

**ENVIRONMENTAL AND SOCIO-ECONOMIC
IMPACTS****APPLICATION FOR APPROVAL OF
THE DEVELOPMENT PLAN FOR
TAGLU FIELD
PROJECT DESCRIPTION****INTRODUCTION****12.1.1 SCOPE**

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

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

Key issues for northern communities discussed in the EIS 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

12.1.2 OBJECTIVES

The objectives of the EIS are to:

- contribute to the development of the Taglu field in a way that enhances benefits and reduces adverse biophysical and social effects
- address issues raised by communities
- 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
- identify suitable management and mitigation measures for development-specific effects and determine the residual effects

12.1.2 OBJECTIVES (cont'd)

- 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

12.1.3 APPROACH**12.1.3.1 Methods**

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

12.1.3.2 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.

12.1.3.3 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.

12.1.3.4 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 Taglu field development.

12.1.3.5 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.

12.1.3.6 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 biophysical 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

A positive or adverse socio-economic effect is considered significant if the effect is:

- high in magnitude, and extends over the long term
- high in magnitude and extends beyond the local study area at any time
- moderate in magnitude, extends over the long term and occurs outside the regional study area

12.1.3.7 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

12.1.3.7 Public Participation (cont'd)

- 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 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

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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PROJECT DESCRIPTION****BIOPHYSICAL IMPACTS****12.2.1 SCOPE**

The biophysical resources evaluated for the Taglu 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 Taglu field development.

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

12.2.2 AIR QUALITY

Air quality effects during construction at Taglu 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

12.2.2 AIR QUALITY (cont'd)

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

No significant effects on air quality are predicted (see Table 12-1). Of the 12 key indicators, the predicted magnitude of effect is low, i.e., <1% of the guideline, for six of them. Effects for the 1-hour, 24-hour and annual NO₂, 1-hour and 8-hour CO and 24-hour PM_{2.5} 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 12-1: Potential Effects of Taglu Activities on Air Quality

Key Indicator	Phase When Impact Occurs	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
1-hour sulphur dioxide (SO ₂)	Operations	Adverse	Low	Local	Long-term	No
24-hour SO ₂	Operations	Adverse	Low	Local	Long-term	No
Annual SO ₂	Operations	Adverse	Low	Local	Long-term	No
1-hour nitrogen dioxide (NO ₂)	Operations	Adverse	Moderate	Local	Long-term	No
24-hour NO ₂	Operations	Adverse	Moderate	Local	Long-term	No
Annual NO ₂	Operations	Adverse	Moderate	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 _{2.5})	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.

12.2.3 NOISE

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

No significant effects on noise levels are predicted from operations at Taglu (see Table 12-2).

Table 12-2: Potential Effects of Taglu 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	Moderate	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, which might include silencers or 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 41 dBA
- predicted maximum well-test flaring noise is 41 dBA
- predicted maximum production facility operational noise is 40 dBA

12.2.4 GROUNDWATER

The potential effects of Taglu 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.

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 12-3).

12.2.5 HYDROLOGY

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

12.2.5 HYDROLOGY (cont'd)

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

Table 12-3: Potential Effects of Taglu 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:

- controlling the release of runoff water to the watershed
- designing for thaw settlement and monitoring temperatures to confirm design assumptions
- conducting visual inspections to monitor drainage conditions and sediment control devices within the Taglu production area
- monitoring visually for effects of land subsidence resulting from gas extraction

No significant effects on hydrology are predicted. Most effects will be low and local (see Table 12-4).

12.2.6 WATER QUALITY

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

- water withdrawals and wastewater releases
- leaks and spills
- suspended sediment inputs from land disturbance

Mitigation strategies to limit effects on water quality include:

- treating wastewater to meet appropriate water quality for discharge

- using deep well injection for produced water and drilling cuttings disposal
- controlling runoff and sediment during construction
- revegetating disturbed areas
- preventing leaks and containing spills
- following all requirements of water use permits
- monitoring waterbodies affected by test water releases

Table 12-4: Potential Effects of Taglu 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	Local	Medium-term	No
	Operations	Adverse	Low to moderate ¹	Local	Long-term	No
	Decommissioning and abandonment	Neutral	No effect	N/A	N/A	No
Sediment concentration	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
Channel morphology	Construction	Neutral	No effect	N/A	N/A	No
	Operations	Adverse	Low to moderate ¹	Local	Long-term	No
	Decommissioning and abandonment	Neutral	No effect	N/A	N/A	No
Note: 1. Moderate magnitude effects are related to land subsidence from gas extraction. N/A = Not applicable because no effects have been predicted.						

No significant effects on water quality are predicted. Effects on water and sediment quality will be low and local during all field development phases (see Table 12-5).

Table 12-5: Potential Effects of Taglu 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	Local	Medium-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Long-term	No

12.2.7 FISH AND FISH HABITAT

The potential effects of Taglu 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

Mitigation strategies to reduce the effects on fish include:

- controlling erosion and sediment
- preventing spills and leaks, and preparing contingency plans
- avoiding spawning, rearing and overwintering fish habitats

No significant effects on fish are predicted (see Table 12-6).

Table 12-6: Potential Effects of Taglu Activities on Fish

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

12.2.8 SOILS, LANDFORMS AND PERMAFROST

The potential effects of Taglu 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 Taglu to reduce effects on soils and landforms include:

- reducing surface disturbance
- controlling erosion
- stabilizing slopes
- monitoring the effects of thaw settlement, soil erosion, slope movement and drainage conditions at selected sites within the Taglu lease

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 12-7).

Table 12-7: Potential Effects of Taglu 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	Long-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 ¹	No
	Operations	Adverse	Low	Local	Far future ¹	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	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.						

12.2.9 VEGETATION

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

- vegetation loss during construction
- dust and air emissions

12.2.9 VEGETATION (cont'd)

- 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

No significant effects on vegetation are predicted (see Table 12-8). 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 12-8: Potential Effects of Taglu Activities on Vegetation Abundance and Distribution

Valued Component	Phase When Impact Occurs	Effect Attributes				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
Vegetation types	Construction	Adverse	Low	Local	Long-term	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 (see Table 12-9). These effects will not extend beyond the life of the Taglu field.

Table 12-9: Potential Effects of Taglu Activities on Vegetation Health

Valued Component	Phase When Impact Occurs	Effect Attributes				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
Vegetation types	Construction	Adverse	Low	Local	Medium-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Adverse	Low	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.

12.2.10 WILDLIFE

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

- reduced habitat resulting from direct loss of habitat from construction, or sensory disturbance that causes wildlife to avoid areas
- increased mortality because hunters and predators can access wildlife more readily along the winter road

Mitigation strategies to reduce effects on wildlife include:

- developing and implementing operating guidelines to:
 - address potential effects to 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
- establishing reclamation plans to re-establish wildlife habitat
- managing waste effectively to avoid attracting wildlife

12.2.10 WILDLIFE (cont'd)

No significant effects on wildlife habitat availability are predicted. Effects on wildlife habitat availability will be low in magnitude and local in geographic extent (see Table 12-10).

Table 12-10: Potential Effects of Taglu 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 ¹	Construction	Adverse	Low	Local	Long-term	No
	Operations	Adverse	Low	Local	Long term	No
	Decommissioning and abandonment	Adverse	Low	Local	Long term	No

Note:

1. Bird species addressed in the effects assessment include great white-fronted goose, snow goose, tundra swan, scap, peregrine falcon, whimbrel and Arctic tern.

No significant effects on wildlife movement are predicted. The effects on wildlife movement in the area will be low and local, primarily as a result of sensory disturbance from human activity (see Table 12-11).

Table 12-11: Potential Effects of Taglu Activity on Wildlife Movement

Valued Component	Phase When Impact Occurs	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
Barren-ground 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

No significant effects on wildlife mortality are predicted (see Table 12-12). 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 barren-ground grizzly bear mortality.

12.2.11 CUMULATIVE EFFECTS

An assessment of cumulative effects concluded that:

- the Taglu field development will not contribute to significant cumulative effects

- no significant overall cumulative effects are predicted
- the Mackenzie Gas Project development 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 12-12: Potential Effects of Taglu Activity on Wildlife Mortality

Valued Component	Phase When Impact Occurs	Effect Attributes				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	No effect	N/A	N/A	No

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

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The socio-economic factors considered for the Taglu field were the effects on:

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

The socio-economic effects described 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 Taglu field development cannot be distinguished from those of all components acting together.

The cumulative effects on these factors were also assessed.

No significant adverse effects are predicted. 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.

12.3.2 REGIONAL ECONOMIC EFFECTS

The Mackenzie Gas Project will generate a large demand for goods, services and labour at various locations in the Northwest Territories.

The project impacts on the economy were assessed by considering:

- 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

12.3.2 REGIONAL ECONOMIC EFFECTS (cont'd)

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

12.3.2.1 Capital and Operating Expenditures

The total capital expenditure for all Mackenzie Gas Project components is \$7,732 million, in constant 2003\$ Cdn (see Table 12-13). The Taglu field development expenditures are \$935 million.

Table 12-13: Mackenzie Gas Project Capital Expenditures

Activity	Expenditure Timing	Total (\$Million)	Taglu (\$Million)
Pre-construction	January 1, 2002 to June 30, 2006	845	108
Construction	July 1, 2006 to June 30, 2010	6,247	446
Ongoing capital	July 1, 2010 to December 30, 2023	639	381
	Total	7,732	935

Table 12-14 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)

Table 12-14: 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	55	927	49	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 expenditure 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 the capital expenditures 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 annual average operating expenditure for the Taglu field is about \$19 million between 2010 and 2035. Nearly all of this expenditure will occur in the ISR. The total project operating expenditure is about \$140 million during this period.

12.3.2.2 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 12-15).

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 12-15: 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 was applied to about half the unemployed workforce, because this condition 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.

12.3.2.2 Employment (cont'd)

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 12-16 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.

Table 12-16: Project Employment Demand in the ISR and GSA

Type of Demand	Number of Jobs					
	2006–2007	2007–2008	2008–2009	2009–2010	Total	Average
Inuvialuit Settlement Region						
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
Total	374	881	1,622	901	3,778	945
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
Total	118	205	262	100	685	171
Gwich'in Settlement Area						
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
Total	1,633	3,459	2,528	287	7,907	1,977
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
Total	372	459	469	287	1,586	397
Note: Numbers might not add up because of rounding.						

12.3.2.3 Labour Income

Project-related construction employment will lead to increased household income in the regions. Project construction will lead to an estimated 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 12-17).

Table 12-17: 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)
Inuvialuit Settlement Region						
Direct	2	9	12	3	26	6
Indirect	3	3	3	3	11	3
Induced	1	1	1	1	3	1
Total	5	13	16	7	40	10
Gwich'in Settlement Area						
Direct	12	13	14	3	41	10
Indirect	6	7	7	11	30	8
Induced	2	2	2	2	9	2
Total	19	22	23	16	80	20
Grand Total	24	35	39	23	120	30
Note: Numbers might not add up because of rounding.						

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 12-18). 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 12-19).

Table 12-18: 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
Inuvialuit Settlement Region					
Direct	136	207	54	49	113
Indirect	8	19	5	5	9
Induced	4	10	3	2	5
Total	148	236	62	56	127
Gwich'in Settlement Area					
Direct	40	37	37	37	38
Indirect	68	129	52	50	74
Induced	34	64	26	25	37
Total	142	230	115	112	149
Grand Total	290	466	177	168	276
Note: Numbers might not add up because of rounding.					

12.3.2.3 Labour Income (cont'd)

Taglu field construction will contribute about 255 people to the total project employment demand between 2006 and 2010 (see Table 12-20).

Drilling and completion activities at Taglu will generate 209 onsite jobs during 2007–2008 and 2008–2009. A total of 418 onsite jobs will be generated over the two years of drilling activities (see Table 12-21).

Once fully operational, the Taglu field will require 23 full-time equivalent (FTE) operations employees (see Table 12-22), including three trainees and nine FTE contract maintenance personnel. These positions will be rotational.

Table 12-19: 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)
Inuvialuit Settlement Region					
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
Total	12.2	19.0	4.9	4.5	10.3
Gwich'in Settlement Area					
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
Total	8.9	13.0	7.5	7.3	9.1
Grand Total	21.1	32.0	12.4	11.8	19.4
Note: Numbers might not add up because of rounding.					

Table 12-20: Taglu Field Peak Construction Employment

Staffing Classification	2006–2007	2007–2008	2008–2009	2009–2010	Total
Supervisors	8	8	19	0	35
Welders	0	2	35	0	37
Teamsters	50	0	4	0	54
Operators	12	14	6	0	32
Labourers	0	0	7	0	7
Other	2	8	47	0	57
Inspectors	2	3	7	0	12
Camp and catering personnel	6	5	10	0	21
Camp infrastructure personnel	0	0	0	0	0
Camp logistics personnel	0	0	0	0	0
Total	80	40	135	0	255

Table 12-21: Taglu Onsite Drilling, Completions and Related Employment

Drilling and Completions	2007–2008	2008–2009	Total
Supervisors, technical, administrative	15	15	30
Surveyors, monitors, safety	8	8	16
Equipment operators	23	23	46
Construction labourers	0	0	0
Welders	4	4	8
Electrician	2	2	4
Mechanic	4	4	8
Camp staff – cooks	28	28	56
Drilling crew personnel	46	46	92
Specialty drilling services	79	79	158
Total	209	209	418

Table 12-22: Taglu Operations Labour Force Requirements

Position	Number of Jobs
Manager	0
Administrative support	0
Professional staff	0
Driver	0
Labourer	0
Millwright	2
Pipefitter	0
Electrician	2
Control room operator	2
Field operator	8
Subtotal	14
Maintenance contractor	9
Total	23

Specific economic effects cannot be attributed to the Taglu field. The Inuvialuit Settlement Region and Gwich'in Settlement Area economies will respond to the overall project demand. 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 12-23). 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 12-23: Economic Effects of the Project and Taglu 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

12.3.2.4 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 Taglu 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 12-24 shows the project-related effects on population mobility during construction.

Table 12-24: 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

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 12-25 shows the project-related effects during operations.

Table 12-25: Potential Operations Effects on Population Mobility

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

12.3.3 INFRASTRUCTURE**12.3.3.1 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
- 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 12-26).

Table 12-26: 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

12.3.3.1 Transportation (cont'd)

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.

12.3.3.2 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 the project might attract to the study area.

12.3.3.3 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 12.3.2.4, 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 12-27). 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 12-27: 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

12.3.3.4 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 12.3.2.4, 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.

12.3.3.5 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.

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

12.3.3.5 Governance (cont'd)

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.

12.3.4 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 which 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.

12.3.4.1 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, including alcohol and drug testing

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 12-28 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.

Table 12-28: 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

The effects on social service delivery are shown in Table 12-29. They generally parallel well-being conditions. All are expected to be short-term and not significant.

Table 12-29: 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

12.3.4.2 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.

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

12.3.4.2 Health Conditions and Health Care Services (cont'd)

- 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

For measures to mitigate substance abuse, see Section 12.3.4.1, 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 12-30). These effects will be of short-term duration, and none are significant.

Table 12-30: Potential Project Effects on Health Conditions

Location	Effect Attributes				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 12.3.2.4, 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 12-31).

Table 12-31: Potential Project Effects on Health Care Services

Location	Effect Attributes				Significant?
	Direction	Magnitude	Geographic Extent	Duration	
Tuktoyaktuk health 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

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

12.3.4.4 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.

12.3.4.5 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 enrolment pressures. Therefore, enrolment 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 12.3.2.4, 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.

12.3.5 TRADITIONAL CULTURE

12.3.5.1 Traditional Harvesting and Land Use

Harvesting 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 and 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 12-32). 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.

Table 12-32: 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

Most employment numbers and opportunities generated by the project will end once construction activities are complete. As relatively few technical operations and maintenance staff will be stationed at Inuvik and Norman Wells, the project is not expected to have any effect on traditional harvesting and land use during operations.

Specifically, the Taglu development has been identified by the Inuvialuit as potentially affecting traditional harvesting. The location of the anchor field in the Kendall Island Bird Sanctuary could result in an adverse effect on migratory bird use of the area and, therefore, affect traditional harvesting of these species.

12.3.5.2 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

12.3.5.2 Preserving Traditional Language and Culture (cont'd)

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 12-33). 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 12-33: Potential Project Effects on Language and Culture Preservation

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

12.3.6 NON-TRADITIONAL LAND AND RESOURCE USE

The Taglu 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 Taglu field area, and it is unlikely that the lands will be developed for other than oil and gas production purposes. Activities taking place at Taglu throughout the life of the field could affect tourism activities, mostly through aesthetic impacts. No specific tourism activities have been identified as occurring near Taglu. 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 12-34 shows the combined effects of the Mackenzie Gas Project on non-traditional land and resource use for the Beaufort Delta Region.

Table 12-34: 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

12.3.6.1 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 Taglu 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 to 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 Kendall Island Bird Sanctuary.

Taglu 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.

12.3.6.2 Visual and Aesthetic Resources

Terrain features limit the line-of-sight to areas on and around Taglu, 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.

12.3.7 HERITAGE RESOURCES**12.3.7.1 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 or

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 Taglu, 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 one is located within the Taglu study area, and it is a buried prehistoric site on the south side of the Kuluarpak Channel. Heritage Resource Impact Assessments will be completed before development begins.

12.3.7.2 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 in potential conflict with production area infrastructure.

12.3.7.3 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 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

12.3.7.3 Borrow Site Investigations (cont'd)

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.

12.3.8 TRADITIONAL KNOWLEDGE

Traditional knowledge studies are being conducted with affected communities in relation to the project sites and activities in the Taglu 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.

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.

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.