

THE LAND

The Mackenzie Gas Project stretches from the Mackenzie Delta to the forests of northwestern Alberta. As a result, there are big differences in the land from one part of the Project to another. This also means that people use the land differently, depending on where they live. The environmental assessment considered these differences. Our studies focused on understanding how the Project will affect the way people use the land in different regions.

Overall, we examined how the Project might affect characteristics of the land, including air quality, noise, landforms, permafrost, soils, vegetation, water, fish and wildlife. This section also discusses climate change and cumulative effects.

Air Quality

Air quality was measured at various proposed facility locations and is typical of northern environments in Canada. At present, human activities have little effect on air quality outside of communities.

Potential Effects and Project Actions

Most of the effects on air quality will be during operations. Exhaust from compressor stations and heaters will be within guidelines, keeping air quality at safe levels for both people and the environment.

Noise

As with air quality, sounds outside communities are typical of northern environments. They are the sounds of nature – wind and water, animals and birds.

Potential Effects and Project Actions

Project noise will come from construction equipment, facility operations, drilling and well-test flaring. Much of the Project noise will be in the production area in the Delta, where flaring (burning off gas) during drilling and well testing will take place over the first few years of development. At 1.5 kilometres from the site, under normal operation, the noise will be about the same as typical background noise in a library or beside a flowing stream.

Along the pipeline route, compressor facilities will be the main contributors to noise. These stations will operate for the life of the Project. Noise levels from



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compressors will be low, and might be heard faintly by someone 1.5 kilometres from the facility.

Our facilities will meet regulatory noise guidelines.

To achieve this, we will:

- Use noise controls, such as silencers and insulation, that will help keep noise levels down in buildings.
 - Schedule noisy activities when they will least affect people and the environment.
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Landforms, Permafrost and Soil

The landforms, soil, types of vegetation and wildlife

Potential Effects and Project Actions

The Project has been designed to reduce land disturbance. For example, we have shortened the length of the pipeline route and the area planned for facilities. Disturbed sites will be reclaimed when they are no longer needed.

During construction, the land surface could be disturbed, vegetation could be removed, and with it, the land's protective insulating layer. This could change the temperature of the land surface. Temperature change of the land surface might cause settlement when permafrost melts or frost heave occurs when previously unfrozen ground freezes along the pipeline rights-of-way or at facilities. We will monitor and repair these effects where necessary. We will also monitor possible soil erosion, slope movement and changes to drainage conditions where required.

Drilling for and production of natural gas from some places in the Mackenzie Delta could cause the local ground surface to "subside" or sink slowly, up to 0.3 to 0.5 metres, over the 30-year life of the Project. The effects are expected to be small, but might lead to more frequent flooding of nearby areas and some land areas covered permanently by water.

Vegetation

Vegetation in the Mackenzie Delta and Valley ranges from treeless tundra in the Delta to heavily forested areas at the southern end of the pipeline corridor. Trees are larger in the south than in the north because growing conditions are better in the south. Large areas of forest in the Mackenzie Valley have burned in recent years.

Rare plants and uncommon vegetation types occur throughout this region. Some plants are used for traditional purposes, such as food, medicine, ceremonies or materials.

Potential Effects and Project Actions

Project construction will result in loss and alteration of vegetation through changes in site conditions or the addition of reclamation species. Clearing and grading for Project construction will result in loss of vegetation, while changes to landforms and soil could result in different vegetation.

Effective design and construction practices will be used so the Project does not significantly affect the amount or health of vegetation, including rare plants. To lessen these effects, we considered ways to reduce the size of the disturbance, such as reducing route length and size of facility footprints, and flagging or fencing sensitive areas. Rare plants will be identified before construction and measures taken to avoid them. Other plans include monitoring and controlling weeds, and reclaiming sites at the end of their use.

However, vegetation might take many years to recover from the disturbance, especially in the tundra and northern forests where soils are cold.

After construction, recovering vegetation in disturbed areas could look different on the landscape for many years. Project sites such as gravel pads, gravel pits and quarries could have changes in the types of native plants that grow.

Groundwater

Groundwater is water below the surface of the ground. In the far North, shallow groundwater movement only occurs close to the surface because groundwater is frozen at deeper levels as permafrost. Groundwater can affect how facilities and pipelines are built. In permafrost areas, groundwater has an effect on whether the soil will remain in place or move.

In addition, groundwater is sometimes an important source of water for streams and lakes. In areas with permafrost, most streams freeze to the bottom in winter. However, fish can live all year in streams where groundwater keeps flowing.

Potential Effects and Project Actions

The Project could potentially affect groundwater through disruption of natural flow. For example, changes to permafrost can happen when vegetation is cleared and could cause changes to groundwater flow patterns. Likewise, removing material at sand and gravel pits could change how rain and melt water flows into groundwater or where seeps and springs occur.

Effects on groundwater from Project-related activities will happen only near facilities and along the pipelines. Most changes to groundwater from the Project will not be greater than natural changes, but some could be permanent. The most important effect is where ice, called "frost bulbs," could form

around the pipe, pushing soil up or causing it to sink. This action might cause slumps on side slopes, change the flow of water in streams during the winter, or cause more ice to develop on the surface of the ground.

We will use measures to limit the effect on groundwater. These include controlling water drainage and monitoring the effects of groundwater on soil movement. We will also look for signs of permafrost changes and soil sinking along the pipeline ditch. Leaving some sand and gravel in place in the pipeline ditch will help keep the natural flow of groundwater.

Rivers, Streams and Lakes

The Mackenzie River is the longest river in Canada. It begins at Great Slave Lake in the NWT and flows north into the Arctic Ocean. A large river, it carries huge amounts of sediment that settle out of the water, creating the Mackenzie River Delta.

The Mackenzie Delta, part of the Mackenzie River system, is the largest delta in Canada. It is made up of large and small channels as well as lakes. The freshwater delta lakes are flooded each spring during break up. These lakes are affected by their connection with the delta channels and the length of time the spring flooding lasts.

Both Niglintgak and Taglu experience spring flooding. Parsons Lake is located on higher ground and does not flood.

The entire pipeline system crosses more than 500 watercourses that vary from small, seasonal streams to large rivers. The amount of flow in these streams and rivers is highest between May and June.

Potential Effects and Project Actions

Most of the time, the Project will have little effect on streams and lakes. However, effects could sometimes occur, such as constructing a pipeline trench at a stream crossing, or dredging the river bottom to move and position a barge. This would increase the amount of sediment in the water. Also, frost bulbs could cause ice to build up and disrupt the stream flow.

We will use a wide variety of ways to limit any effects on streams and lakes. Examples of these are:

- Removing sediment from water that runs across construction sites before releasing the water back into streams or lakes.
- Reducing the time and the amount of work done in the water.
- Keeping activities that disturb the ground away from streams and lakes.
- Recording the amount of water taken from streams and lakes to ensure we do not use too much water.

We will also look at how well the methods we have used to protect lakes and rivers are working.

Water quality might also be affected by leaks, spills, and disposal of waste water. We will take steps to ensure water quality is not affected by these events. The Project also includes practices to prevent leaks and spills and will have emergency response plans in place.

We will monitor water bodies and test any waste water before it is released to ensure it will not harm the environment. Unclean waste water will be treated before it enters streams or lakes. Waste water or drilling waste might be injected into deep wells, sent to a remote disposal site, or transported to approved water treatment and disposal sites. These are all proven technologies already being used in Canada.

Fish and Fish Habitat

Many types of fish live in the Mackenzie Valley streams, rivers and lakes. The Mackenzie River system, including the delta channels and lakes, supports 41 types of fish. The freshwater fish of the Mackenzie Valley include Arctic grayling, northern pike, longnose sucker, slimy sculpin and lake chub. Many freshwater fish are harvested for food commercially, or caught for local consumption or recreation.

The number of fish species in the Mackenzie River is higher than is usually found in other rivers in northern latitudes.

Potential Effects and Project Actions

Fish can be affected when their habitat is disturbed or when water quality changes. This could occur when work needs to be done in the streams or when substances enter the water. The Project will carry out many plans to protect the fish and their habitat. For example, these include:

- Avoiding habitats used for spawning, rearing and staying over the winter.
 - Ensuring the Project does not noticeably change water quality of streams or lakes.
 - Replacing habitat that is damaged by the Project.
 - Reducing the amount of time construction equipment is in the water.
 - Not allowing construction workers to fish while on the job site.
 - Keeping water containing sediment or other substances from construction sites from running into streams or lakes.
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Wildlife

The culture and identity of people in northern communities are connected to wildlife and the land.

Human activities can affect the health, location and numbers of wildlife. For example, the amount and quality of habitat available to wildlife affects the number and general health of animals. Animals are also affected by whether they can move freely across the land. People can protect wildlife by preserving their habitat, allowing freedom of animal movement, and managing the number of animals and birds killed by people or predators.

Potential Effects and Project Actions

Potential effects of the Project on wildlife might come from:

- Changes to habitat because of construction, or because animals avoid areas close to Project facilities and activity.
- Barriers that affect animal movement.
- Increased death of wildlife because problem animals are killed.
- Better access for hunters and trappers.

We considered how the Project might affect species important to communities. These include grizzly bear, polar bear, barren-ground and woodland caribou, moose, marten, lynx, beaver, beluga whale, bowhead whale, ringed seal, and several bird species.

The amount of habitat lost because of construction will be small in comparison to the large area of the Mackenzie Delta and Valley. Also, the Project will not prevent wildlife from moving across the land. However, some animals might not use an area because they will avoid human activity. During the busy construction period, grizzly bear, caribou, moose and beluga whale might avoid certain places. When they avoid these sites, it could affect where hunters will be able to harvest these animals. Easier access for predators and hunters might also affect some animals, such as barren-ground caribou, in ways that change opportunities for hunting during both construction and operations.

Specific guidelines will be used to reduce potential effects on wildlife from the Project. Examples of strategies include:

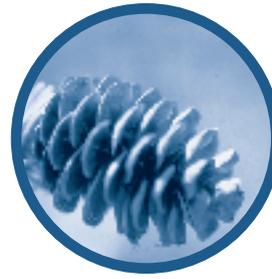
- Managing access to wildlife areas by working together with communities, co-management boards and resource management agencies.
 - Controlling vehicle use of the pipeline corridor.
 - Preventing hunting, trapping, harassment and feeding of wildlife on or near the job site.
 - Limiting the size of the pipeline footprint and related vegetation clearing.
 - Scheduling work activities to avoid sensitive times of the year, such as spring when birds are nesting.
 - Using design and work practices to reduce the barrier effect of the pipeline on wildlife movement.
 - Reclaiming disturbed areas to re-establish wildlife habitat.
 - Managing garbage to ensure animals are not attracted to the Project areas.
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Climate Change

For many years, weather stations have collected information about climate in the North. This information suggests the climate in the Mackenzie Delta and Valley region has been changing and will continue to change. Scientists for the Project, in consultation with other experts, predict that average annual temperatures could increase by up to 2.5° Celsius between 2010 and 2039. This is about the same change experienced over the last 30 years. Annual rain and snowfall could also potentially increase by up to 12% during that time.

It is difficult to know how the land will respond to any changes in climate. From one year to the next, climate can vary. It could take years for the land to respond to gradually changing temperature and precipitation.

The Project design has taken climate change into consideration. It is not expected to significantly affect our facilities or their effect on the environment.



Cumulative Effects of the Project

"Cumulative effects" refers to changes in the environment created by Project activities in combination with past, present and future human activities. We considered the effects of the Project in combination with existing land uses, those expected in the near future and in the distant future.

Examples of existing land uses are communities, transportation, and the oil and gas industry.

Projects in the planning stages include an exploration-drilling program in the Beaufort Sea, and a new bridge across the Mackenzie River. Projects further in the future might include oil and gas exploration and production, new roads, and a new telecommunications line along the Mackenzie Valley.

Some of the conclusions about cumulative effects include:

- The Project footprint will disturb a small portion of the Mackenzie Delta and Valley and the NWT.
- The Project would likely encourage other development, particularly gas exploration and production in the NWT.
- The footprints and effects from any future hydrocarbon development will likely be similar to Project footprints and effects. Future developments will have to develop their own environmental impact assessment.
- One potential cumulative effect is an increase in grizzly bear deaths above the sustainable harvest quota. Waste-management plans, bear-awareness training programs and wildlife-monitoring programs will reduce this concern.
- One potential socio-economic cumulative effect is an increase in competition for qualified northern goods, services and labour. However, this could be corrected through monitoring and co-operation.

NEXT STEPS

Submission of the Environmental Impact Statement (EIS) is required to support the regulatory process. Thousands of approvals from many levels of regulatory authorities must be received before the Mackenzie Gas Project can make a decision whether to construct. This decision will be based on several factors. One is the terms and conditions of the regulatory approvals. Other factors are project costs, whether natural gas markets look good, and whether the Project overall will be profitable.

The Project proponents completed two important steps in October 2004. We submitted the eight-volume EIS to the Joint Review Panel (JRP). At the same time, we also submitted various applications to the National Energy Board (NEB) to develop the Project's natural gas fields, gathering system and the Mackenzie Valley pipeline system.

Public Hearings

Next, the JRP and the NEB review panels will hold public hearings. At these meetings, the public can ask questions about the Project and make their own presentations.

The JRP will oversee the public hearings for the EIS. The NEB will oversee the public hearings for the development of the natural gas fields, the Mackenzie gathering system and the Mackenzie Valley pipeline. Both public hearings will be held in several locations so community members can participate without having to travel too far from their home communities. The public hearings are expected to last several months.

Following these public hearings, the JRP and NEB will make their recommendations.

Other Approvals

Various permits, licences, leases and approvals are required for specific Project activities such as constructing well pads, construction camps and ice roads. Some of these approvals will require public hearings, others will not.

Finally, the Project proponents will need to take into consideration the overall cost and conditions for the Project and decide whether to proceed with construction.

Communication and Consultation

The Project proponents will continue to consult and communicate with the public throughout the life of the Project. We will continue to provide information in a timely manner throughout all Project phases.

The full version of the Environmental Impact Statement (EIS) is available on the Project website at www.mackenziegasproject.com

Audiotapes of the EIS summary will be available in English, French, North Slavey, South Slavey, Gwich'in and Inuvialuktun through the Project's regional offices.

Questions or Comments?

www.mackenziegasproject.com

toll free: 1-866-437-3580

Inuvik Regional Office

151 Mackenzie Road
Inuvik, NT X0E 0T0
Ph: (867) 678-6104

Norman Wells Regional Office

#1 Town Square
Norman Wells, NT X0E 0V0
Ph: (867) 587-3130

Fort Simpson Regional Office

Mackenzie Business Centre
9925-102 Avenue
Fort Simpson, NT X0E 0N0
Ph: (867) 695-2624

Calgary Office

Consultation and Community Affairs
PO Box 2480, Station M
Calgary, AB T2P 3M9
Ph: (403) 237-3580

The following Project videotapes are also available for viewing at the Mackenzie Gas Project regional offices:

- Northern Pipeline Construction: Step by Step
- Building a Northern Pipeline
- Mackenzie Gas Project: Tour of Pipeline Construction

The logo for the Mackenzie Gas Project, featuring the text "Mackenzie Gas Project" in a blue serif font, centered between two horizontal lines that curve upwards at their ends.

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www.mackenziegasproject.com