mining) as well as the number and size of the kimberlite pipes to be mined. Kimberlite will be excavated, crushed and any diamonds will be extracted sent off site for processing. The remaining ore will be returned to the excavation or stockpiled for later reclamation. The likely costs of operating a mine in Edézhíe are not known. However, to be viable, a mine would have to generate annual revenues of at least \$75 million for a small mine and up to \$275 million for a large operation.

2.4.4 Impacts of Diamond Development on the NWT

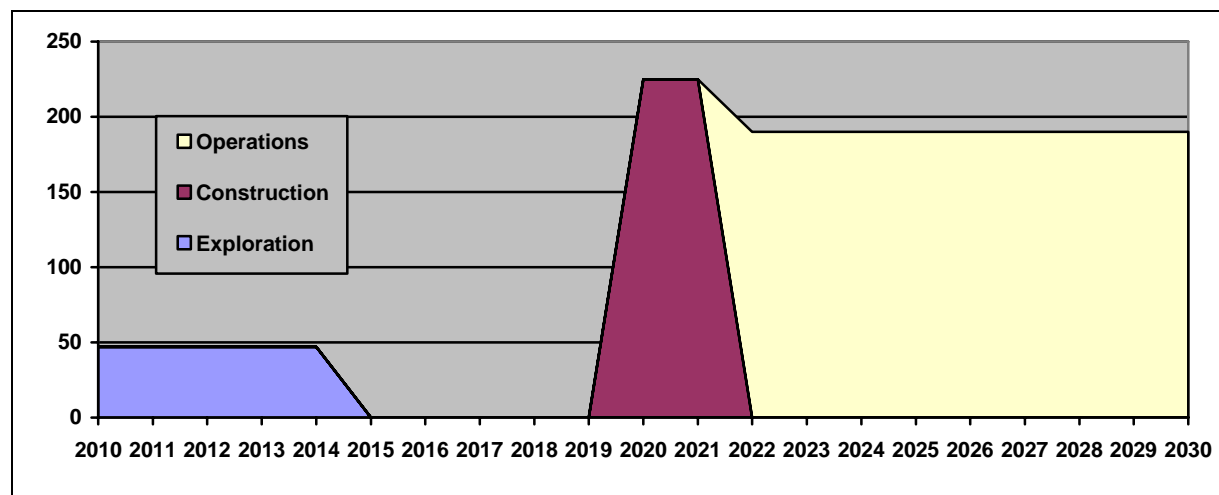
The territorial impacts of developing a diamond mine in the Edézhíe have been estimated using the most recent economic multipliers for the NWT. Estimates of employment for exploration and development were calculated using NWT multipliers for construction (low) and support activities for mining and oil and gas extraction (high). The estimated direct and indirect economic impacts from operation were calculated using multipliers for the diamond extraction industry. While the potential effects of mine construction were initially calculated using multipliers for the construction industry, the resulting effects predicted employment levels that were much greater than reported employment for either the Jericho or Snap Lake mines. Consequently, the actual construction employment numbers for the two mines (as provided by the NWT and Nunavut Chamber of Mines) and increased by 50% to account for indirect effects were used to describe the effects of mine construction. The resulting estimates of diamond mine development on the economy of the NWT are summarized in Table 2-5.

Table 2-5: Impact of Developing a Diamond Mine in the Edézhíe Area on the Economy of the NWT

		Exploration	Construction	Operations
Cost/Revenues (millions)		\$50	\$120-\$1000	\$75-\$275
Years		5	2	10-20
GDP (millions)	Total	\$22-\$40	\$20-\$95	\$55-\$200
	Annual	\$4-\$8	\$26-\$220	
Labour Income (millions)	Total	\$18-\$35	\$15-\$75	\$6-\$22
	Annual	\$4-\$7	\$22-\$180	
Direct and Indirect Employment (person-years)	Total	180-290	150-750	80-300
	Annual	36-58	75-375	

The resulting employment profile over the life of the mine is shown in Figure 2-7 for the average of the ranges provided in Table 2-5. The profile is very similar to the employment profile for a zinc mine, with relatively low employment during the exploration phases and major increase in employment during project construction. The operational workforce for a diamond mine would also be quite large and could provide long term employment opportunities for some regional residents.

Figure 2-7: Direct and Indirect Economic Impacts of Existing and Proposed Diamond Mines



2.4.5 Opportunities for Local Employment

Most of the labour required for mineral exploration 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.

For construction, the creation of 150 to 750 person-years of employment would severely strain the labour resources of the region, especially if a large mine was to be developed and/or other types of mine development were to occur concurrently. Thus some importation of labour goods

and services would be required. As noted previously there were only 190 construction workers in the entire region in 2006, with 50 in Fort Simpson and 35 in Fort Providence. 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 are typically used to clear the site, build the access road, provide the camp services, and operate equipment. For the proposed diamond mine, it is estimated that regional employment would amount to 45 people per year over the construction period. These would mostly be residents of Fort Simpson and Fort Providence. Based on average employment income per person-year, this would translate into increased regional labour income of up to \$3.5 million per year of construction.

For operations, all of the processing staff (numbers could range between 20 and 80 people, depending on the size of the mine) will have to be brought into the region because they require special skills that are not currently available in the regional workforce. The number of regional residents employed on the mining side of the operations will depend on how much is open pit and how much is underground, and whether they have the skills to operate heavy equipment. Most blasters and people operating specialized underground drilling equipment will be brought into the region (from 10 to 50 people). It is believed that regional residents would have skills suitable for many of the open pit mining operations (about 30 positions). Based on these assumptions it is expected that mine operations could directly employ about 30 regional residents. Based on the high ratio of non-basic jobs (sales and service) to basic jobs (goods producing) for the major communities in the region, it is possible that indirect project employment could account for another 40 person-years of employment. The additional regional income resulting directly and indirectly from mine operations would total about \$4 million. Most regional effects from operating the mine would occur in Fort Simpson and Fort Providence.

2.4.6 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 related 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.

2.5 Socio-Economic Effects

The types of potential socio-economic effects that might occur for all four 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 effects.

Positive effects include employment and higher incomes for regional residents, increased capacity and educational levels as a result of training, regional economic diversification and increased stability, improved availability of consumer goods and service, 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 more 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 adverse effects when the project ceases operation 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 Volume 1, most of residents of the six communities do not currently have the training necessary to work on any of the development projects except in a limited capacity: labourers, land clearing, equipment operators, expeditors, 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 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 Volume 1, 86% 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 the communities to work with developers in advance of a project to agree on which approach is preferred and to establish the procedure for monitoring and managing any problems that 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 the four development opportunities, it is likely that the camp model will be used to accommodate most of the workers involved in the exploration phases of petroleum or mineral development. There is no road access into the area and the activity is very short term. 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 Fort Simpson. For construction and operation of a zinc or diamond mine, either the camp or community model could be used. Edézhíe is not as remote as much of the NWT and a permanent road to the mine would have to be constructed, so workers could be housed in regional communities rather than a camp. As noted above, should mine development be proposed for the Edézhíe area, the developer will have to work with the communities to determine the preferred option and to identify strategies for maximizing local benefits while minimizing adverse effects.

2.6 Effects on Use and Non-Use Values

As noted in Volume 1, the Edézhíe area is estimated to annually generate between \$0.9 and \$1.4 million in user benefits for regional residents by providing a source of food, fuel, income through trapping and tourism, and recreation. The area also provides a variety of ecosystem goods and services that benefit mankind beyond direct human use and preliminary information suggests these non-use values, where quantified, could be at least in the range of \$1.0 to \$1.5 million. It is expected that these values will be at

risk should economic development be allowed in some or all of the Edézhíe area. As noted in the previous sections, all forms of development have potential adverse effects that could diminish the value of Edézhíe's natural assets and the user values currently enjoyed by regional residents. For example, oil or gas development could result in habitat fragmentation that could lead to a reduction in caribou populations that could result in fewer animals being harvested for food that could then affect the well-being of the 35% of regional residents who rely on country food for 75% or more of their food consumption. Similarly, development that affects drainage patterns could result in the loss of some wetlands which help to regulate climate by sequestering carbon, thereby potentially contributing to global climate change.

Ideally it would be advantageous for this analysis to be able to describe the potential effects on use and non-use values associated with oil and gas development and zinc and diamond mining. Unfortunately, this is not possible because without knowing exactly where development will occur or the magnitude of that development, it is not possible to estimate potential losses of use and non-use values which are very site specific. For example, the effects of a mine in an area with a very high density of traditional land use will be much greater than were development to occur in an area with a low traditional land use density. In addition, there is currently insufficient information about the environmental and ecological characteristics of specific areas within Edézhíe to be able to specify with any certainty their current ecological functions and values, let alone what the potential effects of development would be. The best that can be done in this analysis is to describe the generic types of environmental disturbances associated with different types of development.

It is hoped that, when proposals for development in the Edézhíe area are submitted, the potential effects on use and non-use values will be assessed at that time. As part of the approval process for future development in and around the Edézhíe area, project proponents will be asked to characterize potential adverse environmental effects and the associated impacts on traditional resource use. This will allow regulators to help determine whether project benefits exceed costs. As more information about the importance of ecological goods and services is known, project proponents could also be asked to provide information on the extent to which these goods and services might be adversely affected and the strategies that will be employed to mitigate these effects.

2.7 Summary

Table 2-6 contains a summary of the four resource development opportunities for the Edézhíe area. Comparing these opportunities suggests the following conclusions:

- There is a high degree of uncertainty regarding the resource development potential of the area and better information can only be obtained by undertaking additional exploration.

- Mineral development is more likely to occur in the near future than oil and gas development because of a lack infrastructure (natural gas pipeline) or small reserves (oil).
- While all four opportunities would initially provide low levels of employment during exploration and high levels of employment during construction, zinc and diamond mining would provide much higher levels of operating employment.
- The potential for employment of local residents is higher for mineral and diamond development, especially during construction.
- The environmental effects of development are different. Oil and gas development would result in a spider-like pattern of surface disturbances that could lead to habitat fragmentation which could threaten caribou populations. Mine developments cause large but localized land and habitat disturbances, but waste rock and tailings can represent a potential hazard to water quality and aquatic life.
- Many of the areas of greatest potential for oil, gas zinc and perhaps diamonds are in the same general parts of the Edézhíe Candidate Protected Area, notably the area around Willow Lake. These parts of Edézhíe also have some of the highest cultural and traditional use values (see Figures 2-35 and 3-3 of Volume 1).

It should be noted that none of these development opportunities will preclude any of the others. In fact, based on the experience in Alberta and elsewhere, the development of a permanent access road, as required for oil and gas drilling or mine construction and operation, is often a catalyst for other types of development. Whichever form of development goes first, likely mining, will eventually help determine the overall pattern of resource development in the region and may also accelerate the pace of development.

Table 2-6: Summary of Potential Development and Associated Effects of Petroleum and Mineral Development in the Edézhzié Area

	Oil	Gas	Minerals	Diamonds
Resource Potential	Potentially 0.5 million barrels 0.1% of current reserves in NWT Exact volumes and locations unknown	Potentially 233 billion cubic feet 0.3% of current discovered reserves in NWT Exact volumes and locations unknown	Moderate potential for lead-zinc. Could be more than one mine Use 1000 ton per day mine (Prairie Creek mine proposal) as example	Unknown potential Could be more than one mine Use an example ranging from 0.5 million carats/year (Jericho Mine) to 2.4 million carats/year (Snap Lake) Could be even larger
Exploration and Development				
When	Exploration in 2020 – tied to capacity in Norman Wells pipeline.	Exploration in 2020 - depends on completion of Mackenzie Gas Pipeline	Exploration in 2010 – removal of restrictions	Exploration in 2010 – removal of restrictions
Activities	Seismic, drilling, construction of temporary or permanent roads	Seismic, drilling, construction of temporary or permanent roads	Geophysical surveys, geochemical surveys, sampling, diamond drilling	Geophysical surveys, geochemical surveys, sampling, diamond drilling
Cost	\$55 million (based on 5 wells at \$9 million each and \$10 million in geological and geophysical exploration)	\$220 million (based on 20 wells at \$9 million and \$40 million in geological and geophysical exploration)	\$50 million (based on 5 years at \$10 million per year)	\$50 million (based on 5 years at \$10 million per year)
Economic Impact	200 to 320 PYs of direct and indirect labour spread over 5 years	790 to 1,280 PYs of direct and indirect labour over 10 years	180 to 290 PYs of direct and indirect labour spread over 5 years	180 to 290 PYs of direct and indirect labour spread over 5 years
Opportunities for Local Economy	Labourers, clearing (seismic), services to seismic and drilling crews	Labourers, clearing (seismic), services to seismic and drilling crews	Labourers, camps and catering, samplers, expediting, contracted services	Labourers, camps and catering, samplers, expediting, contracted services
Potential Environmental Concerns	Noise, habitat fragmentation, drilling fluid disposal	Noise, habitat fragmentation, drilling fluid disposal	Noise, localized loss of habitat	Noise, localized loss of habitat
Construction				
When	Depends on results of exploration but unlikely due to small volumes	2025. Perhaps some development sooner to address local markets	Construction commences in 2020 (5 years to delineate reserves, 5 years to obtain approvals)	Construction commences in 2020 (5 years to delineate reserves, 5 years to obtain approvals)
Activities	Construction of gathering pipeline, pump facilities and tie in to Norman Wells pipeline	Construction of gathering pipeline, pump facilities and tie in to Mackenzie Gas Project	Removal of overburden, road construction, crushing and processing buildings	Removal of overburden, road construction, crushing and processing buildings
Cost	\$175 million (175 km at \$1 million per km)	\$175 million (175 km at \$1 million per km)	\$167 million	\$120 to \$1,000 million

Economic Impact	630 PYs over 2 years	630 PYs over 2 years	600 direct and indirect PYs over 2 years	150 to 750 direct and indirect PYs over 2 years
Opportunities for Local Economy	Clearing, equipment operators, camps and catering, other services	Clearing, equipment operators, camps and catering, other services	Labourers, equipment operators, camps and catering, expediting, other contracted services. Depends on training offered by developer New employment, income education for local workforce	Labourers, equipment operators, camps and catering, expediting, other contracted services. Depends on training offered by developer New employment, income education for local workforce
Potential Environmental Concerns	Erosion and sedimentation, wildlife movement, habitat fragmentation (caribou)	Erosion and sedimentation, wildlife movement, habitat fragmentation (caribou)	Loss of habitat (130 hectares, more if open pit mine, not underground mine), disruption of drainage patterns (open pit mines), noise, dust	Loss of habitat (75 to 500 hectares, more if open pit mine, not underground mine), disruption of drainage patterns (open pit mines), noise, dust
Operations				
When	Depends on results of exploration but unlikely due to small volumes	2027. Perhaps some development sooner to address local markets	2022 (2 years to construct)	2025
Activities	Monitoring and maintaining pipeline and facilities	Monitoring and maintaining pipeline and facilities	Removal and processing of ore and transportation for refining	Removal and processing of ore
Gross Revenues (based on current prices)	\$42 million if all oil extracted (\$100/barrel)	\$350 million if all gas extracted from areas of highest potential	\$40 million per year	\$75 to \$275 million per year Larger mine could generate revenues >\$800 million per year
Economic Impact	1.5 direct and indirect PYs per year over 20 years	10 direct and indirect PYs per year over 10 years	200 direct and indirect PYs per year for 10 to 20 years then mine reclamation	65 to 300 direct and indirect PYs per year for 10 to 20 years then mine reclamation
Opportunities for Local Economy	Monitoring and maintenance positions	Monitoring and maintenance positions	Labourers, equipment operators, camps and catering, expediting, other contracted services. Depends on training, hiring and procurement policies of developer New employment, income education for local workforce	Labourers, equipment operators, camps and catering, expediting, other contracted services. Depends on training, hiring and procurement policies of developer New employment, income education for local workforce
Potential Environmental Concerns	Accidental releases, erosion and sedimentation, wildlife movements, habitat fragmentation (caribou)	Accidental releases, especially if sour gas, erosion and sedimentation, wildlife movements, habitat fragmentation (caribou)	Loss of habitat (130 hectares, more if open pit mine, not underground mine), disruption of drainage patterns (open pit mines), noise, metals in tailing ponds, metals leaching into groundwater, waste rock disposal, acid rock drainage and effects on aquatic life (not an issue at Prairie Creek site)	Loss of habitat (75 to 500 hectares, more if open pit mine, not underground mine), disruption of drainage patterns (open pit mines), noise, salinity/nutrients in receiving waters, metals leaching into groundwater, waste rock disposal, acid rock drainage and effects on aquatic life (less of an issue than at metal mines)

3.0 POTENTIAL DEVELOPMENT SCENARIOS

The terms of reference for the study called for the assessment of three potential development scenarios. These included:

- a status quo scenario, which assumes that the interim land withdrawal is lifted and that none of the Edézhíe area is given protected status,
- a full protection scenario which assumes that all of the candidate protected area is designated as a national wildlife area; and,
- a compromise scenario that called for at least 25% of the candidate protected area being withdrawn for economic development.

At the May 2008 meeting of the Edézhíe Working Group two compromise boundary options were tabled by the Canadian Wildlife Service for discussion. These boundary options were developed using Marxan analysis, which compared available information about the location of potential oil, gas, mineral and diamond deposits with selected conservation targets to determine which parts of the candidate protected area could be withdrawn to allow development without significantly compromising conservation objectives. The two resulting boundary consisted of a minimum bounded area option that would see the protected area reduced in size to 10,565 hectares (a 58% reduction), with 74% of conservation features included, and 88% of the area with non-renewable resource potential excluded. The second option was termed the conservation/economic compromise. Under this option, the protected area would be reduced to 16,588 hectares (a 34% reduction), 92% of conservation features would be included and 71% of lands with non-renewable resource potential would be excluded. While numerous other boundary options could be developed to reflect different combinations of development and protection, the Working Group decided that these two options would be presented to the six communities for further discussion.

Based on these events, it was decided that the socio-economic assessment should consider four scenarios, rather than three. These four scenarios are summarized in Table 3-1 and maps showing the proposed boundaries for Scenarios 2 and 3 are provided in the analysis of these options.

Table 3-1: Summary of Development Scenarios

Scenario	Description	Protected Area		Conservation Features Included	Non-Renewable Resources Potential
		Area (km ²)	% of Current Area		
1	Status Quo	0	0%	0%	100%
2	Minimum Bounded Area	10,565	42%	74%	88%
3	Conservation/Economic Compromise	16,588	66%	92%	71%
4	Full Land Withdrawal	25,230	100%	100%	0%

3.1 Status Quo

3.1.1 Description

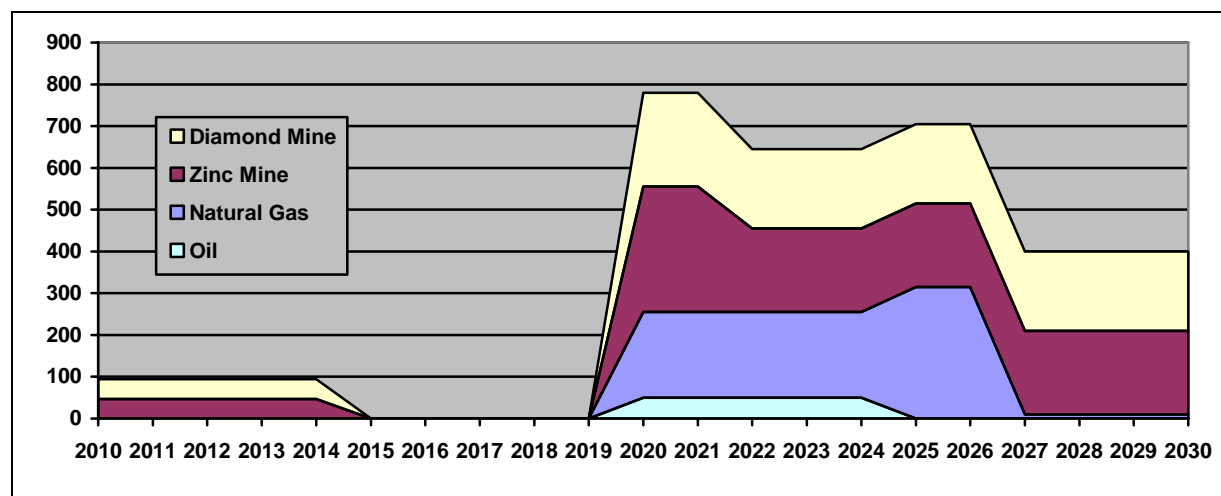
Under the status quo scenario, all of the lands protected by the interim land withdrawal would revert to unprotected status, meaning that non-renewable resource development would be allowed to occur in all of the 25,230 km² that are currently subject to the interim withdrawal. There would be no formal 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.

3.1.2 Non-Renewable Resources Development

Over the period to 2010 to 2030 it is expected that exploration for oil, gas, minerals and diamonds would occur according to the schedule set out in Section 2. Under the status quo scenario development of natural gas fields, a zinc mine and a diamond mine are expected to occur prior to 2030. No oil development is anticipated because the value of expected resources exceeds the costs of extraction and transportation.

Figure 3-1 shows the potential direct and indirect employment in the Edézhíe area that can be attributed to the status quo scenario. In the short term, there is expected to be relatively low new annual employment associated with mineral and diamond exploration, but significant new employment is expected by 2020 (up to 780 person-years) with mine construction coinciding with oil and gas exploration. Employment is predicted to decrease slightly (645 person-years) once the mines begin operating and there will be a slight increase in employment in 2025 as a result of constructing a natural gas pipeline. Once all the projects have been completed, non-renewable resource development in the Edézhíe area is expected to provide 400 person-years of direct and indirect employment in the NWT per year.

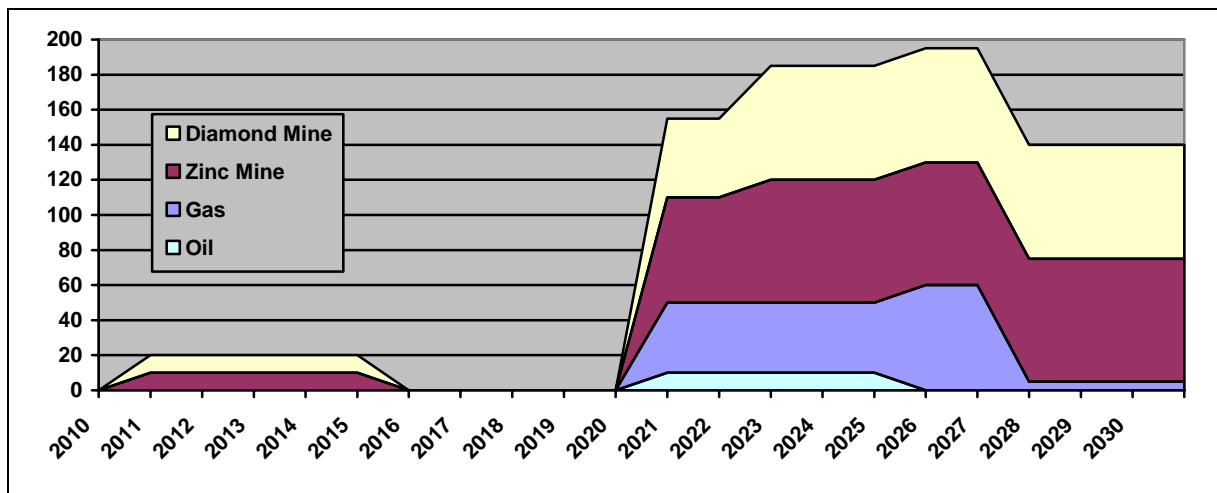
Figure 3-1: Estimated Direct and Indirect Employment in the NWT: Status Quo Scenario



It is estimated that, overall, regional residents would account for between 20% and 35% of the total employment effects. As noted in Section 2, it is expected that 20% of the labour required

for mineral and petroleum exploration and construction will be provided by regional residents. For operation of a natural gas pipeline it is estimated that 50% of the labour (5 jobs) will involve local residents. It is estimated that 65 to 70 local residents will be directly or indirectly employed during mine operation; this represents about 35% of the territorial employment effects. The expected employment of regional residents is shown in Figure 3-2. It shows that, at peak, nearly 200 regional residents could be employed as a result of different phases of all types of mineral and petroleum development. Over the long term, regional employment would amount to about 140 people.

Figure 3-2: Estimated Direct and Indirect Employment in the Region: Status Quo Scenario



Depending on the employment and housing strategies employed by the mining companies, an additional 100 workers from outside the region may choose to relocate to one or more of the communities in the region.

3.1.3 Renewable Resources

As determined in Volume 1, the Edézhzhie area currently serves as a source of subsistence (food and fuel), commercial activities (trapping and tourism), and recreation. As shown in Table 3-2, the value of this activity is estimated to be in the range of \$0.9 to \$1.4 million per year. The Edézhzhie area also provides a broad range of ecological goods and services, such as water regulation and supply and waste treatment by lakes and rivers, climate regulation, water supply, habitat and genetic resources for wetlands, and climate regulation for boreal forests and burns and shrub lands, and the value of these services is believed to at least equal in magnitude to the user benefits. In addition, the area is of cultural importance to regional residents and the value of these benefits has not been quantified.

Table 3-2: Current Renewable Resource Use Values in Edézhíe

Use Values	Nature of Benefit	Low Estimate	High Estimate
Subsistence	Country food	\$632,000	\$806,000
Subsistence	Fuel	\$91,000	\$219,000
Trapping	Commercial sales	\$67,000	\$67,000
Tourism	Spending	\$22,000	\$22,000
Arts and Crafts	Tourist sales	\$11,000	\$14,000
Recreation	Expenditures	\$77,000	\$258,000
Recreation	Extra-market benefits	\$17,000	\$28,000
TOTAL		\$917,000	\$1,414,000

Without knowing the exact location of the proposed development, the footprint of each types of development, or the parts of the Edézhíe where non-renewable use actually occurs, it is very difficult to assess how non-renewable resource use would be affected by the status quo scenario. However, it is likely that, even with appropriate mitigation, non-renewable resource development will ultimately affect the environmental resources of the area and this, in turn, will affect the capacity of the area to continue to support renewable resource use and to continue providing the current value of ecological and cultural values.

The range of potential environmental issues associated with the different types of development has already been described and these are summarized in Table 2-6. The greatest concerns of development relate to fragmentation of caribou habitat due to seismic exploration, localized loss of habitat associated with pipelines, drilling areas and mine sites, the effects of waste rock and tailings on water quality and aquatic life, and the potential for additional development as a result of new roads being constructed into mines sites or gas fields. Under the status quo scenario, which foresees oil exploration, natural gas development, zinc-lead mining, and diamond mining, the full range of these effects can be expected, and these effects will be cumulative.

Under the status quo scenario the most important concern relates to loss of habitat and disturbance of the caribou population. Caribou surveys undertaken by ENR in 2002 and 2003 identified about 110 land blocks where caribou were found in the general vicinity of Fort Simpson and 47 of these blocks (43%) were located in the Edézhíe Candidate Protected Area. Evidence from Alberta indicates that, in areas of intensive oil and gas development, the sustainability of entire caribou populations is at serious risk. Based on harvesting records, caribou account for about 22% of country food for residents of the six communities in the Edézhíe area, and it is believed that up to one-third of the caribou harvest reported by the six communities comes from the Edézhíe area. This harvest would have an annual value of at least \$150,000 per year. With none of the area being protected under the status quo scenario, these values could be at risk.

The Edézhíe area also supports a large moose population that is used for subsistence and recreational hunting, and is of particular importance when game is scarce in the Mackenzie Valley. Moose harvests account for 77% of country food in regional communities. Moose surveys undertaken by ENR in 2002 and 2003 identified 40 land blocks where moose were found in the general vicinity of Fort Simpson and half of these blocks (50%) were located in the

Edézhíe Candidate Protected Area. While the types of disturbances associated with development are less likely to affect the long term sustainability of moose populations, the more likely effect is that the construction of up to three new roads into the Edézhíe area (one road each for natural gas, and the lead-zinc and diamond mines) will result in more intensive hunting in these areas, potentially forcing subsistence hunters to travel further into the area to find moose and other game species. The potential significance of these effects cannot be quantified.

Regional residents place a high value on the water features in the Edézhíe area and, without some form of protection, each of the three major watersheds will be at risk under the status quo scenario. Development could occur on all reaches of the Rabbitskin, Horn and Willowlake watersheds. The most significant risks to the watersheds relate to mining activity and the potential effects of changing drainage patterns and changes in water quality due to increases in nutrients, salinity, metals and possibly acidity. While government approvals for mining and oil and gas activities will set out terms and conditions to ensure that potential adverse effects are minimized, all parts Edézhíe are at some risk, although the risks will be small.

Under the status quo scenario, traditional uses such as hunting, fishing, trapping, collecting native foods, and collecting materials for arts and crafts would be expected to continue. However, non-renewable resource development may lead to land and environmental disturbances that adversely affect the availability or quality of resources used for traditional purposes. According to information collected as part of the Deh Cho Land Use Plan, 4% of the Edézhíe Candidate Protected Area has a very high density of use for traditional land use, and one of the key areas is around Willow Lake, which of some interest for oil and gas development. Another 7% is described as having a high density of traditional use, and some of these areas are at risk due to oil and gas (Willow Lake) and mining (Mustard Lake). Thus, under the status quo scenario, the area will become increasingly less capable of supporting traditional land use activities. In addition, due to the amount of new employment in the non-renewable resource and related support industries, potential interest and/or the availability of time to participate in traditional land uses is also expected to diminish (see Section 3.1.4).

Although tourism is currently a small part of the regional economy, it represents the most promising economic sector in the Deh Cho/Fort Simpson region. Nahanni National Park is a key visitor attraction to the area. With no direct access, there is currently very little tourism in the Edézhíe area; only about 1% of tourism spending in the region can be attributed to Edézhíe. Without some form of official designation as a National Wildlife Area that will draw the attention of tourists, the area will see limited increases in tourism under the status quo scenario. While the development of roads into the gas fields or mines will result in some increases in visitation (assuming access is not controlled), the resulting tourism is expected to be incidental, limited to fishing, unorganized camping, and hunting along the road corridors. The environmental effects of these incidental activities, such as garbage, clearing of informal campsites, and increased pressure on fish and wildlife populations, can be challenging to manage. The economic benefits of these incidental tourists can also be quite small: parties would have visited the area anyway and were not specifically drawn to the area, so the incremental spending associated with an Edézhíe area would be limited. While the roads

constructed to support non-renewable resource development will actually facilitate tourism, development may adversely affect some of the more important tourism features of the area. These features are listed in Table 3-3. The tourist features at most risk under the status quo development include the lower Willowlake and Rabbitskin rivers, each of which is considered to have moderate tourism potential.

Table 3-3: Potential Tourism Features in Edézhíé

Site	Attractions	Tourist Market	Tourism Potential
Mills Lake (Mackenzie River)	Migratory bird habitat terrestrial site Fishing and boating	Ecotourists making day visits, boaters	High
Rabbitskin River	22 small rapids, cultural features	Ecotourists for day or multi-day trips	Moderate
Willowlake River	Boating, fishing, cultural sites	Multi-day boating and ecotourism trips	Moderate
Hornell Lake	Fishing	Fly-in fishing	Moderate
Mink Lake	Waterfowl habitat, cultural features	Too far for day trips; not far enough for overnight trips	Low
Bulmer Lake	Fishing	Fly-in fishing	Low
Willow Lake	Fishing, cultural features	Fly-in fishing	Low
Horn Plateau	Hiking, hunting	Hard ecotourism due to remoteness and muskeg	Low
Horn River	Waterfowl habitat, cultural features, fishing	Ecotourists, day or overnight trips	Some

Source: IMG-Golder, 2006

The status quo scenario may also preclude other types of economic development that are associated with protected areas. National wildlife areas and other protected sites often become of scientific interest due to their undisturbed nature, and can serve as a base for ongoing scientific research. Such initiatives result in researchers visiting the area and can provide a source of revenues to local companies that provide support to these researchers. For example, the Canadian Wildlife Service maintains two trailers on the Suffield National Wildlife Area in southeast Alberta and a field station has been developed nearby to accommodate visiting researchers. This form of development would be precluded under the status quo scenario.

3.1.4 Regional Socio-Economic Effects

While the status quo scenario potentially offers the highest employment and income opportunities for regional residents, it may also offer the highest levels of socio-economic risks. At the present time, the region has a low rate of participation in the labour force (63% compared to 77% for the NWT) and a high rate of unemployment (21% compared to 10% for the NWT). The region has 1605 working regional residents but there are 420 unemployed residents. Average and median incomes in the region in 2005 were 35% less than the NWT average. Furthermore, 38% of the regional population is under 20 years of age (compared to 32% of the NWT) and most of these 1700 people will be entering the job market within the next two to three decades and will be forced to leave the region unless new employment opportunities are created. Thus, if regional residents want economic conditions to improve in the near future, job creation is essential.

The status quo scenario is expected to create a large number of jobs over the next 20 years. As noted above, employment will peak at about 200 person-years of employment (in 2027) and petroleum and mining operations will provide 140 person-years of ongoing employment for the next 20 years. The development of additional mines after 2030 could generate even more employment. Due to the high employment numbers, the status quo scenario is expected to result in the highest population growth and, by providing employment opportunities for today's youth, will continue to retain a youthful population. It is also expected that, by creating a broad range of new jobs, more females will remain in the region, thereby resolving the current male/female imbalance. Depending on the training policies of the mining and petroleum companies undertaking development in the Edézhíe area, educational attainment will increase. Average incomes will also increase. In 2005, average personal earnings in the six communities amounted to \$31,000. According to information from the NWT Bureau of Statistics, average labour income per person-year of employment ranges from \$66,700 for metal ore mining to \$73,000 for diamond extraction to \$100,000 for oil and gas extraction to \$120,700 for employment in support activities for mining and oil and gas extraction. Thus, 140 person-years of direct and indirect employment in mining and oil and gas would generate about \$9.8 million in annual wages and benefits. It is expected that, with higher employment incomes, there would be fewer households in core need and a drop in the number of houses in need of repair.

On the negative side, it is expected that high economic development will result in more non-Aboriginal people moving into the larger communities. Depending on the housing policies of the mining companies, up to 100 mine workers and their families may choose to relocate to one of the larger regional communities. As a result, there will be a decrease in the percentage of Aboriginal people in the region. It is expected that a higher percentage of the Aboriginal people will be employed in the wage economy, resulting in less participation in traditional land uses, a decreased reliance on country food, and a loss of culture and language. There is concern that, as mine and other workers accumulate more personal wealth, they can become more individualistic, resulting in an erosion of families and communities (Gibson and Klinck, 2005). Quality of family life may also suffer, providing housing on-site means that workers are away from their families for extended time periods and then need time when they come off shifts to readjust. With higher incomes, some regional residents are expected to indulge in substance abuse (Gibson and Klinck, 2005) and this can lead to various health effects, including an increased frequency of hospitalization for alcohol-related diseases and more cases of sexually transmitted infections, and possible increases in property crimes and violent crimes. Higher incomes can also translate into more participation in gambling, which can also contribute to social, health and economic problems for individuals and their families (Gibson and Klinck, 2005).

3.2 Minimum Bounded Area

3.2.1 Description

The minimum bounded area scenario was developed to allow development in as much of the Edézhíe area as possible while protecting the areas having the greatest environmental importance. The protected area would consist of 10,565 km², which is 42% of the proposed

Edézhíe Candidate Protected Area. It would include all major lakes, much of the caribou/moose habitat on the Horn Plateau, almost all the IBP Site area, and the lower Horn River conservation values. Modelling suggests that 74% of the key conservation features would be protected. The boundaries of the proposed area are shown in Figure 3-3.

The proposed boundaries would exclude 88% of the lands that have been determined to have some economic development capability. These areas include the southern slopes of the Horn Plateau (feeder streams, caribou/moose habitat), the southwest extension of the Mills Lake key habitat site and the northern slope of the Horn Plateau (Horn River feeder streams). While this option would enable most economic development to proceed, protecting the key environmental areas results in boundaries that feature a thin area of connectivity between the plateau and the Horn River valley that will create some management challenges.

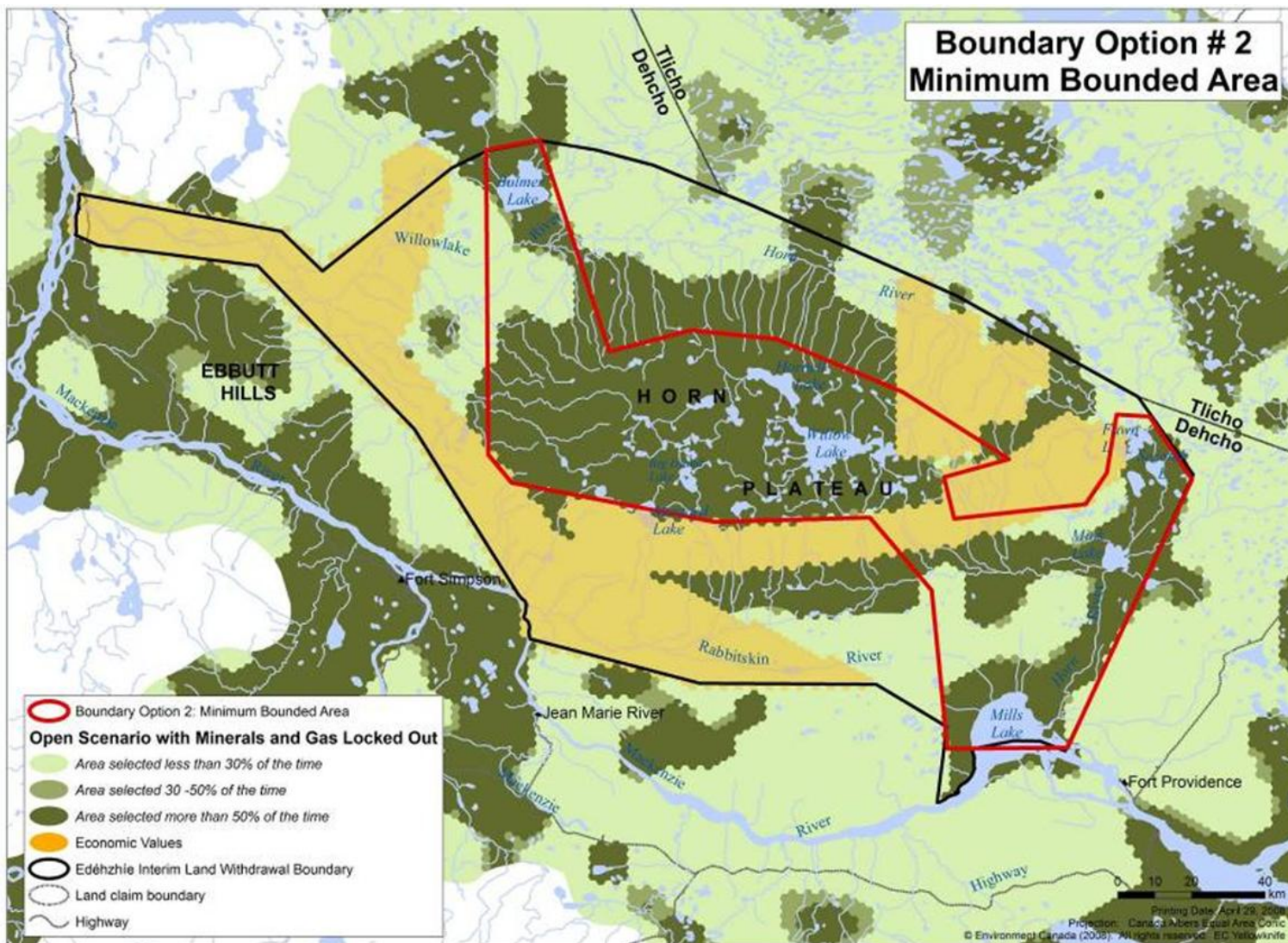
3.2.2 Non-Renewable Resources Development

Under this scenario it is expected that oil exploration would occur in the region but, based on current information, there will be insufficient reserves to justify further development. For natural gas, the proposed protected area boundary would prevent drilling in some of the quarter grids believed to have some of the highest natural gas potential. As noted in Section 2.2.1, 18 quarter grids northeast of Willow Lake are expected to hold 1.3 billion cubic metres of natural gas and it is expected that most gas exploration and development would occur in this area.

Under the minimum bounded area scenario, drilling would be precluded from significant portions of five of these quarter grids representing estimated reserves of 0.3 billion cubic metres or 25% of the natural gas in the land block with the highest gas potential. The value of the resulting recoverable gas from this block would drop from \$350 million to about \$270 million, based on natural gas prices of \$8/Mcf. Thus, the proposed minimum bounded area scenario would effectively reduce the potential economic impacts that would be generated under the status quo scenario by 30%. This loss of reserves and associated revenues may mean that production of the remaining reserves becomes non-economic because of the high cost of constructing a gathering system and pipeline (\$175 million) and development may be delayed until gas prices increase.

In terms of mining, the proposed minimum bounded area scenario would allow mining in all of the three areas having the highest potential for zinc and lead deposits, so the economic effects would be the same as for the status quo scenario. It is difficult to assess the potential effects of this boundary proposal on diamond mining because the areas having the highest diamond potential have not yet been identified. However, for purposes of this analysis, it is assumed that the protected area boundary would reduce the probability of having one diamond mine by 20%; this percentage would be even higher if it determined that the greatest potential for diamond development is on the top of the plateau. In estimating the potential economic effects of diamond development, the employment estimates for the status quo scenario have been reduced by 20%.

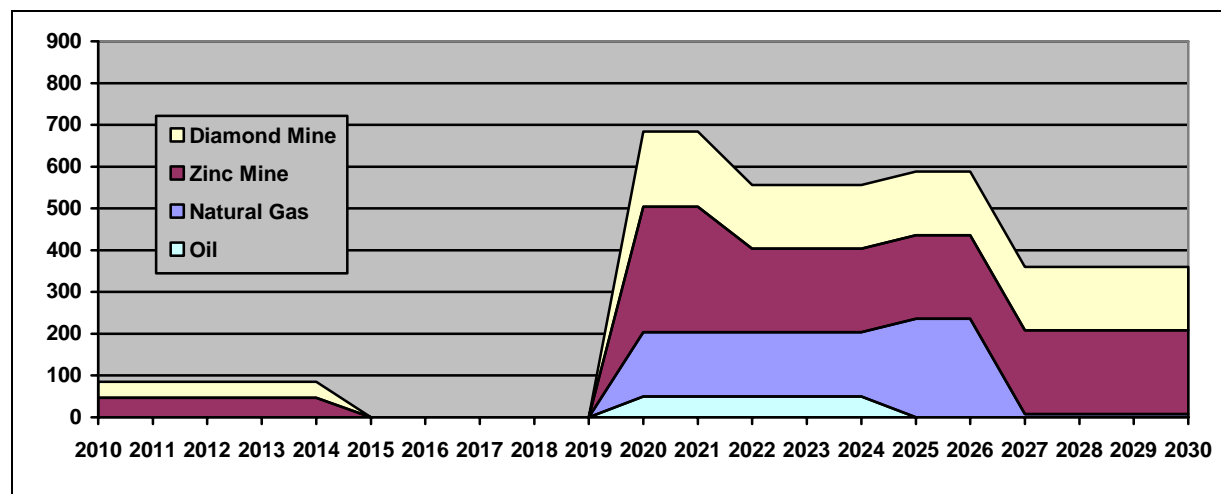
Figure 3-3: Edézhíe Boundary Options: Minimum Bounded Area



Source: Canadian Wildlife Service

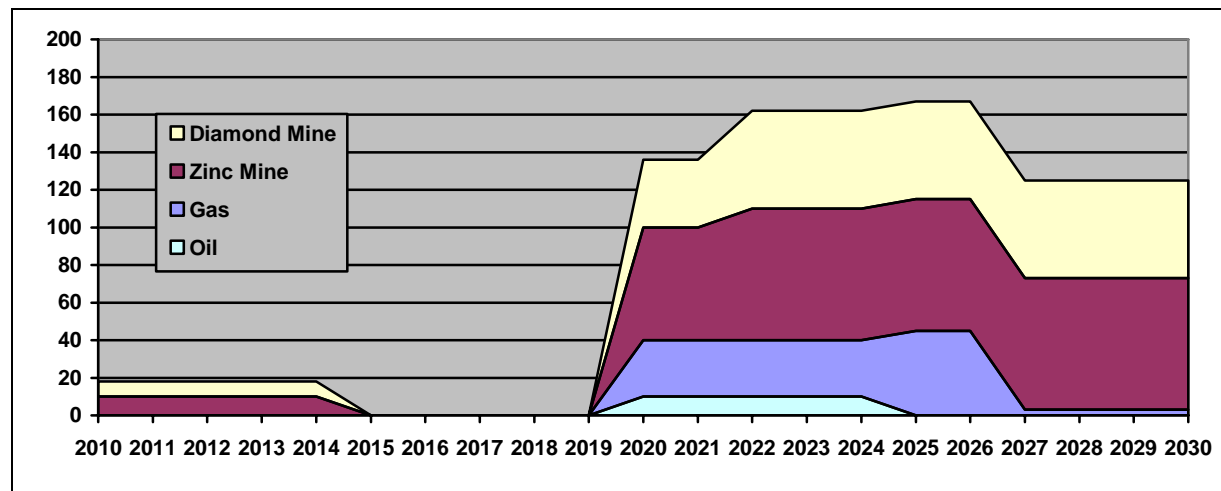
Based on these assumptions, estimates of direct and indirect employment in the NWT that would be expected under the minimum bounded area scenario are shown in Figure 3-4. The overall pattern of employment is much the same as the status quo scenario, but there would be a reduction in the magnitude of employment effects. Peak employment would drop from 780 person-years to 685 and the long term operational employment would drop from 400 to 360 person-years. The amount of employment associated with mineral exploration would also decrease slightly because 42% of the land would be protected and would not be available for mineral exploration or development.

Figure 3-4: Estimated Direct and Indirect Employment in the NWT: Minimum Bounded Area Scenario



As was the case for the status quo scenario, it is estimated that regional residents would account for between 20% and 35% of the total employment effects. This estimate is based on the assumptions that: 20% of the labour required for mineral and petroleum exploration and construction will be provided by regional residents; natural gas operations would employ 5 regional residents; and 65 to 70 local residents will be directly or indirectly employed during zinc mine. The key differences are that, with less natural gas and diamond development, the number of regional residents employed in these activities would be slightly reduced. The resulting estimates of regional employment under the minimum bounded area scenario are shown in Figure 3-5. At the peak, the number of regional residents directly and indirectly employed on non-renewable resource development in the Edézhíe area would drop from 200 under the status quo scenario to about 165 and long term regional employment decrease from about 140 people to 125 people.

Figure 3-5: Estimated Direct and Indirect Employment in the Region: Minimum Bounded Area Scenario



Again, depending on the employment and housing strategies employed by the mining companies, an additional 90 workers from outside the region may choose to relocate to one or more of the communities in the region.

3.2.3 Renewable Resources

The range of potential environmental issues associated the minimum bounded area scenario would be similar to those of the status quo scenario, but the scale of the effects would be reduced because development in the Edézhíe area would be allowed in only 58% of the area available under the status quo scenario.

Fragmentation and loss of caribou habitat due to seismic, pipeline and road exploration remains the most important environmental concern. However, under the minimum bounded area scenario, 29 of the 47 land blocks where caribou were found in the Edézhíe Candidate Protected Area would be protected. The protected area would include about 90% of the land in Edézhíe that has been identified as key caribou habitat. Thus, potential effects on caribou populations and traditional harvesting by regional residents are expected to be minimal.

The minimum bounded area scenario would provide limited protection for moose populations, however. The protected area boundary would only include four of the 20 land blocks where moose were found in the Edézhíe area; the other 16 blocks are in areas that would be available for development. In addition, the development of up to three new roads into the Edézhíe area will result in more intensive hunting in these corridors.

In terms of watershed protection, the minimum bounded scenario would only prevent non-renewable resource development in the lower Horn River watershed and a small portion of the middle reach of the Willowlake River watershed. All other watersheds would continue to be at risk from mining in terms of changes in drainage patterns and changes in water quality due to increases in nutrients, salinity, metals and possibly acidity.

Under the minimum bounded area scenario, traditional uses such as hunting, fishing, trapping, collecting native foods, and collecting materials for arts and crafts would be allowed to continue in the protected area as well as in the remainder of the area. However, restricting non-renewable resource development to some parts of Edézhíe will help ensure that some of the most important areas for traditional activity will be protected and maintained. The minimum bounded area scenario will protect 96% of the land in the Edézhíe area that is described as having a very high density of traditional use and 87% of lands with a high density of traditional use. The only area of high density not protected under this scenario is around the mouth of the Rabbitskin River on the north shore of the Mackenzie River. This scenario will also protect 70% of land with a moderate density of traditional use.

Official designation of at least part of Edézhíe as a National Wildlife Area will draw some tourists. Some tourism will be incidental, as was described for the status quo scenario. However, small numbers of tourists will deliberately choose to visit the area just to see why the area merits protection. The number of such tourists is expected to be small, however, because the area is still relatively remote and the region currently lacks the tourism infrastructure necessary to accommodate a significant increase in visitation. As noted for the status quo scenario, roads constructed to support non-renewable resource development will actually facilitate tourism. Of features having a moderate tourism potential (see Table 3-3), only the middle reach of the Willowlake River and Hornell Lake would be included in the protected area.

Protection of lands under the minimum bounded area scenario may result in some scientific research activities that generate some economic opportunities for regional businesses. The protected area boundary would include 74% of the key conservation features, including the major lakes, much of the caribou/moose habitat on the Horn Plateau, almost all the International Biological Programme (IBP) Site area, and the lower Horn River conservation values. However, as noted previously, the thin area of connectivity between the plateau and the Horn River valley will create some management challenges and may affect the utility of the area for scientific research.

3.2.4 Regional Socio-Economic Effects

The socio-economic effects of the minimum bounded area scenario will also be like those of the status quo scenario but both positive and negative effects will be smaller in magnitude. As noted in Section 3.2.2, direct and indirect employment under this scenario would peak at 165 person-years and operations would provide 125 person-years of long term employment and about \$8.7 million in new income. This would support some population growth, partially correct the male/female imbalance, ensure that a relatively high percentage of young people remain in the region, increase educational attainment, encourage higher labour force participation, increase household incomes, reduce the number of households in core need, and reduce the number of housing in need of repair.

At the same time, the potential introduction of up to 90 mine workers and their families could change the composition of some of the regional communities and would reduce the percentage of Aboriginal people. Increased participation in the wage economy would result in lower participation in traditional land uses and use of country food. Increased incomes could also lead

to increased substance abuse and related crime and health problems but, with fewer new jobs, it is expected that the magnitude of these effects would be less under the status quo scenario.

3.3 Conservation/Economic Compromise

3.3.1 Description

The third scenario was developed as a compromise between economic development and environmental conservation, with more of the candidate area being designated as a protected area and development still being allowed in areas with the highest non-renewable resource potential. The proposed protected area would be about 16,590 km² in area, which represents about 66% of the Edézhíe Candidate Protected Area. The boundaries of the conservation/economic compromise scenario are shown in Figure 3-6.

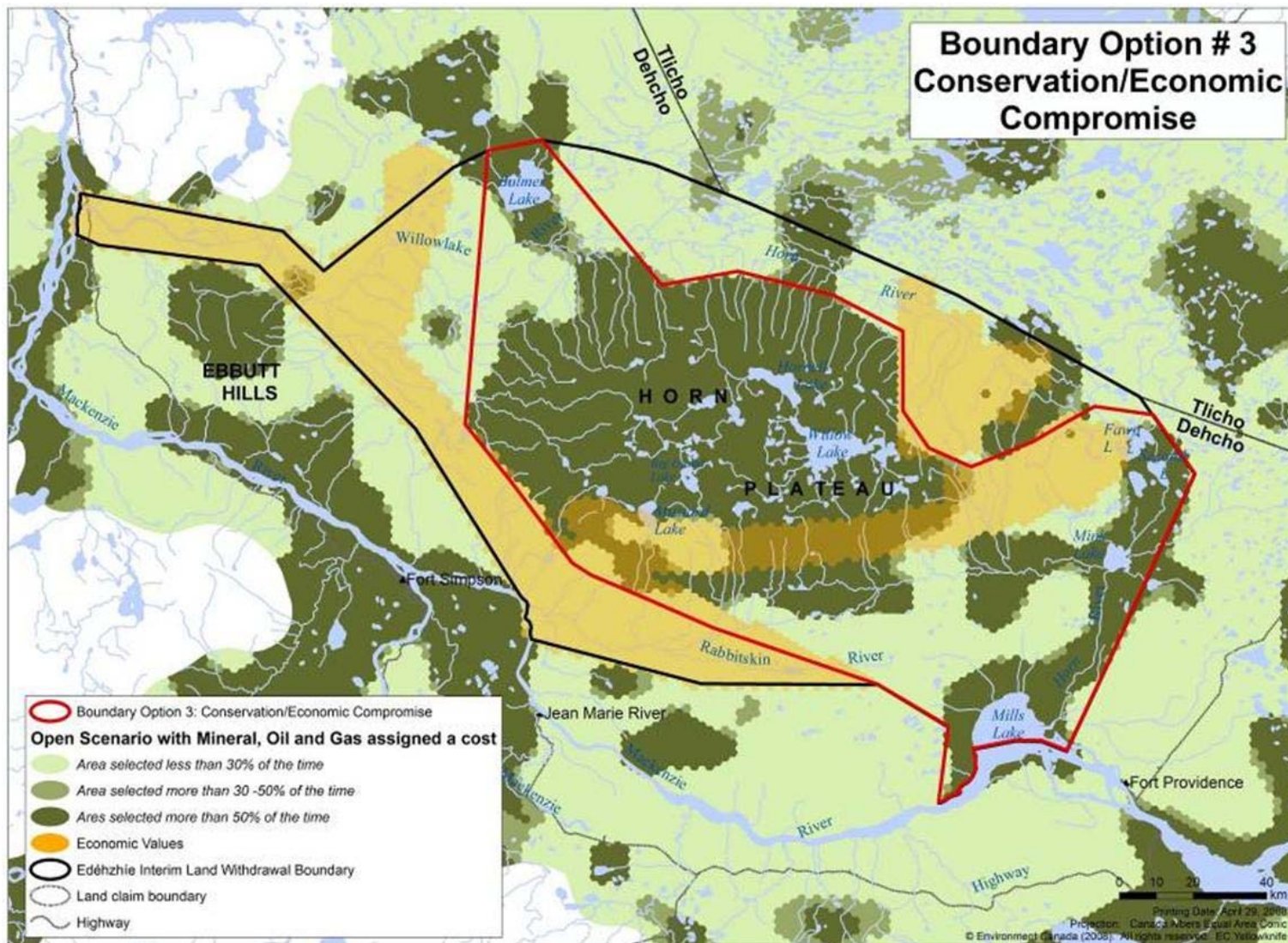
In terms of conservation, the protected area would include the southern and northern slopes of the Horn Plateau (feeder streams, caribou/moose habitat), all major lakes, all of the Mills Lake key habitat site, much of the caribou/moose habitat on the Horn Plateau, almost all the IBP Site area, and the lower Horn River. Under this scenario, 92% of the conservation values would be protected.

Non-renewable resource development would then be allowed in the other 8,540 km². Areas that would be available to development include all lands having high potential and most of the lands having moderate potential for natural gas. Lands available for development include one of the three areas having moderate lead-zinc potential; the other two areas with moderate lead-zinc potential would be situated in the protected area. Due to lack of information about the location of potential diamond deposits, the extent to which this scenario will affect actually diamond development is not known. Overall, this scenario would allow development on 71% of the land base that is known to have some economic development potential.

3.3.2 Non-Renewable Resources

Under this scenario oil and gas development would be expected to occur as per the status quo scenario: there would be oil exploration but no development, and all the areas having the highest natural gas potential (worth \$350 million in revenues) would be developed. In terms of lead and zinc mining, only one of the three sites with moderate potential would be available for potential so, for purposes of this analysis, the territorial employment effects for the status quo scenario have been reduced by 66% to account for this uncertainty. A similar approach has been used to assess the potential effects on diamond mining potential; it is assumed that withdrawing 33% of the Candidate Protected Area from development would reduce the probability of developing a diamond mine by 50% (much of the land available for diamond development is on steep slopes leading off the plateau and are not assumed to be of interest for diamond development).

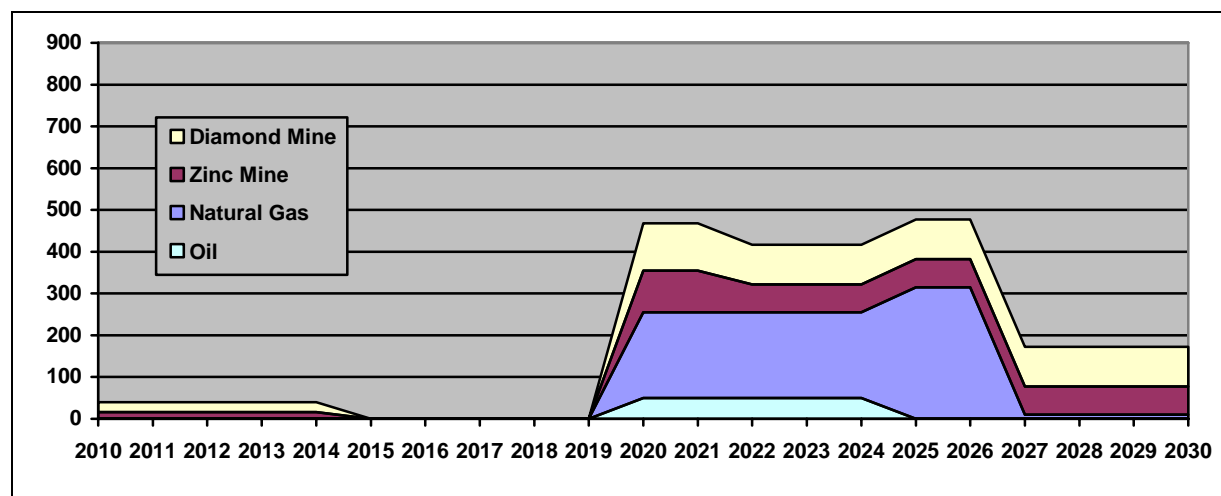
Figure 3-6: Edézhíe Boundary Options: Conservation/Economic Compromise



Source: Canadian Wildlife Service

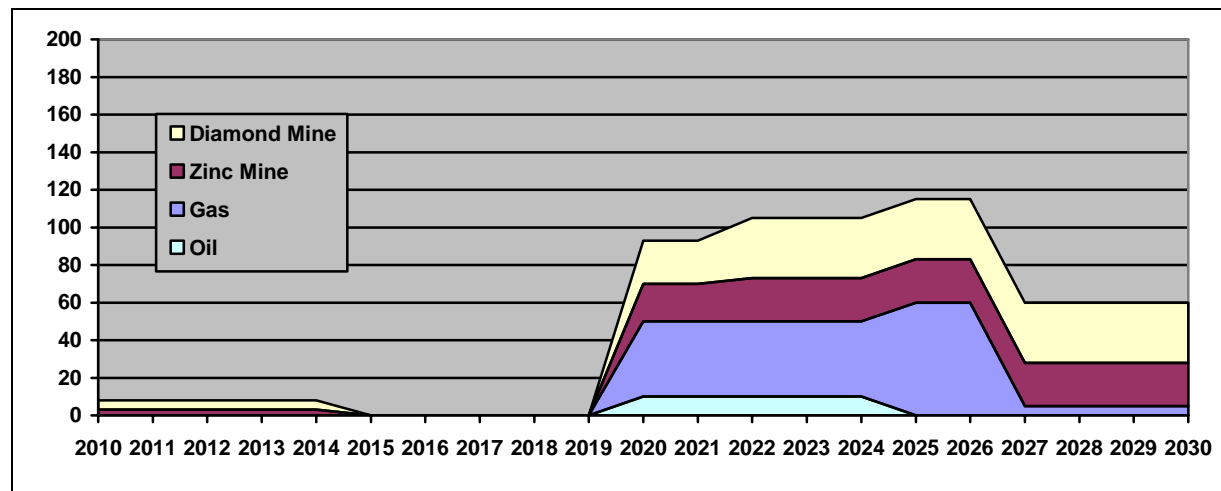
The effects of the conservation/economic development scenario on direct and indirect employment in the NWT are shown in Figure 3-7. The overall pattern of development would be the same as for the other two scenarios but the magnitude of effects would be reduced. Employment associated with mineral exploration in the near future would drop to 40 person-years, compared to 95 under the status quo scenario. Peak employment would amount to 475 person-years compared to 780, and the long-term employment during operations would average 170 person-years per year, compared to 400 under the status quo scenario.

Figure 3-7: Estimated Direct and Indirect Employment in the NWT: Conservation/Economic Compromise Scenario



Estimates of the number of regional residents directly and indirectly employed by non-renewable resource development in the Edézhíe area under the conservation/economic compromise scenario have been developed using the same assumptions as for the other scenarios. Estimates of regional employment associated with mineral development have been scaled down from the status quo scenario to reflect the lower levels of development that are expected to occur. The estimates of regional employment for the conservation/economic compromise scenario are shown in Figure 3-8. For exploration, employment of regional residents would be reduced by half (to 10 person-years). Peak employment of regional residents would drop from 200 under the status quo scenario to about 115 and long term regional employment decrease from about 140 people to 60 people.

Figure 3-8: Estimated Direct and Indirect Employment in the Region: Conservation/Economic Compromise Scenario



At this scale of development, an additional 45 workers from outside the region may choose to relocate to one or more of the communities in the region during mine operations, depending on the employment and housing strategies employed by the mining companies.

3.3.3 Renewable Resources

Under the conservation/economic compromise scenario non-renewable resource development would be limited to 33% of lands that could be developed under the status quo scenario. While the range of potential environmental issues associated development would be the same as for the two previous scenarios, the extent of the issues would be less because of the smaller land base available for development.

Fragmentation and loss of caribou habitat would remain an important environmental concern but the conservation/economic compromise scenario would protect 100% of the land in Edézhzhíe that has been identified as key caribou habitat. In addition, 32 of the 47 land blocks where caribou were found in the Edézhzhíe Candidate Protected Area would be included within the protected area boundaries. Potential effects on caribou populations and traditional harvesting by regional residents under this scenario are also expected to be minimal.

For moose, the conservation/economic compromise scenario would provide much better protection than the previous two scenarios. Eleven of the 20 land blocks where moose were found in the Edézhzhíe area would be protected, leaving only 9 blocks in areas that would be available for development. However, the development of two or three new roads into the Edézhzhíe area could result in more intensive hunting in these corridors.

The conservation/economic compromise scenario would provide marginally better protection of watersheds compared to the other two scenarios. Compared to the minimum bounded scenario, more of the lower Horn River, the upper Rabbitskin River and the middle reach of the Willowlake River would be protected. However, there is still a risk that nutrient, salinity, metals

or possible acidity problems at a mine in the upper reaches could result in changes to water quality and aquatic life in the lower reaches of the three rivers.

Traditional uses such as hunting, fishing, trapping, collecting native foods, and collecting materials for arts and crafts would be allowed to continue under the conservation/economic compromise scenario, and the boundaries would include 98% of the land in the Edézhíe area described as having a very high density of traditional use, 92% of lands with a high density of traditional use, and 87% of land with a moderate density of traditional use. The only area of high density not protected under this scenario remains around the mouth of the Rabbitskin River on the north shore of the Mackenzie River. By further restricting non-renewable resource development in Edézhíe, potential adverse effects on traditional activities will be minimized.

Being larger in size than scenario 2, the conservation/economic compromise scenario will provide protection for more of the features considered to have medium and low tourism potential, notably some protection of the Rabbitskin River and protection of more of the Willowlake River. This will help increase the tourism potential of the Edézhíe area. Between official designation of a large area as a National Wildlife Area and the development of resource roads, this scenario likely offers the greatest tourism potential of all the options. Again, some tourism will be incidental, but an increasing number of tourists will deliberately choose to visit the area, especially if the area becomes a keystone of the regional economic development strategy and marketing. Tourism development may be limited, however, unless additional tourism infrastructure is developed to accommodate significant visitation increases.

Under the conservation/economic compromise scenario, 92% of the key conservation features would be protected, thereby further increasing the potential for scientific research and associated economic benefits for regional communities. Almost all of the Horn Plateau and the lower Horn River would be protected.

3.3.4 Regional Socio-Economic Effects

With more of the land base being protected under the conservation/economic compromise scenario than in scenario 2, opportunities for economic development are more limited so the resulting socio-economic benefits and costs would be smaller. Peak direct and employment under this scenario would be 115 person-years. During operations, mining and gas development would generate 60 person-years of employment and \$4.3 million in labour income. This is less than half the employment that would be created under the status quo scenario. Given the modest increases in regional activities, there would likely be little population growth, some of the male/female imbalance would be corrected, a moderate percentage of young people would remain in the region, there would be some increase in educational attainment, labour force participation would increase slightly, household incomes would increase moderately, the number of households in core need would decrease slightly, and there would be slightly fewer houses in need of major repair.

The overall composition of the existing communities would remain largely unchanged, although the potential introduction of up to 45 mine workers and their families, probably based in Fort Simpson would slightly reduce the percentage of Aboriginal people. Although more regional

residents would participate in the wage economy, this would not likely result in a major change in traditional land uses or use of country food. As relatively few people would experience increased incomes, the potential problems associated with substance abuse and related crime and health problems are not expected to increase substantially.

3.4 Designation of Entire Candidate Protected Area

3.4.1 Description

Under this scenario, all of the 25,230 km² of land temporarily withdrawn for the Edézhzié Candidate Protected Area would be designated as a protected area and no non-renewable resource development activities would be allowed. Figure 3-9 shows a map of the protected area boundaries under this scenario.

3.4.2 Non-Renewable Resources

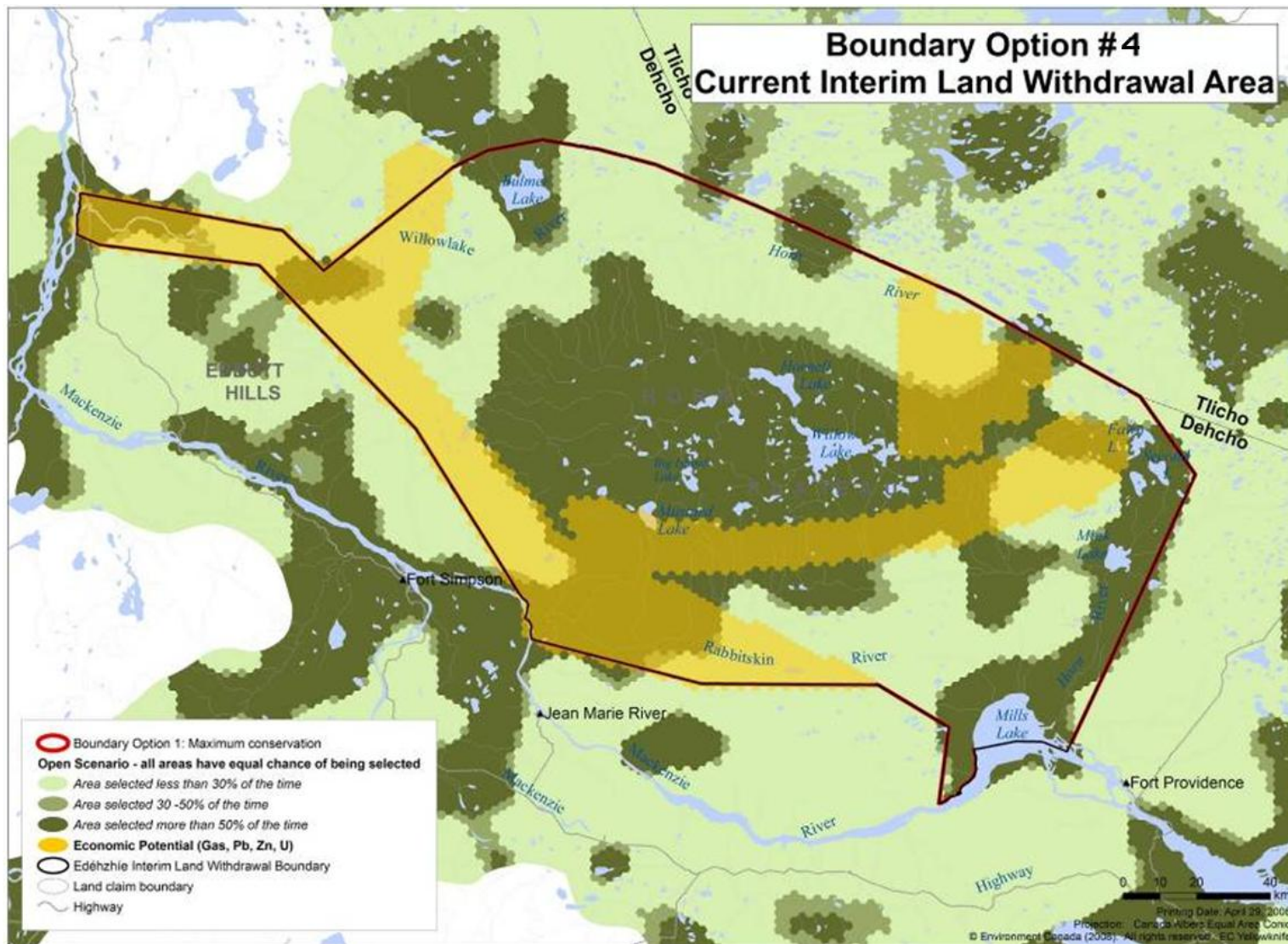
Despite the apparent resource potential of the area, there would be no oil, gas, mineral or diamond development within the National Wildlife Area. Thus, no employment or income benefits from non-renewable resource development would be possible.

3.4.3 Renewable Resources

Designation of the entire Edézhzié area as a National Wildlife Area would essentially protect all renewable resources. There would be no fragmentation or loss of caribou habitat; 100% of the land identified as key caribou habitat would be protected; and all 47 of the land blocks where caribou were found in the Edézhzié Candidate Protected Area would be included within the protected area boundaries. All 20 of the land blocks where moose were found in the Edézhzié area would be protected and there would be no new roads developed. Most of the three major watersheds in the Edézhzié area would be protected; there could still be opportunities for development in the small parts of the three watersheds that lie outside the boundaries of the National Wildlife Area. All of the lands traditionally used by Aboriginal people for hunting, fishing, trapping, collecting native foods, and collecting materials for arts and crafts would be protected and these activities would be allowed to continue.

However, despite more of the Edézhzié area being protected, the potential for both tourism and research would be lower under the full protection scenario. While the pristine nature of the area and the official designation as a National Wildlife Area will draw the attention of some tourists and research scientists, the remoteness of the area and the lack of road access will severely limit the amount of use that occurs. For example, only about 800 people visited the nearby Nahanni National Park Reserve in 2006/07. Access to Nahanni National Park Reserve is limited to flying in and most of this activity consists of commercial canoeing/rafting on the Nahanni River with some day-trips to Virginia Falls.

Figure 3-9: Edézhíe Boundary Options: Full Land Withdrawal



Source: Canadian Wildlife Service

Without having similar major tourist attractions and without road access, it is estimated that, annual tourist visitation to Edézhíe would be about 10% of tourism at Nahanni. This translates into between 80 and 100 visitors per year. Based on information about current visitation and spending in the Deh Cho Region (see Section 3.2.3.2 in Volume 1), this additional visitation would result in additional visitor spending of between \$42,000 and \$53,000 per year, which translates into between 0.6 and 1.0 person-years of additional employment in the retail, food and accommodation, and recreation industries. These effects are very small and could only be increased by improvements in access.

3.4.4 Regional Socio-Economic Effects

Designation of the entire candidate site as a National Wildlife Area would have very little effect on socio-economic conditions in the region in the short term. However, in the absence of other economic development in the broader region, the closure of all or parts of Edézhíe to non-renewable resource development could limit new employment opportunities in the region. Without some economic growth there is likely to be little population growth in the region and, in the long term, the population may even begin to decrease as future generations of children are forced to leave the region to find work. This would leave an aging population in the region and the existing gender imbalance could become worse if more females than males continue to leave the region. Without new employment opportunities in the region, educational attainment, labour force participation and family incomes would largely remain unchanged relative to the rest of the NWT. There would likely be no improvement in housing conditions or the number of families in core need, and the lack of incomes and economic opportunities could result in additional stress for the remaining residents, especially individuals at high risk (i.e., seniors, single parents, disabled), such that health conditions and crime could deteriorate. Protecting the entire area would guarantee that regional residents could continue their participation in traditional uses and could continue to rely on country foods.

Clearly, without some new forms of economic development in the region, the potential for economic and population growth are quite limited. The ultimate socio-economic significance of prohibiting development in all of the proposed Edézhíe Candidate Protected Area will then depend on the development potential of other parts of the Deh Cho Region. At the present time, the greatest potential for economic development lies with tourism and expanded oil and gas development and exploration, notably in the Cameron Hills and Fort Liard areas. The region may also benefit greatly from the construction of the Mackenzie Gas Project. Without better understanding of these other possibilities for economic development in the region, it is not possible to describe the relative importance of precluding non-renewable resource development from the Edézhíe area.

3.5 Summary

Table 3-4 summarizes the non-renewable and renewable resource implications of the four development scenarios and describes the potential territorial and regional employment and income for each. It shows that although the status quo scenario provides the greatest potential for economic development in the region, many of the renewable resources that are used by regional residents for traditional or other purposes may be at risk. While measures to minimize

these risks will be included as part of the terms and conditions in approvals issued for mineral or petroleum development, some of the key areas of development interest coincide with areas of great cultural importance and traditional use. The other scenarios adopt increasing levels of protection that limit economic development potential, resulting in less employment and income for regional residents, but enhance protection of environmental and renewable resources. However, prohibiting development in the entire Edézhíe area may prove economically regressive because, without some other forms of additional economic development, in the region, social and economic conditions could deteriorate.

The potential NWT employment opportunities under the three scenarios that allow non-renewable resource development are shown in Figure 3-10. It shows that without any restrictions on development, the Edézhíe area could support 400 person-years of employment and, that by reducing the area available to development, the long-term employment associated with non-renewable resource development would decrease to 360 person-years under the minimum bounded area and to 170 person-years under the conservation/economic compromise scenario. The corresponding employment estimates for the region are provided in Figure 3-11 and show a similar pattern, although a greater percentage of regional residents would be employed during the operational phases of mining development than during construction.

Figure 3-10: Summary of Direct and Indirect Employment in the NWT for the Three Development Scenarios

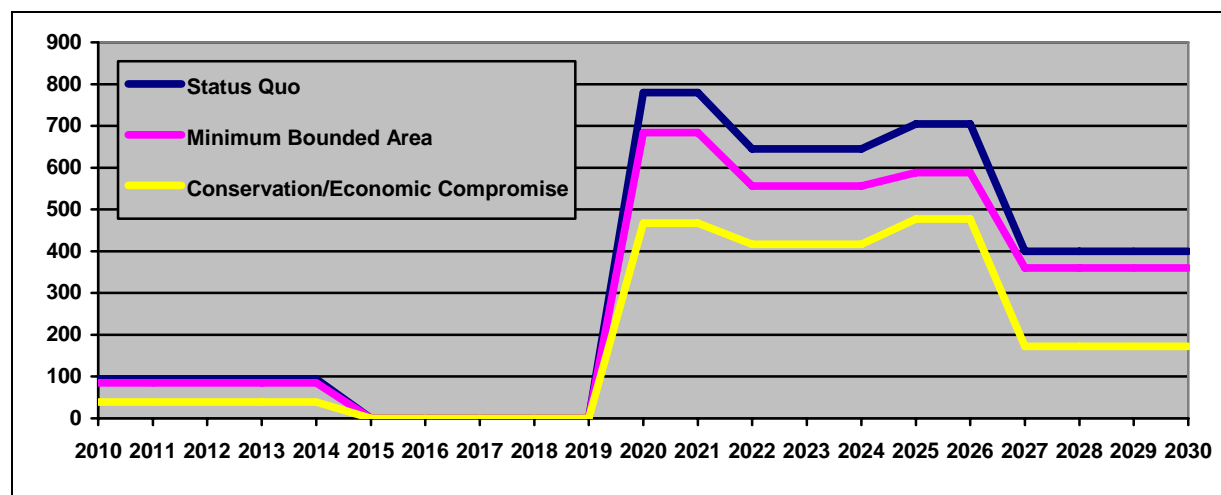
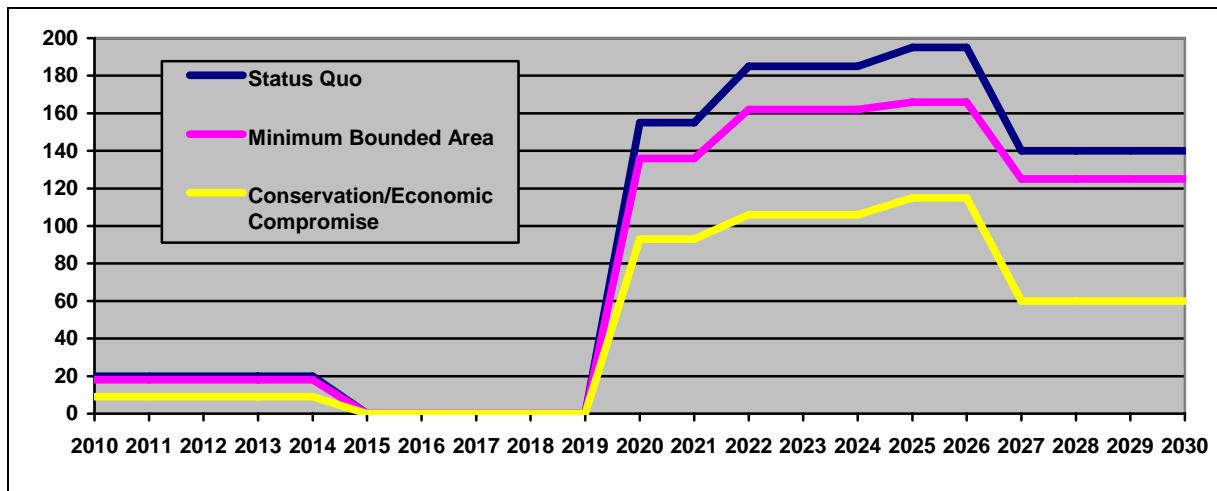


Table 3-4: Summary of Potential Employment Effects in the NWT Associated with Non-Renewable Development in the Edézhzié Area

Resource	Indicator	Scenario			
		Status Quo	Minimum Bounded Area	Conservation/ Economic Compromise	Full Designation
Non-Renewable Resources					
Oil	Production	\$0	\$0	\$0	\$0
Natural Gas	Total Production (20 yrs)	\$350 million	\$260 million	\$350 million	\$0
Zinc-Lead Mine	Annual Production	\$40 million	\$40 million	\$12 million	\$0
Diamonds	Annual Production	\$175 million	\$140 million	\$190 million	\$0
Renewable Resources					
Caribou	Critical habitat protected	0%	90%	100%	100%
	Habitat Blocks Protected	0	29	32	47
Moose	Habitat Blocks Protected	0	4	11	20
Watersheds	Reaches at Risk	All at risk	Upper Horn Lower Willowlake Rabbitskin	Upper Horn Lower Willowlake Lower Rabbitskin	None
Traditional Use Areas at Risk	Very High Density	100%	4%	2%	0%
	High Density	100%	13%	8%	0%
	Moderate Density	100%	30%	13%	0%
Tourism	Destination Visitation	None	Low	Moderate	Low
	Features at Risk	All	Upper and lower Willowlake River Rabbitskin River	Upper and lower Willowlake River Lower Rabbitskin River	None
Research	Conservation Features Protected	0%	74%	92%	100%
Territorial Socio-Economic Effects					
Employment (person-years)	Peak	780	685	475	1
	Long-term	400	360	170	1
Income	Increased Annual Earnings (millions)	\$28	\$25	\$12	\$0
Regional Socio-Economic Effects					
Employment (person-years)	Peak	200	165	115	1
	Long-term	140	125	60	1
Income	Increased Annual Earnings (millions)	\$9.8	\$8.7	\$4.3	\$0
Population	Potential In-migration	100 workers	90 workers	45 workers	0

Figure 3-11: Summary of Direct and Indirect Employment in the Region for the Three Development Scenarios

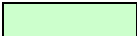



Although it is not possible to quantify the socio-economic effects of the four scenarios, a qualitative assessment is provided in Table 3-5, based on a subjective comparison of each resource development scenario to the situation whether the entire Edézhzié area would be protected. In general, the table shows that the scenarios with the greatest potential to create new employment and income also have the highest magnitude of both positive and negative socio-economic effects.

The underlying issue 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. Thus, the status quo scenario, 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. By limiting resource development on more and more of the land base, the minimum bounded area and conservation/economic compromise scenarios provide lower levels of economic benefits, but they would also have less potential to generate severe social and economic issues. On the other hand, precluding all non-renewable resource development in Edézhzié by designating all of it as a protected area may limit regional economic development opportunities, depending on what types of development occur elsewhere in the region. Without the creation of additional employment and income in the region, 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.

Table 3-5: Summary of Potential Regional Socio-Economic Effects

Attribute	Scenario			
	Status Quo	Minimum Bounded Area	Conservation/Economic Compromise	Full Designation
Population Growth	Highest	Higher	High	Same
Percentage of young people	Highest	Higher	High	Same
Male/female imbalance	Lowest	Lower	Low	Same
Percentage of Aboriginal people	Lowest	Lower	Low	Same
Educational attainment	Highest	Higher	High	Same
Labour force participation	Highest	Higher	High	Same
Employment in primary sector	Highest	Higher	High	Same
Average family income 2005	Highest	Higher	High	Same
Costs of living	Little higher	Same	Same	Same
Housing in need of major repair	Lowest	Lower	Low	Same
Households in core need	Lowest	Lower	Low	Same
Hospitalization for alcohol-related disease	Highest	Higher	High	Possibly higher
Rate of sexually transmitted infections	Highest	Higher	High	Same
Violent crime rates	Highest	Higher	High	Same
Property crime rates	Highest	Higher	High	Same
Participation in traditional land uses	Lowest	Lower	Low	Same
Reliance on country food	Lowest	Lower	Low	Same

 Denotes improvement

 Denotes worsening situation or existing issue

4.0 SUMMARY AND RECOMMENDATIONS

4.1 *Summary of Results*

There are numerous options for resource and environmental protection in the Edézhíe Candidate Protected Area. Four of these options, ranging from no protection to full protection, have been evaluated in terms of their anticipated socio-economic effects.

Comparison of the socio-economic effects on the region and the NWT shows that each option has its own suite of potential benefits and costs. Scenarios that offer either full protection or open all of the area to development tend to maximize the benefits of either protection or development at the expense of the other. On the other hand, scenarios that propose some combination of development and protection potentially provided the broadest range of benefits for regional residents. The two combination scenarios examined in this assessment represent just two of many possible compromise boundary options that could be proposed.

The analysis shows that mining development has greater potential than petroleum development in providing employment for regional residents. While the number of people employed in exploration and construction would be relatively similar in magnitude, mining offers a much greater potential for employing regional residents during operations.

Another observation is that protection of the entire Edézhíe area may not generate the greatest potential for tourism and associated economic effects because there is not the same types of world-class attractions as there are in Nahanni and there would be no road access. It is expected that at least one road would be required to support non-renewable resource development in the region and the resulting increase in accessibility would encourage more people to visit the area.

A third observation is that the development scenarios having the greatest potential to create new employment and income also have the highest potential adverse socio-economic effects. While increased incomes can be used to purchase items that can enhance the quality of life, experience with other projects indicates that some workers will use their new-found wealth to buy items such as drugs and alcohol that can adversely affect their health and well-being and the well-being of other members of their communities. These effects are reduced when the amount of protected area is increased.

Finally, within the NWT, a higher than average percentage of regional residents consumes country food and participates in traditional activities and the Edézhíe area is of importance to these people. Opening Edézhíe to some non-renewable resource development will affect traditional uses in two ways. First, the environmental disturbances associated with non-renewable resource development may limit the capacity of Edézhíe to continue to sustain traditional uses although the magnitude of the effects will depend on the actual location of this development and the relative importance of traditional uses at these locations. Second, by offering more regional residents with an opportunity to participate in a wage economy, non-

renewable resource development may cause a decline in the number of people who are able to continue to participate in traditional uses, thereby reducing the need to retain some areas for traditional uses. It will be up to each community to decide how best to balance the competing needs of traditional land uses and economic development now and in the near future.

4.2 *Uncertainties and Issues*

The main challenge in undertaking this analysis has been the lack of detailed publicly-available information about current uses of the Edézhíe area (Volume 1) as well as the nature, scale, timing and location of potential future non-renewable resource development. The ultimate objective of this analysis has been to demonstrate the potential trade-offs among various scenarios that allow development in all or parts of Edézhíe. However, without knowing exactly which parts of the area are important for traditional land uses and the areas in which development is most likely to occur, the analysis can only describe these trade-offs in very general relative terms; quantification of effects in absolute dollar terms is simply not possible. Thus, the analysis has relied on some generic project descriptions that may or may not accurately describe the nature of development that may ultimately occur. As a result, this analysis should not be treated as a definitive assessment of competing resource values and associated social and economic effects. Instead, the report should be considered as a public education tool that may help community residents and members of the Working Group understand what some of the fundamental development issues may be and to help them determine the questions that will need to be asked regarding the right balance of environmental protection and economic development in Edézhíe.

As a result of the lack of information, some of the items listed in the terms of reference could not be addressed. For example, without detailed development descriptions, it was not possible to develop models to predict social and economic activities for either the region or for individual communities. A more qualitative approach had to be employed and, based on uncertainty about the location or scale of future development, it is not possible to describe potential effects on individual communities, other than to suggest that most of the activity is likely to occur in the largest existing community, Fort Simpson. Similarly, lack of information makes it impossible to estimate the potential labour requirements for specific sectors within the communities, the number of businesses that might be affected, the number of government jobs that might be created, or the amount of royalties paid to the Crown. It was also not possible to determine the substitute areas for traditional harvesting, cultural activities, or resources of interest to tourists, or the incremental costs of using these areas were Edézhíe not available. While estimates could have been prepared, the resulting numbers would have suggested more accuracy in the analysis than is actually possible and could unduly raise community expectations about future employment and income.

While some of these information deficiencies would be addressed by undertaking more studies, it is not clear that the resulting information would be worth the cost or time delay needed for data collection. An alternate, more cost-effective approach is rely on project proponents to collect and present the information on environmental and socio-economic effects and mitigation strategies as part of the environmental assessment process, where the specifics of the proposed development are very clearly defined.

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