

**ENVIRONMENTAL AND SOCIO-ECONOMIC  
IMPACTS****APPLICATION FOR APPROVAL  
OF THE DEVELOPMENT PLAN FOR  
NIGLINTGAK FIELD  
PROJECT DESCRIPTION****INTRODUCTION****13.1.1 SCOPE**

The environmental impact assessment process is a key element of planning, designing, constructing, operating, and eventual decommissioning and abandonment of the Niglntgak development. The environmental impact statement (EIS):

- describes the predicted effects of the Niglntgak development and the associated measures to mitigate these effects
- provides regulatory authorities with the biophysical and socio-economic information needed to make decisions about the Niglntgak development

**13.1.2 KEY ISSUES**

The EIS identifies key issues for northern communities that were identified through a public participation process that began in 2002 and will continue throughout the life of the development. These key issues are:

- environmental protection and effects mitigation
- socio-economic effects and mitigation
- northern community health and wellness

**13.1.3 OBJECTIVES**

The objectives of the EIS are to:

- contribute to the development of the Niglntgak field in a way that enhances benefits and mitigates adverse biophysical and social effects
- ensure that issues raised by communities are directly addressed in the assessment
- predict development-specific effects, including the effects of:
  - the development on biophysical, social and economic conditions
  - biophysical, social and economic conditions on the development
  - incidents and malfunctions

**13.1.3 OBJECTIVES (cont'd)**

- identify suitable management and mitigation measures for development-specific effects and determine the residual effects
- assess the significance of the predicted residual effects on the biophysical and socio-economic environments
- determine if the residual effects could interact cumulatively with the effects from other past, present or foreseeable future projects or activities

**13.1.4 APPROACH****13.1.4.1 Methods**

The assessment process was designed to meet the EIS objectives, and was based on five stages.

**13.1.4.2 Stage 1**

The goal of Stage 1 was to develop key questions that focused the assessment on addressing the communities' main concerns about project effects. These questions examine the effects of the project on an issue, or group of related issues, specific to a particular subject area.

**13.1.4.3 Stage 2**

The goal of Stage 2 was to select valued components (VCs) and key indicators (KIs) that could be used to answer the key questions. These valued components included selected species of animals, plant communities, waterbodies, community wellness, land uses and cultural features related to the communities' concerns. Key indicators that could be used to measure the status of a VC were identified because they could provide a measure of change caused by the project, and they directly relate to the condition of the VC.

**13.1.4.4 Stage 3**

The goal of Stage 3 was to analyze effect pathways that illustrate the expected cause-effect relationships between development components and the biophysical and socio-economic environments, including the influence of effects mitigation. This analysis includes mitigation measures that have been incorporated into the design of the Niglintgak field development.

**13.1.4.5 Stage 4**

The goal of Stage 4 was to describe the predicted effects in ways that are meaningful and are consistent throughout the EIS. This was achieved by answering four basic questions:

- Is the effect good or bad? (The direction of an effect.)

- How intense is the effect? (The magnitude of an effect.)
- How large an area will be affected? (The geographic extent of an effect.)
- How long will the effect last? (The duration of an effect.)

These questions form the framework for describing the effects. The approach was tailored to suit specific topics for each subject area of the impact assessment.

#### 13.1.4.6 Stage 5

The goal of Stage 5 was to evaluate the significance of potential residual effects.

The concept of environmental sustainability was used as the basis for determining significance. Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their needs.

An adverse residual effect is considered significant if the effect is either:

- moderate or high in magnitude and extends into the far future, i.e., more than 30 years after project facilities have been decommissioned and abandoned
- high in magnitude, and occurs outside the local study area at any time

#### 13.1.4.7 Public Participation

Effective stakeholder participation is integral to successfully developing and implementing the EIS. It demonstrates a sound appreciation of community-based knowledge and helps ensure that recommended mitigation measures are consistent with community capabilities and needs.

The objectives of the public participation program were to:

- ensure that community issues and concerns about the field development were understood by the proponents and the EIS assessment team
- ensure that concerns and issues were considered and addressed in the assessment process through management, mitigation or both
- provide project information in a timely and sincere manner to potentially affected and interested stakeholders to enable them to effectively engage with the proponents
- engage stakeholders in scoping field development-related issues, defining effects and contributing to developing mitigation measures to reduce effects
- educate stakeholders about the assessment process

The public participation program followed a community-based process. It provided stakeholders with opportunities to register their perceptions about the development. The opportunities reflected, as much as possible, the ways in which

**13.1.4.7 Public Participation (cont'd)**

stakeholders meet to exchange information. The program was designed to take into account the needs, capabilities and schedules of the communities involved, and included:

- interviews
- group meetings
- community dinners
- open houses
- workshops
- field visits

By acknowledging stakeholders and respecting the ways that they communicate, the public participation team tried to reinforce people's comfort with registering their input.

The public participation program entailed two main rounds of activity:

- Round 1 – issue identification and scoping
- Round 2 – effect assessment and mitigation

Follow-up meetings are planned with communities interested in meeting to review the EIS submission.



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**BIOPHYSICAL IMPACTS**

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**13.2.1 SCOPE**

The biophysical resources evaluated for the Niglntgak field are:

- air quality
- noise
- groundwater (hydrogeology)
- hydrology
- water quality
- fish
- soils, landforms and permafrost
- vegetation
- wildlife

The cumulative effects on these resources were also assessed.

No significant effects are predicted on any of these resources as a result of the Niglntgak field development.

For a detailed assessment of the effects on biophysical resources, see EIS Volume 5: Biophysical Impact Assessment.

**13.2.2 AIR QUALITY**

Air quality effects during construction at Niglntgak are related to dust generated from disturbed areas and traffic, and emissions from vehicles and construction camps. Emissions during operations are related to well test flaring and power generation.

Mitigation strategies, such as dust control, are expected to effectively manage Construction Phase effects. Strategies to reduce emissions during operations include:

- ensuring that flare stack design and performance are consistent with appropriate industry regulations
- using equipment that complies with the Canadian Council of Ministers of the Environment (CCME) standards

## 13.2.2 AIR QUALITY (cont'd)

Air emissions released during construction and decommissioning are not reported in the EIS because they will be minor.

No significant effects on air quality are predicted (see Table 13-1). Of the 12 key indicators, the predicted magnitude of effect is low, i.e., <1% of the guideline, for seven of them. Effects for the 1-hour and 24-hour NO<sub>2</sub>, 1-hour and 8-hour CO and 24-hour PM<sub>2.5</sub> maximum concentrations are predicted to have a moderate magnitude because predicted maximum concentrations exceed 5% of relevant guidelines but are below applicable objectives and standards. Effects are classified as long-term because they will continue for the life of the field operations.

**Table 13-1: Potential Effects of Niglintgak Activities on Air Quality**

Key Indicator	Phase When Impact Occurs	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
1-hour sulphur dioxide (SO <sub>2</sub> )	Operations	Adverse	Low	Local	Long-term	No
24-hour SO <sub>2</sub>	Operations	Adverse	Low	Local	Long-term	No
Annual SO <sub>2</sub>	Operations	Adverse	Low	Local	Long-term	No
1-hour nitrogen dioxide (NO <sub>2</sub> )	Operations	Adverse	Moderate	Local	Long-term	No
24-hour NO <sub>2</sub>	Operations	Adverse	Moderate	Local	Long-term	No
Annual NO <sub>2</sub>	Operations	Adverse	Low	Local	Long-term	No
1-hour carbon monoxide (CO)	Operations	Adverse	Moderate	Local	Long-term	No
8-hour CO	Operations	Adverse	Moderate	Local	Long-term	No
24-hour fine particulate matter (PM <sub>2.5</sub> )	Operations	Adverse	Moderate	Local	Long-term	No
1-hour benzene	Operations	Adverse	Low	Local	Long-term	No
1-hour BTEX	Operations	Adverse	Low	Local	Long-term	No
Area potential acid input	Operations	Adverse	Low	Local	Long-term	No

Note: BTEX = Benzene, toluene, ethylbenzene and xylene.

## 13.2.3 NOISE

The potential effects of the field development on the local noise environment at Niglintgak are related primarily to facility operation, drilling activity and well test flaring.

No significant effects on noise levels are predicted from operations at Niglintgak (see Table 13-2).

**Table 13-2: Potential Effects of Niglintgak Activities on Noise**

Valued Component	Phase When Impact Occurs	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
Environmental sound levels	Construction – Drilling	Adverse	Moderate	Local	Short-term	No
	Construction – Well test flaring	Adverse	Low	Local	Short-term	No
	Operations	Adverse	Low	Local	Long-term	No

Mitigation strategies to limit noise emissions include:

- using design criteria to meet EUB Guide 38 noise guidelines for remote sites (i.e., 40 dBA at 1.5 km)
- implementing engineering noise controls, as necessary, such as silencers, insulation and upgraded building shells
- scheduling discretionary activities to avoid sensitive time periods, where practical, in sensitive areas

The guideline limit for assessing operational noise is 40 dBA at 1.5 km. No guideline applies to the assessment of noise from flaring or drilling. In the production area, within the 1.5 km radius:

- predicted maximum well drilling noise is 42 dBA
- predicted maximum well-test flaring noise is 40 dBA
- predicted maximum production facility operational noise is 40 dBA

#### 13.2.4 GROUNDWATER

The potential effects of Niglintgak field development activities on groundwater can be related to changes in permafrost patterns, which can occur from such activities as vegetation removal.

Mitigation strategies to limit effects on groundwater include monitoring visual changes in location and extent of groundwater discharge areas, where present, and adopting hydrology and water quality mitigative measures.

No significant effects on groundwater are predicted. Effects are predicted to be low in magnitude, i.e., within the normal range of variation, and local in extent (see Table 13-3).

#### 13.2.5 HYDROLOGY

The potential effects of Niglintgak activities on hydrology can be related to:

## 13.2.5 HYDROLOGY (cont'd)

- site disturbance during construction
- water withdrawal and disposal
- land subsidence resulting from gas extraction

Table 13-3: Potential Effects of Niglintgak Activities on Groundwater

Valued Component	Phase When Impact Occurs	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
Groundwater quantity and flow patterns	Construction	Adverse	Low	Local	Far future	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Neutral	No effect	N/A	N/A	No
Groundwater quality	Construction	Adverse	Low	Local	Long-term	No
	Operations	Adverse	Low	Local	Far future	No
	Decommissioning and abandonment	Neutral	No effect	N/A	N/A	No

Note: N/A = Not applicable because no effect has been predicted.

Mitigation strategies to limit effects on hydrology include:

- grading and ditching to direct runoff through silt fences, sediment traps, vegetation, berms or isolation areas for controlled release to the watershed
- providing a setback from watercourses to reduce impacts on local drainage patterns and streamflow
- designing for thaw settlement, and using insulating materials
- conducting visual inspections to monitor drainage conditions and sediment control devices within the Niglintgak production area
- monitoring streambed conditions and bank stability at water crossings
- monitoring visually for the effects of production-related land subsidence

No significant effects on hydrology are predicted. Most effects will be low and local (see Table 13-4).

## 13.2.6 WATER QUALITY

Potential effects of Niglintgak activities on water quality can be related to:

- wastewater releases or withdrawals at facilities and camps
- leaks and spills
- suspended sediment inputs from land disturbance and watercourse crossings

Table 13-4: Potential Effects of Niglintgak Activities on Hydrology

Key Indicator	Phase When Impact Occurs	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
Runoff amounts	Construction	Adverse	Low	Local	Medium-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Neutral	No effect	N/A	N/A	No
Drainage patterns	Construction	Adverse	Low	Local	Medium-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Neutral	No effect	N/A	N/A	No
Water levels and velocities	Construction	Adverse	Low to moderate <sup>1</sup>	Local	Medium-term	No
	Operations	Adverse	Low to moderate <sup>1</sup>	Local	Long-term	No
	Decommissioning and abandonment	Neutral	No effect	N/A	N/A	No
Sediment concentration	Construction	Adverse	Low to high <sup>2</sup>	Local	Medium-term	No
	Operations	Adverse	Low to moderate <sup>2</sup>	Local	Long-term	No
	Decommissioning and abandonment	Neutral	No effect to high <sup>2</sup>	Local	Short-term	No
Channel morphology	Construction	Adverse	Low	Local	Medium-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Neutral	Low	Local	Medium-term	No

Note:

1. Moderate effects are related to barge-based gas conditioning facility option.

2. Moderate to high effects are related to barge-based gas conditioning facility option.

N/A = Not applicable because no effects have been predicted.

Mitigation strategies to limit effects on water quality include:

- treating wastewater to meet appropriate water quality standards before discharge or deep well injection
- controlling runoff and sediment during construction
- revegetating disturbed areas
- preventing leaks and containing spills
- limiting water withdrawal to meet regulatory standards
- monitoring waterbodies affected by test water releases

No significant effects on water quality are predicted. Effects on water and sediment quality will be low in magnitude and local in extent during all field development phases (see Table 13-5).

**Table 13-5: Potential Effects of Niglintgak Activity on Water Quality**

Valued Component	Phase When Impact Occurs	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
Water and sediment quality	Construction	Adverse	Low to moderate <sup>1</sup>	Local	Medium-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Neutral	Low to moderate <sup>1</sup>	Local	Long-term	No

Note: 1. Moderate effects are related to barge-based gas conditioning facility option.

### 13.2.7 FISH AND FISH HABITAT

The potential effects of Niglintgak activities on fish and fish habitat can be related to:

- changes in water levels and water flow related to such activities as water withdrawal
- sediment deposition caused by erosion from construction sites
- direct effects to fish habitat from such activities as constructing watercourse crossings

Mitigation strategies to reduce the effects on fish include:

- controlling erosion and sediment
- constructing primarily during winter conditions
- preventing spills and leaks, and preparing contingency plans
- avoiding spawning, rearing and overwintering fish habitats
- monitoring water quality and fish health at selected lakes and watercourses

No significant effects on fish are predicted (see Table 13-6).

### 13.2.8 SOILS, LANDFORMS AND PERMAFROST

The potential effects of Niglintgak activities on soils and landforms can be related to surface disturbance during construction that can damage soils, degrade permafrost, cause erosion, and remove uncommon landforms.

Mitigation strategies at Niglintgak to reduce effects on soils and landforms include:

- reducing surface disturbance
- controlling erosion
- stabilizing slopes

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- monitoring the effects of thaw settlement and frost heave, soil erosion, slope movement and drainage conditions at selected sites within the Niglintgak lease

**Table 13-6: Potential Effects of Niglintgak Activities on Fish**

Key Indicators	Phase When Impact Occurs	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
Habitat	Construction	Adverse	Low	Local	Long-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Far future	No
Health	Construction	Adverse	Low	Local	Short-term	No
	Operations	Neutral	No effect	N/A	N/A	No
	Decommissioning and abandonment	Adverse	Low	Local	Short-term	No
Distribution and abundance	Construction	Adverse	Low	Local	Short-term	No
	Operations	Neutral	No effect	N/A	N/A	No
	Decommissioning and abandonment	Adverse	Low	Local	Short-term	No

Note: N/A = Not applicable because no effects have been predicted.

No significant effects on soils and landforms are predicted. All project effects on these features are low in magnitude and local in extent (see Table 13-7).

**Table 13-7: Potential Effects of Niglintgak Activities on Soils and Landforms**

Valued Component	Phase When Impact Occurs	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
Ground stability	Construction	Adverse	Low	Local	Short-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Neutral	No effect	N/A	N/A	No
Uncommon landforms	Construction	Adverse	Low	Local	Far future <sup>1</sup>	No
	Operations	Adverse	Low	Local	Far future	No
	Decommissioning and abandonment	Neutral	No effect	N/A	N/A	No
Soil quality	Construction	Adverse	Low	Local	Short-term to far future	No
	Operations	Adverse	Low	Local	Short-term to far future <sup>1</sup>	No
	Decommissioning and abandonment	Adverse	Low	Local	Short-term	No

Note:  
1. Far future effects relate to changes to patterned ground.  
N/A = Not applicable because no effects have been predicted.

## 13.2.9 VEGETATION

The potential effects of Niglintgak activities on vegetation can be related to:

- vegetation loss during construction
- dust and air emissions
- changes in landforms, soils and permafrost

Mitigation strategies to reduce effects to vegetation include:

- reducing the areal extent of the disturbance to the extent practical, considering safety, constructability and operability
- controlling weeds to prevent weedy species invasion
- reclaiming disturbed areas
- monitoring vegetation composition and cover, vegetation and vigour and presence of weeds at selected sites

No significant effects on vegetation are predicted (see Table 13-8). The effects on vegetation types are low in magnitude and local in extent. No effects on the abundance and distribution of vegetation communities of concern or rare plants are predicted.

**Table 13-8: Potential Effects of Niglintgak Activities on Vegetation Abundance and Distribution**

Valued Component	Phase When Impact Occurs	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
Vegetation types	Construction	Adverse	Low	Local	Far future	No
	Operations	Adverse	Low	Local	Far future	No
	Decommissioning and abandonment	Adverse	Low	Local	Far future	No
Vegetation communities of concern	Construction	Neutral	No effect	N/A	N/A	No
	Operations	Neutral	No effect	N/A	N/A	No
	Decommissioning and abandonment	Neutral	No effect	N/A	N/A	No
Rare plants	Construction	Neutral	No effect	N/A	N/A	No
	Operations	Neutral	No effect	N/A	N/A	No
	Decommissioning and abandonment	Neutral	No effect	N/A	N/A	No

Note: N/A = Not applicable because no effects are predicted.

No significant effects on vegetation health are predicted. Dust and air emissions are predicted to result in low magnitude, local effects to the health of some vegetation types and rare plants (see Table 13-9). These effects will not extend beyond the life of the Niglintgak field.

**Table 13-9: Potential Effects of Niglintgak Activities on Vegetation Health**

Valued Component	Phase When Impact Occurs	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
Vegetation types	Construction	Adverse	Low	Local	Short-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Adverse	Moderate	Local	Medium-term	No
Vegetation communities of concern	Construction	Neutral	No effect	N/A	N/A	No
	Operations	Neutral	No effect	N/A	N/A	No
	Decommissioning and abandonment	Neutral	No effect	N/A	N/A	No
Rare plants	Construction	Neutral	No effect	N/A	N/A	No
	Operations	Neutral	No effect	N/A	N/A	No
	Decommissioning and abandonment	Neutral	No effect	N/A	N/A	No

Note: N/A = Not applicable because no effects have been predicted.

**13.2.10 WILDLIFE**

The potential effects of Niglintgak activities on wildlife can be related to:

- reduced habitat resulting from the direct loss of habitat from construction, or sensory disturbance that causes wildlife to avoid areas
- barriers that the field facilities might present to wildlife movement, such as trenches or above-ground flow lines that inhibit wildlife movements
- increased mortality because hunters and predators can access wildlife more readily along roads or pipeline rights-of-way

Mitigation strategies to reduce effects on wildlife include:

- developing and implementing operating guidelines to:
  - address potential effects on wildlife
  - reduce sensory disturbance on wildlife
- managing access in cooperation with communities and regulatory agencies
- reducing the development footprint and related vegetation clearing, where practical, while maintaining a safe construction and operating site
- scheduling work activities to avoid sensitive life-cycle stages, where practical
- implementing design and work practices to reduce the barrier effects of the development on wildlife movement
- establishing reclamation plans to re-establish wildlife habitat

## 13.2.10 WILDLIFE (cont'd)

- managing waste effectively to prevent wildlife attraction

No significant effects on wildlife habitat availability are predicted. Effects on wildlife habitat availability will be local. Most effects will be low magnitude except for short-term moderate effects on beluga whales related to the barge-based gas conditioning facility option (see Table 13-10).

Table 13-10: Potential Effects of Niglintgak Activities on Wildlife Habitat Availability

Valued Component	Phase When Impact Occurs	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
Barren-ground grizzly bear	Construction	Adverse	Low	Local	Long-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Long-term	No
Birds <sup>1</sup>	Construction	Adverse	Low	Local	Long-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Long-term	No
Beluga whale	Construction	Adverse	Moderate	Local	Short-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Adverse	Moderate	Local	Short-term	No
Bowhead whale	Construction	Adverse	Low	Local	Medium-term	No
	Operations	Neutral	N/A	N/A	N/A	No
	Decommissioning and abandonment	Adverse	Low	Local	Medium-term	No
Ringed seal	Construction	Adverse	Low	Local	Short-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Medium-term	No
Polar bear	Construction	Adverse	Low	Local	Long-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Medium-term	No
Note:						
1. Bird species addressed in the effects assessment include greater white-fronted goose, snow goose, tundra swan, scaup, peregrine falcon, whimbrel and Arctic tern.						
N/A = Not applicable because no effects have been predicted.						

No significant effects on wildlife movement are predicted. The effects on wildlife movement in the area will be low magnitude and confined to the local area (see Table 13-11).

No significant effects on wildlife mortality are predicted (see Table 13-12). Industry-caused mortality of barren-ground grizzly bear is assumed to be less

than the sustainable harvest quota. As a result, a low-magnitude effect, regional in extent, is predicted for the barren-ground grizzly bear mortality.

**Table 13-11: Potential Effects of Niglintgak Activity on Wildlife Movement**

Valued Component	Phase When Impact Occurs	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
Grizzly bear	Construction	Adverse	Low	Local	Medium-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Short-term	No
Beluga whale	Construction	Adverse	Low	Local	Short-term	No
	Operations	Neutral	No effect	N/A	N/A	No
	Decommissioning and abandonment	Adverse	Low	Local	Short-term	No
Bowhead whale	Construction	Adverse	Low	Local	Short-term	No
	Operations	Neutral	No effect	N/A	N/A	No
	Decommissioning and abandonment	Adverse	Low	Local	Short-term	No
Ringed seal	Construction	Adverse	Low	Local	Short-term	No
	Operations	Neutral	No effect	N/A	N/A	No
	Decommissioning and abandonment	Adverse	Low	Local	Short-term	No
Polar bear	Construction	Neutral	No effect	N/A	N/A	No
	Operations	Neutral	No effect	N/A	N/A	No
	Decommissioning and abandonment	Neutral	No effect	N/A	N/A	No

Note: N/A = Not applicable because no effect has been predicted.

### 13.2.11 CUMULATIVE EFFECTS

An assessment of cumulative effects concluded that:

- the Niglintgak field development will not contribute to significant cumulative effects
- no significant overall cumulative effects are predicted

The Niglintgak development, as part of the Mackenzie Gas Project, might lead to future gas exploration and development within the Northwest Territories. However, information to adequately assess potential cumulative effects from such developments is not currently available.

**Table 13-12: Potential Effects of Niglintgak Activity on Wildlife Mortality**

Valued Component	Phase When Impact Occurs	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
Barren-ground grizzly bear	Construction	Adverse	Low	Regional	Medium-term	No
	Operations	Adverse	Low	Regional	Long-term	No
	Decommissioning and abandonment	Neutral	N/A	N/A	N/A	No
Beluga whale	Construction	Adverse	Low	Local	Medium-term	No
	Operations	Neutral	N/A	N/A	N/A	No
	Decommissioning and abandonment	Adverse	Low	Local	Medium-term	No
Bowhead whale	Construction	Adverse	Low	Local	Medium-term	No
	Operations	Neutral	N/A	N/A	N/A	No
	Decommissioning and abandonment	Adverse	Low	Local	Medium-term	No
Ringed seal	Construction	Adverse	Low	Local	Medium-term	No
	Operations	Neutral	N/A	N/A	N/A	No
	Decommissioning and abandonment	Adverse	Low	Local	Medium-term	No
Polar bear	Construction	Adverse	Low	Local	Medium-term	No
	Operations	Adverse	Low	Local	Medium-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Medium-term	No

Note: N/A = Not applicable because no effect has been predicted.

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The socio-economic key issues evaluated for the Niglntgak field were the effects on:

- the regional economy
- infrastructure
- individual, family and community wellness
- traditional culture
- non-traditional land and resource use
- heritage resources

Most of the socio-economic issues are overall effects from the Mackenzie Gas Project, resulting from the combined influences of all project components and activities in the Beaufort Delta Region. The effects of the Niglntgak field development cannot be distinguished from those of all components acting together. The need for goods, services and employment, and their economic impact, will be further defined and assessed during the construction and operations phases of the field development.

The cumulative effects on these issues were also assessed.

No significant adverse effects are predicted on any of these issues as a result of the Niglntgak field development. Several significant positive effects on regional economies are predicted.

For a detailed assessment of the socio-economic effects, see EIS Volume 6: Socio-Economic Impact Assessment.

**13.3.2 REGIONAL ECONOMIC EFFECTS**

The Mackenzie Gas Project will generate a large demand for goods, services and labour at various locations in the Northwest Territories. Suppliers, contractors and northern residents are expected to respond to these demands to the extent possible. Where demand exceeds northern supply capacity, supply requirements will be filled from outside the Northwest Territories.

The project impacts on the economy were assessed by considering:

**13.3.2 REGIONAL ECONOMIC EFFECTS (cont'd)**

- project capital and operating expenditures
- regional capacity of workers and businesses
- project employment and labour income
- demography and population mobility

The assessment also considers mitigating measures planned or implemented by the proponents of the Mackenzie Gas Project to enhance northern and Aboriginal labour skills and business capacity. Some examples of mitigating measures taken or planned include:

- providing qualified Aboriginal and other northern residents with the opportunity to work during construction
- participating in industry initiatives to educate and train potential trades and technical workers for pipeline and production operations
- providing full and fair opportunity for Aboriginal and northern businesses to participate in business opportunities
- providing lead time to Aboriginal businesses to develop the ability to qualify and compete for work
- structuring work packages to better align with the capacity of northern businesses, where appropriate
- placing particular emphasis on local content plans when awarding work

**13.3.2.1 Capital and Operating Expenditures**

The total capital expenditure for all Mackenzie Gas Project components is \$7,732 million, in constant 2003\$ Cdn (see Table 13-13).

**Table 13-13: Mackenzie Gas Project Capital Expenditures**

Activity	Expenditure Timing	Total (\$Million)
Pre-construction	January 1, 2002 to June 30, 2006	845
Construction	July 1, 2006 to June 30, 2010	6,247
Ongoing capital	July 1, 2010 to December 30, 2023	639
Total		7,732

Table 13-14 shows that, of the \$6.2 billion construction expenditures:

- \$1.9 billion (31%) will be made in the Inuvialuit Settlement Region (ISR)
- \$1.1 billion (17%) will be made in the Gwich'in Settlement Area (GSA)

The balance of the project investment will occur outside the regions.

**Table 13-14: Mackenzie Gas Project Capital Investment by Area**

Location	2006–2007		2007–2008		2008–2009		2009–2010		Total	
	(\$M)	(%)	(\$M)	(%)	(\$M)	(%)	(\$M)	(%)	(\$M)	(%)
Project total	1,409	100	2,261	100	1,907	100	671	100	6,247	100
Inuvialuit Settlement Region	301	21	580	26	672	35	362	54	1,915	31
Gwich'in Settlement Area	276	20	419	19	308	16	77	11	1,079	17
Other	831	59	1,262	56	927	48	232	35	3,253	52

Note: Numbers might not add up because of rounding.

Although the total capital investment for constructing all Mackenzie Gas Project components is \$6.2 billion, and the components are physically located in the Northwest Territories, most of the capital spending on goods and services needed to construct the Mackenzie Gas Project components will go to businesses located outside of the Northwest Territories. This is because the regions in the Northwest Territories lack the capacity to undertake such a large project, given the small population base and workforce, and the limited number, size and scope of local businesses and contractors.

Of the \$1.9 billion of capital expenditures to occur in the Inuvialuit Settlement Region during construction from 2006 to 2010, an estimated \$328 million (17%) will be spent in the region. Similarly, of the \$1.1 billion of capital expenditures to occur in the Gwich'in Settlement Area, \$353 million (33%) will be spent in that area. Together, this constitutes \$681 million over four years in the Beaufort Delta Region.

The estimated total capital expenditure for the Niglintgak field is \$369 million between 2002 and 2009 (see Table 13-15).

The estimated annual average operating expenditure for the Niglintgak field is about \$10 million between 2010 and 2035.

**Table 13-15: Capital Expenditures for the Niglintgak Field, Barge Option**

Expenditure Type	2002 (\$M)	2003 (\$M)	2004 (\$M)	2005 (\$M)	2006 (\$M)	2007 (\$M)	2008 (\$M)	2009 (\$M)	Total (\$M)
Engineering and project management	1	4	4	6	18	18	14	7	72
Line pipe and piping materials	0	0	0	0	0	0	13	0	13
Major equipment and modularization <sup>1</sup>	0	0	0	0	14	97	28	0	138
Logistics	0	0	0	0	0	0	3	0	3
Construction <sup>2</sup>	0	0	0	0	0	0	7	9	16
Camp buildings set-up and catering	0	0	0	0	1	4	5	5	15
Drilling site preparation and site construction	0	0	0	0	4	6	2	2	14
Drilling and service wells	0	1	1	1	1	25	41	30	98
Total	1	4	4	7	37	149	113	54	369

Note:  
Numbers might not add up because of rounding.

- Includes prefabricated modules, production equipment, and other equipment and material.
- Includes labour travel, fuel, construction equipment rental, installation labour, granular delivery, facilities site preparation, facilities construction and borrow royalty.

**13.3.2.2 Employment**

During Mackenzie Gas Project construction, an annual average of 261 people from the Inuvialuit Settlement Region and 407 from the Gwich'in Settlement Area would be available to seek project employment and related work (see Table 13-16).

A GNWT Labour Force Survey identified the total available labour pool and those who would be willing to accept direct employment rotation. Acceptance of work rotation was taken as an indicator of labour accepting direct project employment.

**Table 13-16: Estimated Labour Pool Available in ISR and GSA for Project-Related Work**

Indicator	2006–2007		2007–2008		2008–2009		2009–2010		Average	
	ISR	GSA	ISR	GSA	ISR	GSA	ISR	GSA	ISR	GSA
Total unemployed	313	574	315	603	318	629	320	608	317	603
Will do rotational work (%)	82	65	82	76	82	75	82	54	82	67
Total unemployed adjusted for rotational work	258	372	260	459	262	469	264	328	261	407

The willingness to do rotational work only applies to direct jobs, which make up about half of the total number of project-related jobs created.

An estimate of direct employment demand for the region was developed by comparing the job type and occupation requirements for each project component located in the region with the expected skills of the local labour force.

The Statistics Canada Inter-Regional Input-Output Model was used to estimate the total demand generated by the project for indirect and induced employment in the Northwest Territories. The territorial estimates were then broken down into regions using project expenditure data. Table 13-17 describes the project employment demand in the Inuvialuit Settlement Region and the Gwich'in Settlement Area. Taking into account capacity constraints of the available labour force in these regions, an estimated annual average of 568 workers are expected to be available to meet the demand for Mackenzie Gas Project jobs during construction, assuming that project-related training is made available in the Northwest Territories.

**13.3.2.3 Labour Income**

Project-related construction employment will lead to increased household income in the regions. Project construction is estimated to lead to an increase of about \$120 million in labour income in the Inuvialuit Settlement Region and Gwich'in Settlement Area throughout the construction period. This comprises \$67 million in direct project-related income and \$53 million earned by those producing goods and services for the project and its employees (see Table 13-18).

Table 13-17: Project Employment Demand in the ISR and GSA

Type of Demand	Number of Jobs					
	2006–2007	2007–2008	2008–2009	2009–2010	Total	Average
<b>Inuvialuit Settlement Region</b>						
Modelled employment demand without labour supply constraints						
Direct	59	145	566	39	809	202
Indirect	216	527	784	663	2,189	547
Induced	99	209	272	199	780	195
<b>Total</b>	<b>374</b>	<b>881</b>	<b>1,622</b>	<b>901</b>	<b>3,778</b>	<b>945</b>
Estimated employment demand with labour supply adjustments						
Direct	59	145	201	39	445	111
Indirect	40	40	40	41	160	40
Induced	20	20	20	20	80	20
<b>Total</b>	<b>118</b>	<b>205</b>	<b>262</b>	<b>100</b>	<b>685</b>	<b>171</b>
<b>Gwich'in Settlement Area</b>						
Modelled employment demand without labour supply constraints						
Direct	499	1,986	1,277	60	3,822	956
Indirect	906	1,174	1,001	181	3,263	816
Induced	228	300	249	46	822	206
<b>Total</b>	<b>1,633</b>	<b>3,459</b>	<b>2,528</b>	<b>287</b>	<b>7,907</b>	<b>1,977</b>
Estimated employment demand with labour supply adjustments						
Direct	232	287	293	60	872	218
Indirect	93	115	117	181	506	127
Induced	46	57	59	46	208	52
<b>Total</b>	<b>372</b>	<b>459</b>	<b>469</b>	<b>287</b>	<b>1,586</b>	<b>397</b>
Note: Numbers might not add up because of rounding.						

Table 13-18: Estimated Project-Related Labour Income in the ISR and GSA – 2006 to 2010

Type of Demand	2006–2007 (\$M)	2007–2008 (\$M)	2008– 2009 (\$M)	2009–2010 (\$M)	Total (\$M)	Average (\$M)
<b>Inuvialuit Settlement Region</b>						
Direct	2	9	12	3	26	6
Indirect	3	3	3	3	11	3
Induced	1	1	1	1	3	1
<b>Total</b>	<b>5</b>	<b>13</b>	<b>16</b>	<b>7</b>	<b>40</b>	<b>10</b>
<b>Gwich'in Settlement Area</b>						
Direct	12	13	14	3	41	10
Indirect	6	7	7	11	30	8
Induced	2	2	2	2	9	2
<b>Total</b>	<b>19</b>	<b>22</b>	<b>23</b>	<b>16</b>	<b>80</b>	<b>20</b>
<b>Grand Total</b>	<b>24</b>	<b>35</b>	<b>39</b>	<b>23</b>	<b>120</b>	<b>30</b>
Note: Numbers might not add up because of rounding.						

**13.3.2.3 Labour Income (cont'd)**

Between 2009 and 2030, total project-related employment in the Inuvialuit Settlement Region and Gwich'in Settlement Area is expected to fluctuate between 168 and 466 jobs and average 276 jobs (see Table 13-19). These jobs will result in average annual labour income estimates that range from \$12 to \$32 million or an annual average of about \$19 million during this period (see Table 13-20).

**Table 13-19: Estimated Project-Related Annual Average Employment (2009 to 2030)**

Type of Demand	Number of Jobs				
	2009–2015	2016–2020	2021–2025	2026–2030	2009–2030
<b>Inuvialuit Settlement Region</b>					
Direct	136	207	54	49	113
Indirect	8	19	5	5	9
Induced	4	10	3	2	5
<b>Total</b>	<b>148</b>	<b>236</b>	<b>62</b>	<b>56</b>	<b>127</b>
<b>Gwich'in Settlement Area</b>					
Direct	40	37	37	37	38
Indirect	68	129	52	50	74
Induced	34	64	26	25	37
<b>Total</b>	<b>142</b>	<b>230</b>	<b>115</b>	<b>112</b>	<b>149</b>
<b>Grand Total</b>	<b>290</b>	<b>466</b>	<b>177</b>	<b>168</b>	<b>276</b>
Note: Numbers might not add up because of rounding.					

**Table 13-20: Annual Average Labour Income in the ISR and GSA**

Type of Demand	2009–2015 (\$M)	2016–2020 (\$M)	2021–2025 (\$M)	2026–2030 (\$M)	2009–2030 (\$M)
<b>Inuvialuit Settlement Region</b>					
Direct	11.5	17.6	4.6	4.2	9.6
Indirect	0.4	1.0	0.3	0.2	0.5
Induced	0.2	0.4	0.1	0.1	0.2
<b>Total</b>	<b>12.2</b>	<b>19.0</b>	<b>4.9</b>	<b>4.5</b>	<b>10.3</b>
<b>Gwich'in Settlement Area</b>					
Direct	4.0	3.7	3.7	3.7	3.8
Indirect	3.5	6.6	2.7	2.6	3.8
Induced	1.4	2.7	1.1	1.0	1.6
<b>Total</b>	<b>8.9</b>	<b>13.0</b>	<b>7.5</b>	<b>7.3</b>	<b>9.1</b>
<b>Grand Total</b>	<b>21.1</b>	<b>32.0</b>	<b>12.4</b>	<b>11.8</b>	<b>19.4</b>
Note: Numbers might not add up because of rounding.					

The Niglintgak field barge option will contribute about 170 people to the total project employment demand between 2006 and 2010 (see Table 13-21). The Niglintgak land-based option contributes about 250 people to total project employment demand.

**Table 13-21: Niglintgak Field, Barge Option – Peak Construction Employment**

Staffing Classification	2006–2007	2007–2008	2008–2009	2009–2010	Total
Supervisors	3	7	12	4	26
Welders	2	7	28	1	38
Teamsters	0	2	3	1	6
Operators	1	4	12	1	18
Labourers	2	8	24	3	37
Other	2	4	11	4	21
Inspectors	0	1	4	1	6
Site-abandonment personnel	0	0	0	0	0
Site-abandonment infrastructure personnel	0	0	0	0	0
Site-abandonment logistics personnel	0	0	0	0	0
Camp and catering personnel	2	3	6	2	13
Camp infrastructure personnel	0	0	1	0	1
Camp logistics personnel	1	1	1	1	4
Total	13	37	102	18	170

Drilling and completion activities at Niglintgak will generate 97 on-site jobs in 2007–2008 and 122 jobs during 2008–2009 and 2009–2010. A total of 341 jobs will be generated (see Table 13-22).

**Table 13-22: Niglintgak On-Site Drilling, Completions and Related Employment**

Drilling and Completions	2006–2007	2007–2008	2008–2009	Total
Supervisors, technical, administrative	11	13	13	37
Surveyors, monitors, safety	12	13	13	38
Equipment operators	30	28	28	86
Construction labourers	6	4	4	14
Welders	1	1	1	3
Electrician	1	1	1	3
Mechanic	1	1	1	3
Camp staff – cooks	12	12	12	36
Drilling crew personnel	12	24	24	60
Specialty drilling services	11	25	25	61
Total	97	122	122	341

Once start-up is complete and the facilities are fully operational, the Niglintgak development will require 13 full-time equivalent (FTE) operations employees (see Table 13-23), including two trainees and two FTE contract maintenance personnel. These positions will be rotational.

The Inuvialuit Settlement Region and Gwich'in Settlement Area economies will respond to the overall project demand and the specific demand of the Niglintgak

**13.3.2.3 Labour Income (cont'd)**

field development. The combined regional economic effects, including project procurement, employment and income, are expected to be significant, positive and high in magnitude during construction. During operations, regional economic effects in the Inuvialuit Settlement Region will be positive, low in magnitude, regional and beyond in extent, long-term and not significant (see Table 13-24). In the Gwich'in Settlement Area, economic effects during operations will be positive, moderate in magnitude, regional and beyond in extent and long-term and significant. The moderate magnitude is attributed to Inuvik, the primary business and service centre for the Beaufort Delta Region.

**Table 13-23: Niglintgak Operations Labour Force Requirements**

Position	Number of Jobs
Manager	1
Administrative support	1
Professional staff	0
Driver	0
Labourer	0
Millwright	2
Pipefitter	0
Electrician	2
Control room operator	1
Field operator	4
Subtotal	11
Maintenance contractor	2
Total	13

**Table 13-24: Economic Effects of the Project and Niglintgak Field**

Location	Phase	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
Inuvialuit Settlement Region	Construction	Positive	High	Regional and beyond regional	Short-term	Yes
	Operations	Positive	Low	Regional and beyond regional	Long-term	No
Gwich'in Settlement Area	Construction	Positive	High	Regional and beyond regional	Short-term	Yes
	Operations	Positive	Moderate	Regional and beyond regional	Long-term	Yes

**13.3.2.4 Demography and Population Mobility**

The possibility that increases in populations will overburden community infrastructure and services is a concern. All aspects of field development and project construction will create demands for labour, and thus tend to encourage

migration to regional and other centres of project activity. Relevant mitigation measures include hiring southern workers for project and production-related positions in selected provincial cities, from contractor lists and via media advertising. Hiring in the North will be restricted to qualified Aboriginal and other northerners, and this restriction will be publicized.

Aboriginal and other northerners will be able to sign up for project work in their home communities, which will help discourage intra-territorial migration. However, these measures will only be partly effective because there will be many indirect and induced jobs during the Construction Phase, which might cause workers to migrate within and into the Northwest Territories.

The effects of the Niglintgak field development are not distinguishable from combined project effects. These effects will be expressed primarily in Inuvik, where the population is expected to increase by about 450 during construction. Table 13-25 shows the project-related effects on population mobility during construction.

During the Operations Phase, from 2009 to 2015, the initial transitional effect on Inuvik could be an increase of about 280 people. This effect will stabilize during early operations, and by 2021 to 2025 will reach about 200 people. Table 13-26 shows the project-related effects during operations.

**Table 13-25: Potential Construction Effects on Population Mobility**

Region	Effect Attribute				Significant?
	Direction	Magnitude	Geographic Extent	Duration	
Beaufort Delta	Adverse	Low	Regional	Short-term	No
Inuvik	Adverse and positive	High	Local	Short-term	No

**Table 13-26: Potential Operations Effects on Population Mobility**

Region	Effect Attribute				Significant?
	Direction	Magnitude	Geographic Extent	Duration	
Inuvik	Positive	Low	Local	Long-term	No

### 13.3.3 INFRASTRUCTURE

#### 13.3.3.1 Transportation

The Mackenzie Gas Project will increase demand on all transportation modes, including highway, railroad, barge and air transportation, during the Construction Phase, in addition to increasing project-related travel.

Agreements between the project and the GNWT, and between the project and applicable municipalities, will be negotiated and will include provisions for the project's use of permanent and seasonal roads. The agreements will consider:

- coordination of road maintenance activities

**13.3.3.1 Transportation (cont'd)**

- coordination of road upgrading, where required
- options that could include making contributions in kind, such as constructing winter roads, maintaining and repairing highways or contributing to a portion of maintenance costs

Other general mitigation measures will include:

- continuing discussions with barge service and air transportation providers to provide them with ample lead time to ensure sufficient capacity to meet community requirements and project demands
- coordinating with the GNWT and other responsible authorities to provide construction air and barge traffic demand projections, including provisions for assessing the need for, and completing upgrading and other improvements to, regional and municipal airports, airstrips and barge landings

All project effects are expected to be low to moderate in magnitude, of short duration and not significant (see Table 13-27).

Extensive transportation will not be required during the Operations Phase. As a result, the effects of the Operations Phase on transportation infrastructure were not assessed.

**Table 13-27: Potential Effects on Transportation Infrastructure**

Region	Mode of Transportation	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
Beaufort Delta	Road	Adverse	Low	Regional	Short-term	No
	Marine	Adverse	Moderate	Regional	Short-term	No
	Air	Adverse	Moderate	Regional	Short-term	No

**13.3.3.2 Energy and Utilities**

During the construction and operations phases, the project will have no effects on the energy and utilities systems of any community. Accordingly, there is no need to detail project effects on energy and utilities infrastructure during either of these phases.

All communities have sufficient capacity to accommodate any foreseeable demands created by the projected level of in-migrants or transients that the project might attract to the study area.

**13.3.3.3 Housing**

Project effects on housing and accommodations will include direct and indirect demands for short and long-term accommodation. Demands for short-term

accommodation will be reduced by providing project construction camps. Programs to discourage speculative in-migration (see Section 13.3.2.4, Demography and Population Mobility) will help reduce pressures on accommodation.

Based on population projections, an estimated additional 160 dwellings will be needed in Inuvik from 2002 through 2011. Because of its proximity to the gathering system and other activity in the coastal area, Tuktoyaktuk might experience some degree of speculative in-migration.

The effects on housing are expected to be adverse, short-term and not significant in affected communities (see Table 13-28). Housing effects are expected to be high in magnitude and local in Inuvik, and moderate and local in Tuktoyaktuk. Low-magnitude local effects are expected in the other Beaufort Delta Region communities.

**Table 13-28: Potential Effects of Mackenzie Gas Project on Housing**

Region	Effect Attribute				Significant?
	Direction	Magnitude	Geographic Extent	Duration	
Inuvik	Adverse	High	Local	Short-term	No
Tuktoyaktuk	Adverse	Moderate	Local	Short-term	No
Other Beaufort Delta communities	Adverse	Low	Local	Short-term	No

#### 13.3.3.4 Recreation Resources

Camp facilities will meet the recreation needs of the vast majority of project employees. The remaining employees will be based in Inuvik, most for relatively short periods. There will also be some speculative in-migration to Inuvik, in spite of planned mitigation measures (see Section 13.3.2.4, Demography and Population Mobility). Inuvik is well equipped with a large-capacity recreation complex and other facilities.

Some positive effects might be expected in Inuvik, where increased recreation demand and user fee revenues could lead to increases in the hours facilities are open for use.

No effects are expected on recreation facilities and use during the Operations Phase, other than a low-magnitude, localized, adverse and positive effect in Inuvik.

#### 13.3.3.5 Governance

Governance encompasses both the authority to make decisions and the ability to access and manage the funds required to make some decisions consequential. Governance arrangements in the Northwest Territories are changing as a result of ongoing devolution discussions between regional representatives and the governments of the Northwest Territories and Canada.

**13.3.3.5 Governance (cont'd)**

The project will provide a substantial source of revenue to the various levels of government from:

- benefits and access agreements
- direct taxation
- payment of royalties

During the Construction Phase, the project will generate \$136 million in personal taxes from activity in the Northwest Territories. The GNWT share, after adjustment for the formula financing grant (FFG) is taken into account, is estimated to be \$9.8 million. Estimates of corporate tax flows have not been included. During project operations, total taxes generated from activity in the Northwest Territories will amount to about \$399 million annually, of which the GNWT share, after the FFG is taken into account, is estimated to be \$22 million. The GNWT share will vary from 7% of the total during construction to 5% during operations.

The size of these various project payments should exceed the costs of sustaining adequate levels of infrastructure and services to meet project demands. However, before a final devolution agreement is implemented, the largest part of these revenues will accrue to the federal government, while the likely costs of the project for infrastructure and services will impinge on the local, regional and territorial governments. These authorities will not have the resources to pay for the project-induced needed infrastructure and public services expenditures under current programs and budgets.

There is an issue with the timing of expenditures for the physical infrastructure necessary before and during construction, and the substantial project royalty fee and tax revenues receivable during operations. Accordingly, Construction Phase effects on governance are seen as adverse, moderate in magnitude, regional and beyond regional in extent, but short-term and not significant. The Operations Phase effects will be positive, low in magnitude, regional and beyond regional in extent, long-term and not significant.

**13.3.4 INDIVIDUAL, FAMILY AND COMMUNITY WELLNESS**

The focus of individual, family and community wellness is on the effects of the project Construction Phase, when there will be elevated levels of employment and income that might positively or negatively affect individual, family and community wellness. When construction has been completed, the elevated levels of employment and income will decline. The smaller numbers employed for technical operations, anchor field and pipeline maintenance during the Operations Phase will be stationed primarily in Inuvik, with a few in Norman Wells, and perhaps some maintenance staff in Fort Simpson. Accordingly, during the Operations Phase, there will be no need for mitigation to reduce adverse effects on wellness, and no residual effects are expected.

**13.3.4.1 Community Well-Being and Delivery of Social Services**

The most frequent and persistent problems that community wellness centres must address are substance abuse, primarily alcohol and derivative violence, often in families. The increased incomes from project employment could add substantially to substance abuse-related problems, and to the burdens of the social service workers who must try to deal with the problems.

Because of Inuvik's location and central role as service centre for the Beaufort Delta Region, many of the wellness issues will express themselves there. As a result, effective mitigation will be a serious challenge, requiring a concentrated effort by all.

The single most important mitigation focuses on controlling substance abuse, and this will require initiatives by the project proponents, the GNWT and local communities. Measures initiated by the project proponents will include:

- providing money-management training programs in camps, and supporting community-based money-management training programs, to reduce the potential for negative lifestyle choices
- enforcing policies for alcohol and drug-free workplaces and camps

The GNWT should ensure that the resources of RCMP detachments are adequate to strictly enforce liquor ordinances, laying charges against those guilty of violent abuse and detaining inebriated people who might endanger themselves or others.

The proponents encourage local communities to enact ordinances restricting alcohol import amounts and mobilizing their resources to discourage substance abuse and associated violence.

Measures that reduce adverse effects on community wellness reduce the demands and the stresses on social services workers, who will then be better able to deal with wellness problems.

Table 13-29 shows that the project effects on well-being during the Construction Phase are expected to be adverse and high in magnitude in Inuvik, Tuktoyaktuk, Paulatuk and Aklavik, and moderately adverse in Fort McPherson and Tsiigehtchic. These effects are expected to be neutral and low-magnitude in Holman and Sachs Harbour. In each of these communities, the effects are expected to be local, short-term and not significant.

The effects on social service delivery are shown in Table 13-30. They generally parallel well-being conditions. All are expected to be short-term and not significant.

**13.3.4.2 Health Conditions and Health Care Services**

All project camps will have health care staff and facilities appropriate to camp size. Staffing and facility equipment will ensure that any accident victims and seriously ill patients can be stabilized for medical evacuation.

**13.3.4.2 Health Conditions and Health Care Services (cont'd)**

The most serious threats to health in communities are posed by:

- substance abuse and the consequential elevated risks of accidental and violent injuries
- population movement and the potential that contagious diseases might be spread by transients or workers returning from camps

**Table 13-29: Potential Project Effects on Well-Being Conditions**

Location	Effect Attribute				Significant?
	Direction	Magnitude	Geographic Extent	Duration	
Inuvik	Adverse	High	Local	Short-term	No
Tuktoyaktuk, Paulatuk and Aklavik	Adverse	High	Local	Short-term	No
Fort McPherson and Tsiigehtchic	Adverse	Moderate	Local	Short-term	No
Holman and Sachs Harbour	Neutral	Low	Local	Short-term	No

**Table 13-30: Potential Project Effects on Delivery of Social Services**

Location	Effect Attribute				Significant?
	Direction	Magnitude	Geographic Extent	Duration	
Inuvik	Adverse	High	Local	Short-term	No
Tuktoyaktuk, Paulatuk, Aklavik	Adverse	High	Local	Short-term	No
Fort McPherson, Tsiigehtchic	Adverse	Moderate	Local	Short-term	No
Holman, Sachs Harbour	Neutral	Low	Local	Short-term	No

For measures to mitigate substance abuse, see Section 13.3.4.1, Community Well-Being and Delivery of Social Services.

The project proponents will work with GNWT Health and Social Services to design project health and work environment guidelines and procedures for:

- developing medical alert and quarantine protocols
- conducting fitness-for-work assessments
- assessing and caring for ill or injured workers
- enhancing communications and cooperation among medical personnel in the camps and regional and territorial health authorities

The project effects on health conditions during construction are expected to be adverse and of moderate magnitude in all of the Beaufort Delta Region communities (see Table 13-31). These effects will be of short-term duration, and none are significant.

**Table 13-31: Potential Project Effects on Health Conditions**

Location	Effect Attribute				Significant?
	Direction	Magnitude	Geographic Extent	Duration	
Inuvik	Adverse	Moderate	Local	Short-term	No
Other Beaufort Delta communities	Adverse	Moderate	Local	Short-term	No

Effects on health care services are driven by changes in community and regional health conditions, speculative in-migration and problems associated with the recruitment and morale of nurses. The GNWT is engaged in seeking to solve these recruitment and morale issues.

Mitigation measures to discourage speculative in-migration will reduce the risk of overburdening health care facilities (see Section 13.3.2.4, Demography and Population Mobility).

The project effects on the Tuktoyaktuk health care centre and on Inuvik Hospital in-patient services are expected to be adverse and high in magnitude. Effects on health care services in the other Beaufort Delta Region communities are expected to be adverse and moderate in magnitude (see Table 13-32).

**Table 13-32: Potential Project Effects on Health Care Services**

Location	Effect Attribute				Significant?
	Direction	Magnitude	Geographic Extent	Duration	
Tuktoyaktuk care centre	Adverse	High	Local	Short-term	No
Inuvik Hospital out-patient services	Adverse	High	Local	Short-term	No
Inuvik Hospital in-patient services	Adverse	Moderate	Regional	Short-term	No
Other Beaufort Delta Region health care centres	Adverse	Moderate	Local	Short-term	No

#### 13.3.4.3 Human Health Risks

During both construction and operations, the project will have no effects on air, water or soil quality that could induce adverse effects on the health of humans, plants or animals.

Concerns were expressed in some communities about emissions from diesel trucks parked with engines idling near communities. Relevant mitigation includes using vehicles that burn low-sulphur diesel fuel and avoiding idling engines in vehicles parked near communities. The effects of diesel exhaust on human health

**13.3.4.3 Human Health Risks (cont'd)**

are expected to be adverse, low-magnitude, local and short-term, and not significant.

**13.3.4.4 Public Safety and Protection Services**

Many RCMP detachments in the Beaufort Delta Region report that they are overburdened. During the Construction Phase, police will be affected by having to address any increased problems in the communities they serve, and occasional problems in camps.

Controlling alcohol and drug abuse will be the most effective way to mitigate many policing problems (see Section 12.3.4.1, Community Well-Being and Delivery of Social Services). However, because substance abuse problems are difficult to resolve, these measures will only be moderately effective.

Given the increased likelihood of substance abuse and derivative problems that the increased community earnings from project construction might bring, Construction Phase effects on local policing are expected to be adverse, high in magnitude in Inuvik, and from low to moderate in magnitude in other Beaufort Delta Region communities. The geographic extent will be local and of short-term duration. Thus, these effects are considered not significant.

There will be no need for mitigation and no residual effects on policing services during the Operations Phase.

**13.3.4.5 Education Attainment and Services**

Education attainment and services in the study area will be somewhat affected by the project. Some adolescents will respond to employment opportunities by leaving school prematurely, and some former dropouts might return to qualify for more training. Children of in-migrants could increase enrollment pressures. Therefore, enrollment pressures and project-related changes in education and training programs might increase or decrease. Some effects might tend to carry on from construction into operations.

The schools, project personnel and community members will seek to discourage adolescents from leaving school early. Measures previously described in Section 13.3.2.4, Demography and Population Mobility, to discourage in-migration to regional centres, which might increase enrolment, will be relevant as well.

Project construction and operations effects on education attainment, as well as on education facilities and services, are expected to be positive and adverse in all communities, and of moderate magnitude and local extent in Inuvik. The effects in the remaining Beaufort Delta Region communities are expected to be low in magnitude and local in extent.

Construction Phase effects on education facilities and services are expected to be positive and adverse, moderate in magnitude and local in Tuktoyaktuk, positive

and neutral, low in magnitude and regional in Inuvik, and generally neutral in the remaining study area communities.

During the Operations Phase, effects on education attainment are expected to be positive, moderate in magnitude, and local in Inuvik, and positive, low in magnitude and local in the other Beaufort Delta Region communities. Effects on education facilities and services in Inuvik and Tuktoyaktuk are expected to be positive, low in magnitude, local and regional in extent. In other Beaufort Delta Region communities, there would be no effect on education facilities and services during project operations.

None of the project effects on education attainment or education facilities and services are predicted to be significant for either the construction or the operations phases.

### 13.3.5 TRADITIONAL CULTURE

#### 13.3.5.1 Traditional Harvesting and Land Use

Two issues relate to traditional harvesting at Niglintgak:

- the effects of the barge option on marine harvest
- the project effects on harvesting activity generally

The Inuvialuit, and in particular the hunters and trappers' committees, have identified the Niglintgak barge option as an option that could affect traditional harvesting. During the public participation process, specifically, the Inuvialuit Settlement Region-Gwich'in Settlement Area Regional Workshop held in Inuvik, individuals expressed concerns about marine habitats in the region, and the effects that barge traffic and potential dredging would have on beluga whales, herring and marine birds in the Mackenzie Delta. According to participants, potential disturbances of the river bottom would affect the herrings' use of that area. This would, in turn, affect both the herring harvest by people and, potentially, the beluga's use of the region, as the herring is a food source for the whale. Additionally, the vibration resulting from the potential dredging and barge traffic could affect beluga and marine bird use of the region.

Although the barge option for the Niglintgak field could affect subsistence harvesting in the area, further information obtained from the ongoing traditional knowledge and environmental studies will better inform this assessment. The EIS biophysical effects assessment concluded that beluga habitat availability, movement and mortality are not expected to be significantly affected. Further, although some localized and short-term physical displacement could occur, it is unlikely that there would be a loss of harvesting opportunity.

A detailed mitigation plan will be prepared when the traditional knowledge studies currently underway provide spatial and temporal information related to sensitive traditional land use or subsistence harvesting areas. The bathymetric and environmental studies conducted during the summer of 2004 will also

**13.3.5.1 Traditional Harvesting and Land Use (cont'd)**

provide more detailed information related to potential dredging requirements and their subsequent effect on marine habitats.

Harvesting activities and seasonal wage employment are now symbiotic, because low incomes from trapping necessitate wage employment to pay for the expensive equipment now needed for efficient harvesting. The project will provide wage employment that might support harvesting equipment and expense requirements.

Project employment could jeopardize harvester lore and disciplines by pre-empting harvesting opportunities because of time needed for employment. Some Aboriginal workers might find the paid work more rewarding than harvesting, promoting interest in a southern lifestyle. However, Aboriginal workers could also react negatively and strengthen their appreciation of the more traditional relationships and the lifestyle they enjoy at home.

Elders are powerful influences for sustaining tradition. The project will aid their efforts and help meet the traditional food requirements of communities by providing Aboriginal workers with flexible work schedules to accommodate traditional pursuits, where feasible.

The project will also provide cultural-awareness training to workers and support community-based initiatives that promote traditional harvesting, lifestyles and positive community relationships, such as:

- traditional harvesting training camps for young people
- traditional skills proficiency demonstrations or competitions

Low-magnitude adverse effects on harvesting activity are expected in Inuvik (see Table 13-33). The availability of project employment in the Beaufort Delta Region is expected to have moderate adverse effects on harvesting in the other communities in the region.

Most employment opportunities generated by the project will end once construction and associated restoration activities are complete. Accordingly, no project effects on traditional harvesting or culture are expected.

**Table 13-33: Potential Mackenzie Gas Project Effects on Traditional Harvesting**

Location	Effect Attribute				Significant?
	Direction	Magnitude	Geographic Extent	Duration	
Beaufort Delta Region	Adverse	Moderate	Regional	Short-term	No
Inuvik	Adverse	Low	Local	Short-term	No

**13.3.5.2 Preserving Traditional Language and Culture**

The effects of the project on cross-generation transference of traditional language skills, and knowledge of, and identification with, traditional culture are central to

questions about language and culture retention. As in the case of resource harvesting, project influences might either strengthen or weaken language and culture.

Recent surveys have shown a decline in the use of Aboriginal languages in all regions. Fluency declined by 11% between 1989 and 1999 in the Northwest Territories as a whole. This erosion of fluency in Aboriginal languages is already strongly influenced by the use of English in the media, schools and most work situations. As a result, project employment will likely have little effect on language and cultural retention.

Nevertheless, to help counteract these influences, the project will support community-based initiatives that promote traditional culture, lifestyle and positive community relationships, such as:

- Aboriginal language-proficiency demonstrations or competitions
- cultural activities and events that are consistent with the proponents' principles and practices for community involvement

Workers will have access in camps to Aboriginal language reading material, radio and television broadcasts, and tapes and CDs, where available.

Because previous exposure to English has been so great, only low-magnitude adverse effects on traditional language and culture retention are expected in most communities. No effects are expected in Inuvik, Norman Wells, Yellowknife and Hay River (see Table 13-34). Most employment opportunities generated by the project will end once construction and associated restoration activities are complete. Accordingly, no project effects on traditional harvesting or culture are expected.

**Table 13-34: Potential Project Effects on Language and Culture Preservation**

Location	Effect Attribute				Significant?
	Direction	Magnitude	Geographic Extent	Duration	
Beaufort Delta Region	Adverse	Low	Regional	Short-term	No
Inuvik	Adverse	No effect	Local	Short-term	No

### 13.3.6 NON-TRADITIONAL LAND AND RESOURCE USE

The Niglintgak field is located within federal crown lands. No impact on land ownership is expected because of this development.

There is little physical presence on the landscape affecting visual or aesthetic value. Oil and gas exploration activities have previously taken place in the Niglintgak field area, and it is unlikely that the lands will be developed for other than oil and gas production purposes. Activities taking place at Niglintgak throughout the life of the field could affect tourism activities, mostly through aesthetic impacts. No specific tourism activities have been identified as occurring

## 13.3.6 NON-TRADITIONAL LAND AND RESOURCE USE (cont'd)

near Niglintgak. However, there could still be occasional recreational use of the area. The quality of recreational activities in the area could be affected by sensory disturbance from increased traffic, noise and emissions during construction, particularly for those activities that could be enjoyed by local community members, such as snowmobiling.

Table 13-35 shows the combined effects of the Mackenzie Gas Project on non-traditional land and resource use for the Beaufort Delta Region.

**Table 13-35: Potential Project Effects on Non-Traditional Land and Resource Use**

Valued Component	Impact	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
Granular resources	Decrease in available land base for granular extraction	Neutral to adverse	No effect to low	Local	Short-term to long-term	No
	Change to existing granular operations	Positive or adverse	Moderate	Local to regional	Short-term	No
		Positive	Low	Regional	Long-term	No
	Loss of granular resources	Adverse	Moderate	Regional	Short-term to long-term	No
		Adverse	Low	Regional	Long-term	No
Net effect on granular resources	Adverse	Low	Regional	Long-term	No	
Oil and gas activities	Decrease in available land base for other oil and gas activities	Adverse	Low	Local	Short-term to long-term	No
	Changes in other oil and gas activities	Positive to adverse	No effect to low	Local to regional	Short-term to long-term	No
Non-traditional resource harvesting	Decrease in available land base for resource harvesting activities	Adverse	Low	Local	Short-term to long-term	No
	Change in non-traditional hunting and fishing success	Adverse	Low to moderate	Regional	Short-term	No
		Neutral to adverse	No effect to low	Local	Long-term	No
Change in resource harvesting opportunities	Positive or adverse	Low	Local	Short-term to long-term	No	
Tourism and recreation	Decrease in available land base for tourism and outdoor recreation activities	Neutral to adverse	No effect to low	Local to regional	Short-term to long-term	No
	Change to tourism and recreation activities	Neutral to adverse	No effect to low	Local to regional	Short-term	No
		Positive to adverse	No effect to low	Local to regional	Long-term	No
	Change in quality of tourism and outdoor recreation	Neutral to adverse	No effect to low	Local to regional	Short-term	No
		Positive to adverse	No effect to low	Local to regional	Long-term	No
Change to summer tourist and recreational boat traffic in the Mackenzie River and Mackenzie Delta	Neutral to adverse	No effect to low	Local to regional	Short-term to long-term	No	

**13.3.6.1 Protected Areas**

Project effects on environmentally protected areas in the Inuvialuit Settlement Region are discussed on a regional basis, as the effects are geographically specific. The land and resource use that takes place in these protected areas is governed by the land-use categories identified in the Community Conservation Plans (CCPs) in the Inuvialuit Settlement Region. They range from Category A, lands with no known significant and sensitive cultural or renewable resources, to Category E, lands where cultural or renewable resources are of extreme significance and sensitivity.

Development of Niglintgak will result in a decrease in the total land base of the Kendall Island Bird Sanctuary for the life of the project. This could result in an adverse effect on the protected resources within this area, specifically the migratory birds. Activities that occur in the winter will not have a marked effect on the sanctuary, as no birds are present during this time. However, some spring and summer activities will be required, and these activities could affect the migratory bird population that uses the Kendall Island Bird Sanctuary.

Niglintgak is located within several areas designated as Inuvialuit Category C lands for:

- spring goose harvesting
- fall goose harvesting
- important migratory bird habitat

The Inuvialuit CCPs allow development within these areas, but recommend managing these areas to eliminate, to the greatest extent possible, potential damage and disruption. It is expected that this recommendation will be met following implementation of project mitigation measures.

The proposed route for bringing the barge-based processing facility to the Niglintgak site is around Alaska to the Tuktoyaktuk area, through Kittigazuit Bay, up the East Channel of the Mackenzie River and then down the Middle Channel of the Mackenzie River to the Niglintgak site. The Kittigazuit Bay area includes a Beluga Management Zone 1A and is classified as Category E by the Inuvialuit CCPs. All zones classified as Beluga Management Zone 1A are under consideration to become Marine Protected Areas.

The *Beaufort Sea Beluga Management Plan* states:

*All shipping activities (including dredging) should be confined to designated routes and areas. Passage through or close to Zone 1 outside of designated routes, even if it is the shortest route, should be avoided from breakup to August 15.*

This indicates that dredging and shipping are permitted within zones classified as Beluga Management Zone 1A at all times of the year, as long as the activity is taking place along a designated route. The plan also indicates that designated routes are “those marine transportation corridors established, following

**13.3.6.1 Protected Areas (cont'd)**

consultation with the Department of Fisheries and Oceans, by Transport Canada.”

The EIS biophysical effects assessment has concluded that beluga habitat availability, movement and mortality are not expected to be significantly affected. Furthermore, although some localized and short-term physical displacement could occur, it is unlikely that there would be a loss of harvesting opportunity.

**13.3.6.2 Visual and Aesthetic Resources**

Terrain features limit the line-of-sight to areas on and around Niglintgak, but a new industrial presence in the area and associated lighting will be noticeable to land travellers and people in aircraft.

No significant effects are expected. Visual and aesthetic resources will be most noticeable on the ground at a local scale or from the air on a regional level.

**13.3.7 HERITAGE RESOURCES****13.3.7.1 Archaeological Investigations**

Heritage resources are non-renewable resources that might be located at or near the ground surface and, therefore, are highly susceptible to any activities disturbing the ground. They are defined and managed by GNWT legislation.

Based on community and regulatory input, the key issues relating to heritage resources include loss of, or damage to, historical, cultural, archaeological and palaeontological resources. The methods used for project-focused field reconnaissance and heritage resources impact assessment are considered standard for archaeological investigations of this type in the region. As the infrastructure and borrow sites are not specific to the anchor fields, they are included in this discussion.

For the anchor fields, including Niglintgak, two crews of three to four people completed investigations in the summer and fall of 2002 and 2003. Areas of investigation were selected based on aerial photographs, NTS map analysis and helicopter overflight. Field investigations involved qualitatively assessing the heritage resource potential of each proposed development area and photographing the locations investigated. Because of the large area encompassed by these anchor fields, only parts of each were subject to ground inspection.

Fifty-one heritage resource sites were recorded in the Inuvialuit Settlement Region. Only two are located within the Niglintgak study area. Heritage Resource Impact Assessments will be completed before development begins.

### 13.3.7.2 Infrastructure Investigations

Twelve infrastructure locations were inspected in the Inuvialuit Settlement Region as part of the 2002 focused reconnaissance, and an additional nine locations were investigated in 2003. Some assessment-level investigations were possible in 2003 because of the more refined level of location information available. Two prehistoric sites and four historic sites have been recorded as being in potential conflict with production area infrastructure.

### 13.3.7.3 Borrow Site Investigations

Seventeen borrow sites were inspected in the Inuvialuit Settlement Region as part of the granular resource component of the 2002 reconnaissance. In 2003, 15 borrow sites were subject to reconnaissance and assessment-level investigations. For most of the locations, the level of investigation was typically concentrated on a limited area. Because of scheduling issues, definitive alignments were not available for the access roads associated with the borrow sites. Therefore, few access roads were inspected. Seven sites were inspected, including both prehistoric and historic sites. These were recorded as being in potential conflict with the borrow sites.

A list of all sites identified is contained in EIS Volume 6: Socio-Economic Impact Assessment.

The studies completed to date have focused on key resources and landforms within zones that might be developed for the project, with the intent of assisting in planning future research strategies and formulating recommendations for the final impact assessment. The heritage resources program designed for the project recognizes these uncertainties and has adopted a staged approach that will provide increasing levels of precision for assessment of the heritage resource effects of the project. When full information on present resources and expected effects is gathered, mitigation programs will be implemented to offset or reduce predicted negative effects. Without the information that will be forthcoming as the project unfolds and is approved, mitigation can only be discussed in general terms. Mitigation strategies are usually devised when full information on effects is known, and are made in consultation with the regulatory agency responsible for heritage resource management in the Northwest Territories – the Prince of Wales Northern Heritage Centre.

## 13.3.8 TRADITIONAL KNOWLEDGE

Traditional knowledge studies are being conducted with affected communities in relation to the project sites and activities in the Niglintgak area. Traditional knowledge is being collected to help in project planning and to provide information for the regulatory process. As the traditional knowledge studies are still underway, supplemental information will be provided to northern regulators and the Joint Review Panel on this subject. As an interim measure, existing traditional knowledge sources have been reviewed and considered in the EIS. For further information on the traditional knowledge study process, see EIS Volume 1: Overview and Impact Summary.

**13.3.8 TRADITIONAL KNOWLEDGE (cont'd)**

Traditional knowledge studies underway have been designed with community input and participation. Community or regional organizations have been engaged to undertake traditional knowledge studies relevant to the project.

The traditional knowledge program includes:

- reviewing existing information
- collecting and validating new information
- producing traditional knowledge baseline reports

Traditional knowledge working groups have been established in the Inuvialuit Settlement Region and the Gwich'in Settlement Area. The purpose of the working groups is to develop a framework, determine content, establish a schedule and provide guidance for the traditional knowledge study.

Once the research is undertaken, the studies are expected to document data related to such topics as:

- mammals
- birds
- fisheries
- vegetation
- surface and groundwater flows
- historical, cultural and spiritual sites

The data collected during the traditional knowledge program will be integrated with the other components of the environmental and socio-economic studies being undertaken for the project. Available and relevant traditional knowledge will be given full consideration and incorporated into each of the studies associated with the project.

As the community and regional traditional knowledge studies are still underway, existing traditional knowledge sources have been reviewed as an interim measure to provide as much information as possible for the EIS, pending completion of the community studies. The information collected during this review has been provided to appropriate members of the project environmental team for use in the EIS, and will be distributed to traditional knowledge working groups that have not completed their studies. The working groups will be asked to review and validate the documented information and will be encouraged to incorporate any relevant information into the traditional knowledge studies being conducted.