INFRASTRUCTURE

Barge Landing Sites

Existing barge infrastructure will be the main mode for transporting materials and supplies for all drilling sites, and for transporting facility modules, camps, pipe, valves, construction equipment and fuel for construction activities north of Fort Simpson.

Materials and equipment delivered by vehicle or rail to Hay River, and by vehicle to Fort Simpson, will be transferred to barges for transport downstream. The barges will be moved by tugs. A single tug will be capable of pushing or pulling up to six fully laden barges. The towed barges will be moored to buoys at the barge landings. Tugs will pull each barge to the near shore landing area for unloading.

The two existing barge landing sites at Inuvik will be used. No new barge landings are planned for the GSA. However, the Inuvik sites might need to be upgraded to accommodate the increased volume of barge traffic and the weight of equipment, materials, and supplies required for project construction. No new land requirements have been identified for these upgrades.

Pipeline and Facility Construction Camps

New temporary camps, stationary and mobile, will be needed in the GSA to house the workers required to build the proposed facilities and infrastructure, and construct the pipelines for the project.

Stationary Camps

Stationary camps are required at the Inuvik area facility and at the Campbell Lake infrastructure site, which is located about three kilometres north of Campbell Lake. The Inuvik area facility is situated in the Campbell Creek Special Management Zone, as defined in the Gwich'in land use plan. The Campbell Lake site is situated in the Transportation – Dempster Highway: Mackenzie River to Inuvik Special Management Zone. Since the Campbell Lake camp will be visible from the Dempster Highway, this site is included in the land use plan exception application filed with the GLUPB.

The camp at the Inuvik area facility on Crown land will be designed to accommodate 250 people. The camp at Campbell Lake on private land will be designed to accommodate 1,350 people. These camps will typically consist of

modular units arranged in conventional construction field camp configurations, and will have footprints of about 2.1 ha at the Inuvik area facility and 7.4 ha at the Campbell Lake site. They will include sleeper, lavatory, shower, kitchen and dining units, recreational facilities, first aid stations, generator sets and water treatment units. They might also have offices, maintenance shops and bulk storage trailers. Artist's impressions of two sizes of stationary camps (1,350 and 250 persons) are shown in Figure 3-3 and Figure 3-4.

The foundation design for the temporary stationary camps will be based on a site-specific geotechnical assessment. The camp layout and footprint will be subject to site-specific influences such as terrain, environment, and local communities. Site security plans will be developed, as required, to address the health and safety of personnel, and the security of equipment and materials.

The camps will be designed to be self-sufficient in terms of power, water treatment, sewage and solid waste treatment and disposal, and communications capabilities. However, when they are located near a community, opportunities to purchase water, power or waste management services will be assessed. This assessment will include community input.

Water for the Inuvik area facility and Campbell Lake camp will likely be purchased from Inuvik and transported by truck to the sites. The daily requirements are estimated at 57 m^3 at the Inuvik area facility and 306 m^3 at the Campbell Lake camp. These estimates are based on a consumption rate of 227 L per day per person.

Mobile Camps

About 20 mobile camps will be required for the project, some of which will be used in the GSA. Mobile camps are small, self-contained units that might be based on barges or land. They will be moved frequently during construction and will typically be used for the crews developing new stationary camps, expanding existing camps, or installing storage facilities, barge landing sites, borrow sources and access roads. The land-based mobile camps will accommodate 35 to 70 people.

Site location, seasonal conditions, and travel distances will determine the water sources for the mobile camps. In most cases, the water will be obtained off site and delivered by truck.

The mobile camps will be self-sufficient in terms of power, water supply, water treatment, sewage and solid waste treatment and disposal, and communications capabilities. Possible exceptions are the camps near Inuvik and other Gwich'in communities with municipal facilities.

As with the stationary camps, site security plans for mobile camps will be developed as required, to address the health and safety of personnel, and the security of equipment and material.

Pipe and Equipment Stockpile Sites

Three stockpile sites will be developed in the GSA to store pipe, materials and equipment after they have been delivered to Inuvik and before they are needed for construction on the project. These sites might also store construction equipment when it is not being used. They will be developed between 2006 and 2008.

One of the proposed stockpiles might be located in Inuvik. The other two will be within the footprints of the Inuvik area facility and Campbell Lake site. All three will be used for materials and equipment storage. The Town of Inuvik and the Campbell Lake site will also be used to store line pipe.

Stockpile sites will typically be about seven hectares in area. The dimensions will depend on site location and the quantity and size of pipe and other materials to be stored. The Inuvik town site has existing roads. In most cases, a road will be constructed to connect the sites to the pipeline right-of-way or facility site.

Site preparation methods will depend on the conditions at each location. The sites will be developed to allow safe movement of trucks and equipment, and safe crane operations. The portions used for vehicle traffic will be gravelled.

Fuel Storage Sites

Fuel storage sites will be developed at the Inuvik area facility and at the Campbell Lake site. Both will be located within the site footprint. Use of existing bulk fuel storage at Inuvik is also planned.

The primary fuel for camp, construction equipment and light duty trucks will be diesel. The chartered air carriers will supply aviation fuel. The volumes of fuel to be stored will be about 100,000 L at the Inuvik area facility and about 1.1 million L at the Campbell Lake site.

The fuel storage sites will be set back at least 100 m from any body of water or will be protected from flooding, unless otherwise authorized. These sites will be several hectares in area, depending on the tank size, location and quantity of fuel to be stored. The fuel tanks will either be double-walled or single-walled with secondary containment systems.

Most fuel storage facilities will be located on compacted gravel foundations. The tanks will be placed on skids if they need to be mobile, or on sleeper footings or pilings, if they are stationary.

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Figure 3.4 has been moved to reduce file size. To view it, click on the link to the figure in the web page List of Figures for this document.

Large fuel storage sites, such as the one at Campbell Lake, will be equipped with:

- site lighting sufficient for safety and maintenance purposes
- a perimeter containment berm if double-walled tanks are not used
- electronic monitoring for detecting tank levels and inventory control
- emergency shutdown system in the event of a fire or line rupture
- an access control system

Access Roads

Existing roads and highways will be used for the project wherever practical, including the Dempster Highway near Inuvik. This two-lane gravel highway is open most of the year.

Ice bridges are required during the winter at the Peel and Mackenzie River crossings. These crossings are closed to traffic for about one month in the spring and fall. Ferries are used in summer.

An estimated 160.4 km of new access roads will be required in the GSA to transport personnel, material and equipment to and from the pipeline right-of-way, pipeline facilities, camps and stockpile sites, water sources and borrow sites (see Table 3-4). About 45.2 km of these roads are on Gwich'in private land. The remaining 115.2 km are on Crown land. The estimates include a 30% allowance for approaches, topography and routing uncertainties.

Table 3-4: Type and Length of New Access Roads

Purpose	No. of Roads	Estimated Length (km)
Borrow Sites	14	96.0
Water Sources	37	37.1
Air Strips	0	0
Camps	0	0
Stockpiles	0	0
Facilities	1	16.3
Pipeline (ROW access)	2	11
Total	54	160.4

A travel lane will also be installed within the pipeline rights-of-way for winter construction. This is shown in Figure 3-5 and discussed in the pipeline right-of-way topic.

Figure 3-5: Example of Right-of-Way with Travel Lane

Types of Roads

Two types of roads will be constructed, all-weather roads and temporary winter roads. The design for the all-weather and winter access roads will be site specific and will consider factors such as:

- community input
- geotechnical conditions and terrain features, including drainage patterns
- load weight and size
- existing cut lines and previously disturbed areas
- type of borrow material available, such as till, gravel, shale or rock
- seasonal reinstallation of access roads
- water sources for winter access road construction

A road allowance about 20 m wide will be required in all cases. The travel surface will differ depending on type and purpose of the road.

All-Weather Roads

About 19.4 km of all-weather roads will be constructed in the GSA, including 15.1 km on Crown land and 4.3 km on private land.

The proposed all-weather roads include the 16.3 km all-weather road from the Inuvik area facility to the Dempster Highway and Campbell Lake site. The Campbell Lake site will be connected to the Dempster Highway by a short all-weather approach to the new road to the Inuvik area facility. A borrow site development, 20.073P, requires an upgrade to an existing all-weather road.

All-weather roads will require a compacted roadbed of locally obtained borrow material (see Figure 3-6 and Figure 3-7 for typical drawings).

Loose surface material, including tree stumps and roots, might be salvaged from the roadbeds and graded areas and stored for use during reclamation. Crossings will be installed at watercourses. Erosion control devices will be installed, as necessary, on moderate and steep slopes. Culverts will be used for maintaining surface drainage across the road allowance.

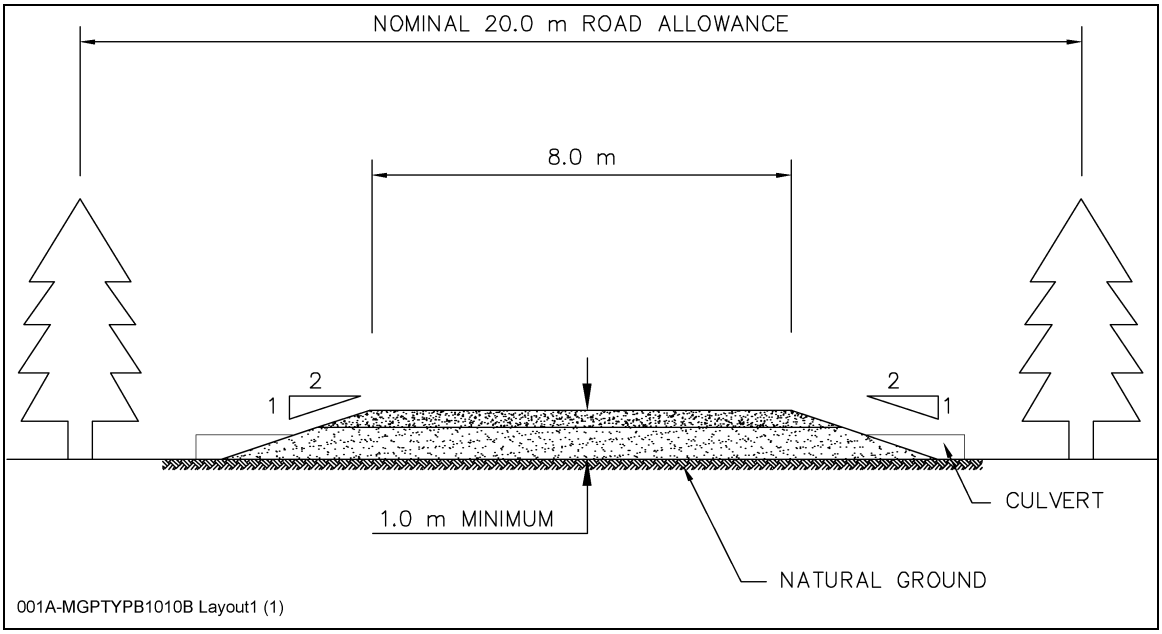

Figure 3-6: Typical All-Weather Access Road (8.0 m)

Winter Roads

In addition to the pipeline travel lane and existing access roads, new winter roads will be constructed and maintained for development activities. Some of these roads will be required for more than one season. A typical winter road is shown on the schematic in Figure 3-8.

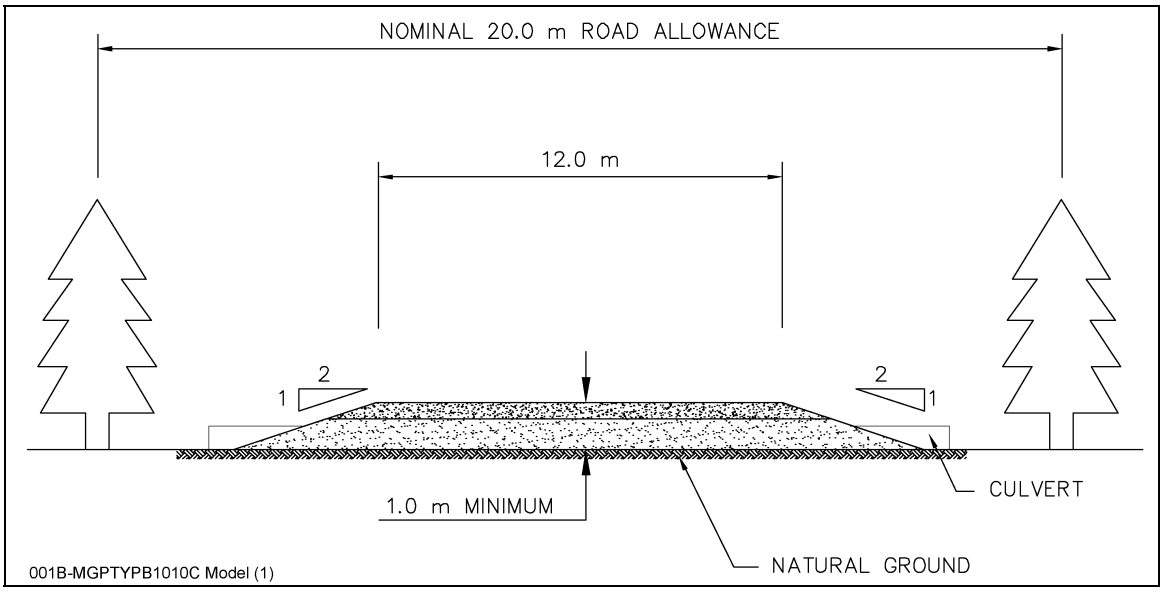

Figure 3-7: Typical All-Weather Access Road (12.0 m)

Winter road construction will start once a sufficient frozen ground depth, suitable for supporting heavy equipment, is achieved. Trees will be cut off at ground level and windrowed. Snow, brush and vegetative material will be compacted with light tracked equipment. Continued compaction will be achieved with snow and water by using progressively heavier equipment. Excess snow accumulations and loose surface material will be ploughed to the side of the travel surface.

By using equipment with a protected blade or equivalent, the disturbance of the surface organic layer will be limited. The road will be built up to strength by continuing to add water and snow in areas of sensitive terrain and where practical. A smooth, hardwearing road surface will be achieved by dragging and surface grading. Maintenance will be done on an ongoing basis using conventional construction equipment, water and snow.

Winter roads built above the tree line will be designed to protect the tundra by building up a layer of ice and snow about 10 cm thick for the travel portion of the roadbed over land, or as authorized by the applicable authorities. Where the snow cover is limited, water will be added to the available snow cover to create the required depth of ice. Roads constructed on lakes and rivers will require minimum ice depths of about 1.2 m.

The potential water use requirements for the winter access roads and the pipeline travel lane in the GSA are estimated at about 38,200 m^3 and 124,000 m^3 per construction season, respectively.

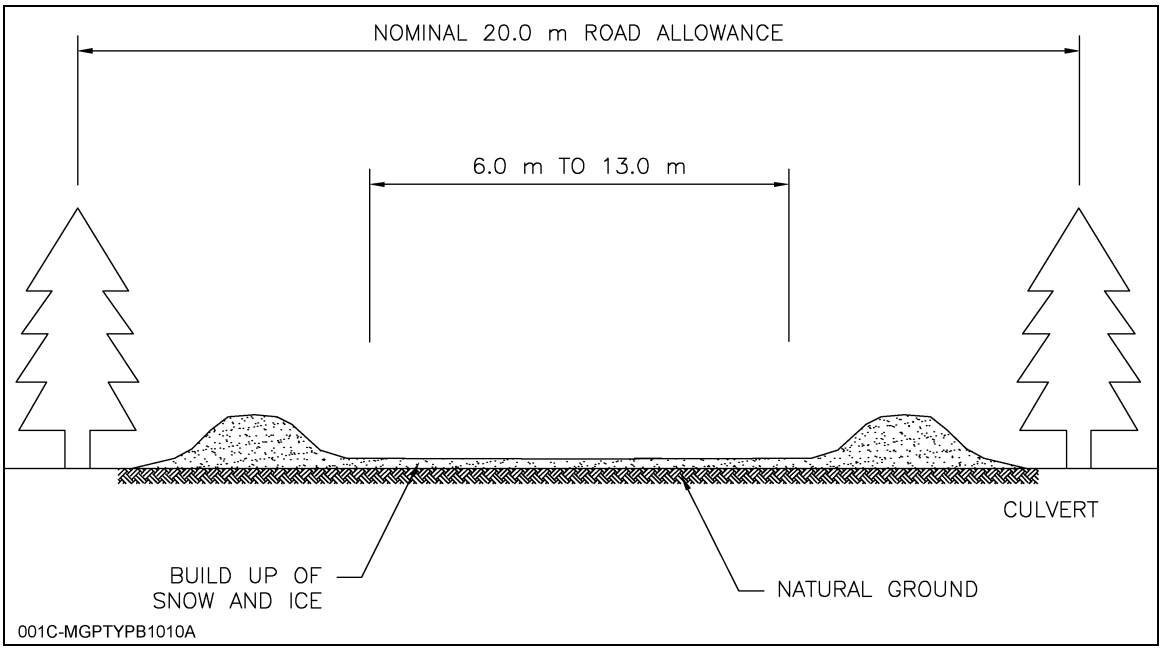

Figure 3-8: Typical Winter Access Road

Water Supply Intake Systems

Temporary water intake systems will be required to obtain a water from potential water sources. These might include a temporary hose from water sources or trucks and portable pumping systems that are fed directly from openings in the ice of water sources.

Airstrips and Helipads

The commercial airport in Inuvik, which is capable of handling heavy aircraft, will be used. No new airstrips are planned for the GSA.

A helicopter landing area will be developed within the footprint of the Inuvik area facility. Helipad dimensions will typically range from about 30 x 30 m (0.1 ha) to about 36 x 135 m (0.5 ha).

The Campbell Lake site will include a landing area for helicopters during construction.

Communications

Communication equipment will be included at the Inuvik area facility and the Campbell Lake site. It will be housed in self-contained buildings, if required. The communications will be through public systems, such as the NorthwesTel network or by satellite. A backup system will be provided in case the primary system fails.

The communication infrastructure will support:

- telephone and fax systems
- Internet and e-mail service
- multiple channel very high frequency radio, both hand-held and in-vehicle radios
- satellite telephones
- satellite television and radio at the camps
- air-to-ground communication at airstrips and helipads
- communication links with the truck, barge and air transport providers

Repeater towers might be required to increase communication coverage along the pipeline corridor. The repeater tower range is estimated at between 10 and 20 km.

A radio telecommunication system will be installed at the Inuvik area facility. This system will provide a communication link within the facility for operations and maintenance personnel.

At points along the pipelines in the GSA, personnel will use hand-held radios to communicate within work parties. Portable satellite phones will be used for external communication. Air-to-ground communication will be provided for areas with airstrips and helipads. Marine communication will be available, as required, for river transport.

SCOPE

Natural materials needed to construct the project will be obtained from new and existing borrow sites, commonly known as sand or gravel pits and rock quarries. These sources will be accessed along the proposed pipeline corridor.

About five million cubic metres of borrow materials will be required for the project, including the pipeline right-of-way, access roads and facility sites. Of this project total, an estimated 720,000 m^3 of borrow material will be needed for developments in the GSA.

About 127 potential borrow sites have been identified for the project. This includes 15 potential sites in the GSA. Nine are on Gwich'in private lands (see Table 3-5). An estimated 938,000 m^3 of borrow material could be obtained from the 15 sites.

Table 3-5: Summary of Potential Borrow Sites in the GSA

Borrow Source	Potential Borrow Material	Existing	Land Ownership	Expected Year(s) In Use	Land Use Designation (Gwich'in land use plan)
2.051PA	Sandstone and limestone	Yes	Private	2006-09	General Use
2.061P	Sand and gravel with some silt	Yes	Crown	2006-09	Transportation
2.064BP	Limestone	No	Crown	2007-08	General Use
4.020P	Sand and gravel	No	Private	2007-08	Lakes Around Travaillant Lake
4.023P	Sand and gravel	No	Private	2007-08	Lakes Around Travaillant Lake
4.026P	Sandy gravel	No	Private	2007-08	Lakes Around Travaillant Lake
4.038APA	Sand and gravel	No	Private	2007-08	Lakes Around Travaillant Lake
4.038APB	Sand and gravel	No	Private	2007-08	Lakes Around Travaillant Lake
4.039P	Sand and gravel	No	Private	2007-08	Lakes Around Travaillant Lake

Table 3-5: Summary of Potential Borrow Sites in the GSA (cont'd)

Borrow Source	Potential Borrow Material	Existing	Land Ownership	Expected Year(s) In Use	Land Use Designation (Gwich'in land use plan)
4.059AP	Sand and gravel	No	Private	2007-08	Lakes Around Travaillant Lake, Travaillant Lake, Mackenzie/Tree River
4.100P	Shale	No	Private	2007-08	Lakes Around Travaillant Lake
4.103PB	Gravelly sand and silty sand	No	Crown	2007-08	Lakes Around Travaillant Lake
5.013P	Gravelly sand	No	Crown	2007-08	Lakes Around Travaillant Lake
5.020P	Mostly gravel and sand with some silt	No	Crown	2007-09	General Use
20.073P	Limestone	Yes	Crown	2007-09	Transportation

Borrow Site Development

A typical borrow site development is depicted in Figure 3-9.

The development schedule for borrow sites will be determined by project needs during construction and, potentially, during operations. The sites will be developed for the components they will supply and will be reclaimed, as required.

The schedule at each site will be influenced by the ice content of the borrow material. Sites with a high ice content might be excavated at least one year in advance, with the borrow material likely to be excavated and stockpiled. The piles of high ice content material might be allowed to melt and drain over the summer for use the following winter. Other activities that might be required at various borrow sites during the summer include stripping overburden, excavating borrow material and stockpiling.

Most borrow sites will have material that will meet the applicable specifications for road and pad construction. However, where the material does not meet specifications for pipeline backfill, it will be crushed or screened during site excavation. Materials might be screened to separate borrow material for different uses. Large material might be crushed to make it suitable for use on the project.

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PROJECT COMPONENTS

Gathering, Gas and NGL Pipelines

The proposed pipeline route through the GSA extends from the ISR to the SSA boundary, a distance of 187.2 km. Of this total, about 110 km crosses Gwich'in private land in two segments. The remaining 76.4 km is situated on Crown land. The proposed pipeline segments are shown in Table 3-6 and Figure 3-10.

The first Crown land segment C1, which is a short 100 m segment from the ISR boundary to the inlet of the Inuvik area facility, is part of the gathering pipeline. The other segments are all for the NGL and gas pipelines.

The distances in Table 3-6 show the southernmost section of the gathering pipelines, designated as KP-S (Storm Hills lateral), and the KP markings for the gas pipeline, which start at the Inuvik area facility and end at the NGTL interconnection in Alberta.

Table 3-6: Pipeline Segments in the GSA

Pipeline Segment	Area(s)	Length (km)	Start	Finish	Land Use Designation (Gwich'in land use plan)
Crown Land – C1	Inuvik	0.1	S-051.6	S-051.7	Campbell Creek
Crown Land – C2	Inuvik	11.8	0.0	011.8	Campbell Creek
Private Land – P1	Inuvik	3.4	011.8	015.2	Campbell Creek
Crown Land – C3	Inuvik, Caribou Lakes	32.9	15.2	048.1	Campbell Creek, General Use
Private Land – P2	Caribou Lakes, Fish Trap Lake, Travaillant River, Thunder River	106.6	48.1	154.7	Lakes Around Travaillant Lake, Travaillant Lake, Mackenzie/Tree River
Crown Land – C4	Thunder River	31.6	154.7	186.3	Lakes Around Travaillant Lake, General Use

The 40 m wide right-of-way for the Storm Hills lateral, leading into the Inuvik area facility, is situated in the Campbell Creek Special Management Zone.

The 50 m wide right-of-way for the gas and NGL pipelines crosses through the Campbell Creek and Lakes Around Travaillant Lake special management zones, the Travaillant Lake, Mackenzie/Tree River Conservation Zone, and general use zones in the Caribou Lakes and Thunder River areas.

The gas and NGL pipelines will be buried and generally installed in separate ditches, about 13 m apart. If necessary, they might be placed in a common trench where there are ice-rich or steep slopes and at larger watercourse crossings.

Pipeline Facility

For the GSA, there is only one facility proposed, the Inuvik area facility. This facility is required to process dehydrated sweet natural gas and NGLs received from the gathering pipelines. It is described in detail in Section 7.

The Inuvik area facility will be located about 20 km northeast of Inuvik in the Campbell Creek Special Management Zone, at the terminus of the gathering pipeline and the start of the gas and NGL pipelines.

The Inuvik area facility will occupy about 48 ha, of which about 26 ha will be fenced. Site preparation is expected to start in 2006. Access will be by helicopter initially, followed by the proposed all weather road extending about 16.3 km north from the Dempster Highway.

The facility will include maintenance, administration and control room facilities. It will be staffed 24 hours per day with operations personnel.

Pipeline Appurtenances

Block Valves

Block valves will be installed along the gathering pipelines, gas and NGL pipelines at about the same time as the pipelines are installed. Block valves allow pipeline segments to be isolated for operations and maintenance.

In the GSA, block valve assemblies will be installed for the Storm Hills lateral, gas and NGL pipelines within the footprint of the Inuvik area facility and along the pipeline right-of-way at intermediate locations where compressor and pump stations might be required in the future.

The NGL pipeline will have additional block valves installed on each side of large watercourse crossings and in certain instances, on one side only (see Table 3-7 for the proposed locations).

The intermediate gas and NGL valve sites near Fish Trap Lake and Thunder River are located within the Lakes Around Travaillant Lake Special Management Zone (the special management zone), near KP-69.7 and KP-156.5. An NGL valve site is situated in the Travaillant Lake, Mackenzie/Tree River Conservation Zone, near KP-108.7.

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Intermediate block valves will be mostly below ground in the GSA. However, these valves will have extensions about 1.2 m above ground to allow valve actuators to be installed.

Risers with valves will also be installed. These will be used to depressurize the pipeline to permit pipeline maintenance (see Figure 3-11). NGLs, if removed, will be stored in mobile storage tanks or re-injected into the downstream pipeline sections.

The block valve assemblies will include blowdown or drain valves and bypass valves to depressurize the pipeline for maintenance. The design of the gas pipeline block valve assemblies will include side valves that will permit future station piping to be connected without taking the pipeline out of service. Manual blowdown or drain valves will be used to vent sweet natural gas and remove fluid from the pipelines.

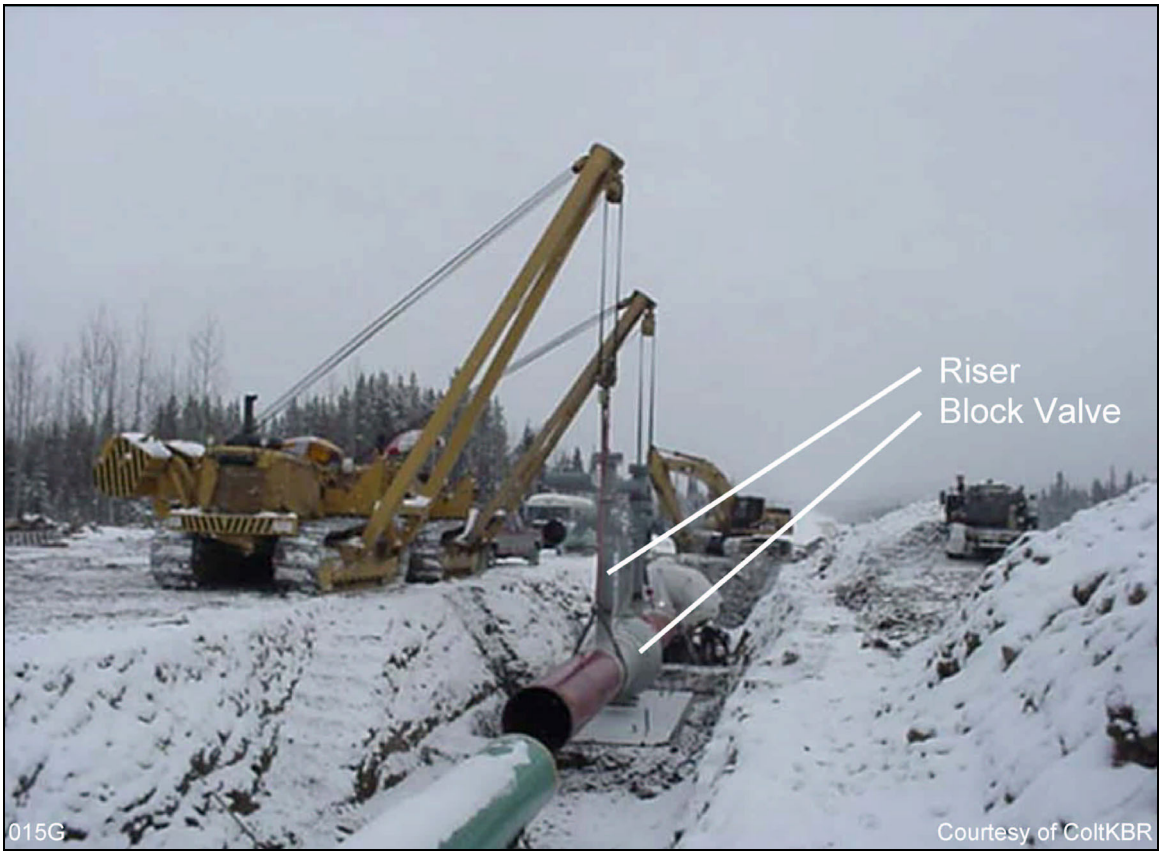

Figure 3-11: Example of Underground Block Valve and Riser Installation

Figure 3-12 and Figure 3-13 are drawings of typical intermediate block valve sites for the gas and NGL pipelines. Artist's impressions are provided in Figure 3-14 and Figure 3-15.

A main control centre (MCC) in Calgary will be used to remotely monitor, control and diagnose NGL and gas block valve functions for the pipelines. The intermediate valve sites will be equipped with thermo-electric generators (TEG), which will produce limited power. Lights will only be used when operations or maintenance staff are present.

Table 3-7: Intermediate Valve Sites on NGL and Gas Pipelines

Valve Type	Site Name	Kilometre Post (KP)	Land Ownership	Land Use Designation (Gwich'in land use plan)
NGL pipeline check valve and manual block valve location	Unnamed creek	16.0	Crown	Campbell Creek
NGL pipeline check valve and manual block valve location	North Caribou Lake	32.0	Crown	General Use
Gas pipeline block valve location	Future Fish Trap Lake compressor station	69.7	Private	Lakes Around Travaillant Lake
NGL pipeline block valve location	Travaillant River – upstream	76.5	Private	Lakes Around Travaillant Lake
NGL pipeline check valve and manual block valve location	Travaillant River – downstream	79.3	Private	Lakes Around Travaillant Lake
NGL pipeline check valve and manual block valve location	Unnamed hills – upstream	108.7	Private	Travaillant Lake, Mackenzie/Tree River
NGL pipeline block valve location	Thunder River – upstream	152.9	Private	Lakes Around Travaillant Lake
NGL pipeline isolation valve upstream of future pump station location	Future Thunder River pump station – upstream	156.4	Crown	Lakes Around Travaillant Lake
Gas pipeline block valve location	Future Thunder River compressor station	156.5	Crown	Lakes Around Travaillant Lake
NGL pipeline isolation valve downstream of future pump station	Future Thunder River pump station – downstream	156.5	Crown	Lakes Around Travaillant Lake
NGL pipeline block valve location	Unnamed hills – upstream	176.7	Crown	General Use

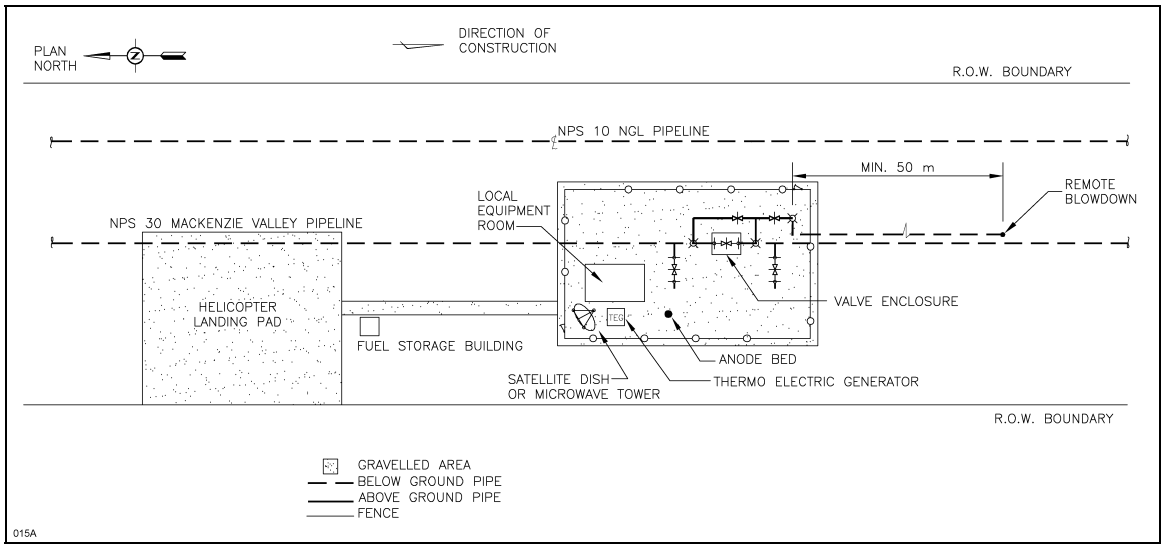

Figure 3-12: Typical Block Valve (Gas) – Dual Pipeline Site

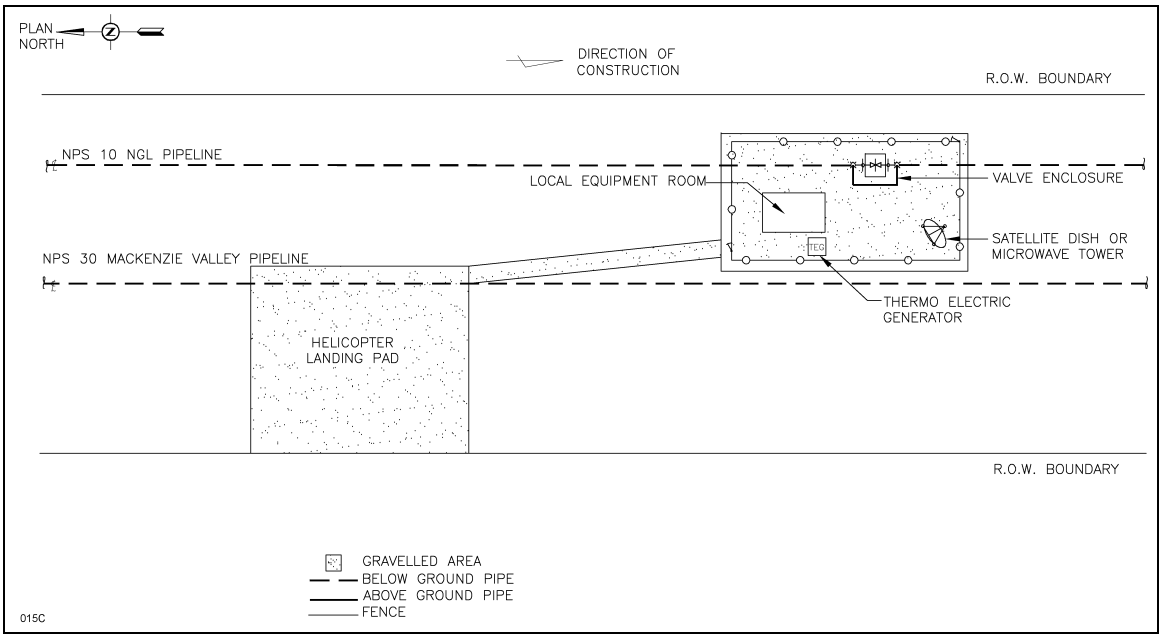

Figure 3-13: Typical Block Valve (NGL) – Dual Pipeline Site

Pigging Facilities

Pig launchers and receivers are facilities that enable pigs to be inserted into, or removed from, the pipeline (see the photograph provided in Figure 3-16). Pigs are devices placed into pipelines to clean the inside of the pipeline or to monitor its condition and position.

Cleaning pigs are usually made of hard rubber or foam and might be ball or bullet-type. Monitoring or smart pigs, equipped with inertial-guidance

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technologies, will be used to determine pipeline centreline coordinates. With regular runs of smart pigs, it can be determined if pipeline movement is occurring as a result of ground movement and the resultant strains. Other types of smart pigs, such as magnetic flux or ultrasonic pigs, will be used to determine if areas of the pipelines have experienced potentially problematic metal loss.

Pig launchers will be installed at the beginning of the gas and NGL pipelines at the Inuvik area facility. A pig receiver for the Storm Hills lateral will also be located within the site. There are no other pigging facilities proposed in the GSA.

Figure 3-16: Example of a Pig Launcher or Receiver

Cathodic Protection

The pipelines will be protected from external corrosion by a combination of an external coating and a cathodic protection system. This system will consist mainly of deep impressed current anode groundbeds that will be appropriately spaced to provide the pipeline with the requisite level of cathodic protection (see a schematic in Figure 3-17).

Shallow groundbeds might also be considered in areas of discontinuous permafrost, which occur in the southern part of the GSA. Where required, a galvanic system might be used to complement the impressed current system.

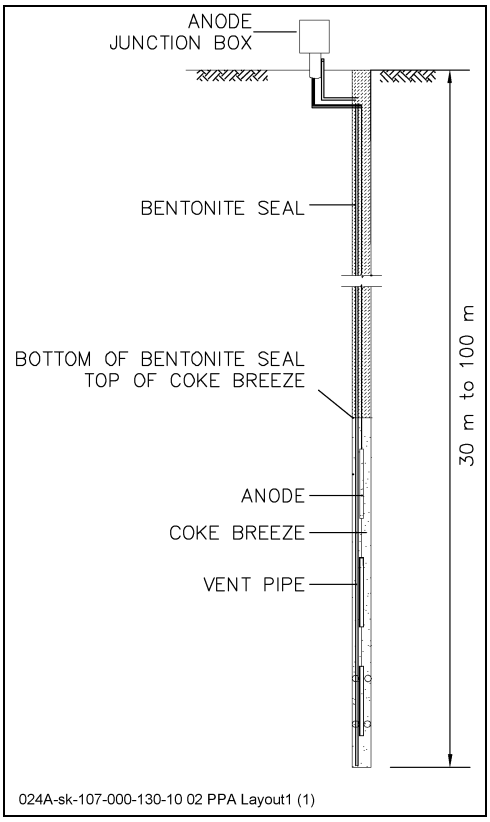

Figure 3-17: Typical Deep Anode Groundbed

Deep anode groundbeds will be installed at the Storm Hills lateral pig receiver and the gas and NGL pipeline pig launchers, both of which will be located within the Inuvik area facility footprint. There will also be groundbeds at the Fish Trap Lake and Thunder River block valve sites near kilometre posts 69.7 and 156.5.

A rock drill will typically be used to drill deep anode groundbeds in frozen and rocky terrain (see Figure 3-18).

The anodes will be powered by rectifiers or TEG. Rectifiers will be used where alternating current (AC) power is available at the facility sites. TEGs will be used at locations without a continuous supply of AC power.

Test stations consisting of junction boxes and test lead posts will be installed at about 3.0 km intervals along the pipeline right-of-way. The effectiveness of the cathodic protection system will be evaluated by taking measurements at the test stations of electrical potential of the pipeline with respect to the ground.

Signs and Markers

Appropriate signs will be specified and designed to warn the public, GWNT Department of Transportation and any third-party utility companies of the

Figure 3-18: Example of a Deep Well Anode Drill

presence of the pipelines. These bilingual warning signs, in English and the regional Aboriginal language, will consist of the following:

- road crossing warning signs, which will be installed where the crossing pipeline enters and exits the road right-of-way and will be visible from the travelled surface of the road

- pipeline crossing warning signs, which will be installed adjacent to the intersection of crossing pipelines

- watercourse crossing signs, which, except for vegetated crossings, will be installed just back from the top of the bank on either side of the watercourse crossing, and if practical, will be visible from the centre of the channel

- signs which will be posted directly above the pipeline on any fence lines that are crossed, and placed on the support post of the aerial markers

- signs which will be placed on all posts installed to support cathodic protection test lead junction boxes

Aerial markers will be installed at about 5.0 km intervals along the pipeline, and will provide reference locations along the pipeline that will be visible from the air.

PIPELINE CONSTRUCTION

Construction Plan

A preliminary multi-year construction plan has been developed for the project. In developing this plan, the following were considered:

- safety and emergency response
- concerns of local residents
- environmental protection
- regulatory requirements
- permafrost conditions
- seasonal constraints
- reduced daylight during the winter
- severe weather conditions
- coordination between the gas and NGL pipeline construction
- construction logistics
- infrastructure requirements
- specialized construction equipment
- select fill requirements

Public concerns considered in the construction planning process are described in Section 10.

Construction Spreads

The preliminary construction plan assumes that pipeline construction will be segmented into five construction spreads for each year of construction. Two spreads are planned for the GSA.

One of the construction spreads in the GSA includes the Storm Hills lateral and 95 km of dual pipelines from the Inuvik area facility to Crossing Creek Lake (E2). It is scheduled for the second pipeline construction season.

The other construction spread in the GSA (D1) extends from Crossing Creek Lake to Little Chicago in the SSA, a distance of about 106 km. It will be constructed in the first pipeline construction season (see Section 1 and the foldout maps in Appendix C – Foldout Maps).

Construction Methods

Conventional winter pipeline and industrial facility construction methods and equipment will generally be used to build the proposed pipelines and associated

facilities. Conventional winter construction techniques include:

- winterizing construction equipment and fuel tanks
- welding, followed by trenching
- lowering and backfill of the pipelines
- providing protection and housing for the workforce, including camp facilities, lighting and weather protection

Right-of-Way and Temporary Workspace

Right-of-Way Configuration

The pipeline right-of-way will provide work, travel and spoil areas to support safe and efficient construction. The configuration of a typical single pipeline alignment in a 40-m wide right-of-way is shown in Figure 3-19. Figure 3-20 shows a typical dual pipeline alignment in a 50-m wide right-of-way.

A trencher travel lane will be located between the ditch spoil pile and the edge of the right-of-way. The lane will be between 3.5 and 5.0 m wide and will be used to move lighting plants and ditching equipment.

A travel lane and work area will also be located within the right-of-way. Its surface will be prepared to safely accommodate the movement of construction equipment, including buses and pipe-stringing trucks. Over sensitive terrain and where practical, snow and ice pads will be constructed on the travel lane to facilitate the movement of construction equipment. An example of a busy right-of-way during construction is provided in Figure 3-21.

Right-of-way preparation techniques suitable for several combinations of slope and soil conditions have been developed. These techniques are designed to reduce potential erosion or instability related to permafrost and disturbance of surface organic cover.

Steep longitudinal and sidehill slopes will be graded during construction to provide safe working conditions and for performance of the work (see Figure 3-22). Grading will depend on various factors such as slope angles, soil types and ice content. Work pads might be prepared where unstable ice-rich soils make grading impractical.

Mitigation measures will be implemented both during and after construction to limit potential thaw settlement in permafrost areas. These measures might include the following but not are limited to revegetation, drainage control structures, surface insulation methods such as wood chips where available, and reclamation of graded slopes.

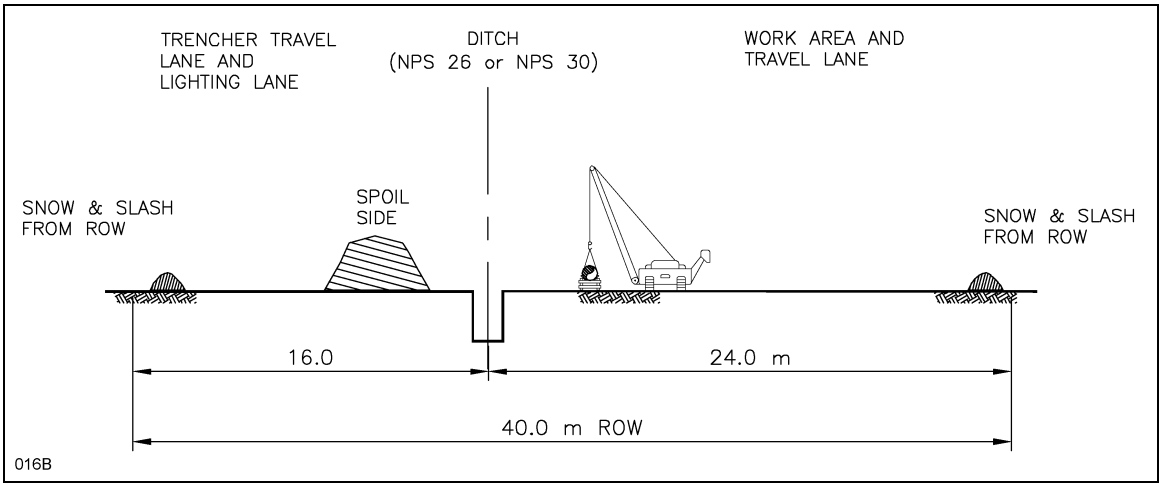

Figure 3-19: Typical Right-of-Way Configuration for Single Pipe (40 m)

Temporary Workspace

Temporary workspace during construction will be required at a number of locations for the following uses:

- shooflies on the pipeline right-of-way
- watercourse crossings with defined banks
- turnaround areas or pushouts
- road, highway and pipeline crossings
- equipment storage areas
- deep grade or large slope sites
- sidebends
- sharp direction change areas
- valve sites
- pig launcher and receiver sites
- timber storage sites

The temporary workspace requirements for the pipelines through the GSA are estimated at 38.8 ha on private lands and 22.1 ha on Crown lands. This space is necessary for construction activities and is incremental to the right-of-way itself. Areas required for timber storage and shooflies on the pipeline right-of-way are excluded from these estimates and will be identified as construction planning and engineering progresses.

The need, exact location, and size of additional temporary workspaces will be determined in the field during surveying, clearing and construction.

Typical workspace requirements are depicted in Figure 3-23, Figure 3-24, and Figure 3-25 for a watercourse crossing, pushout area and sidebends.

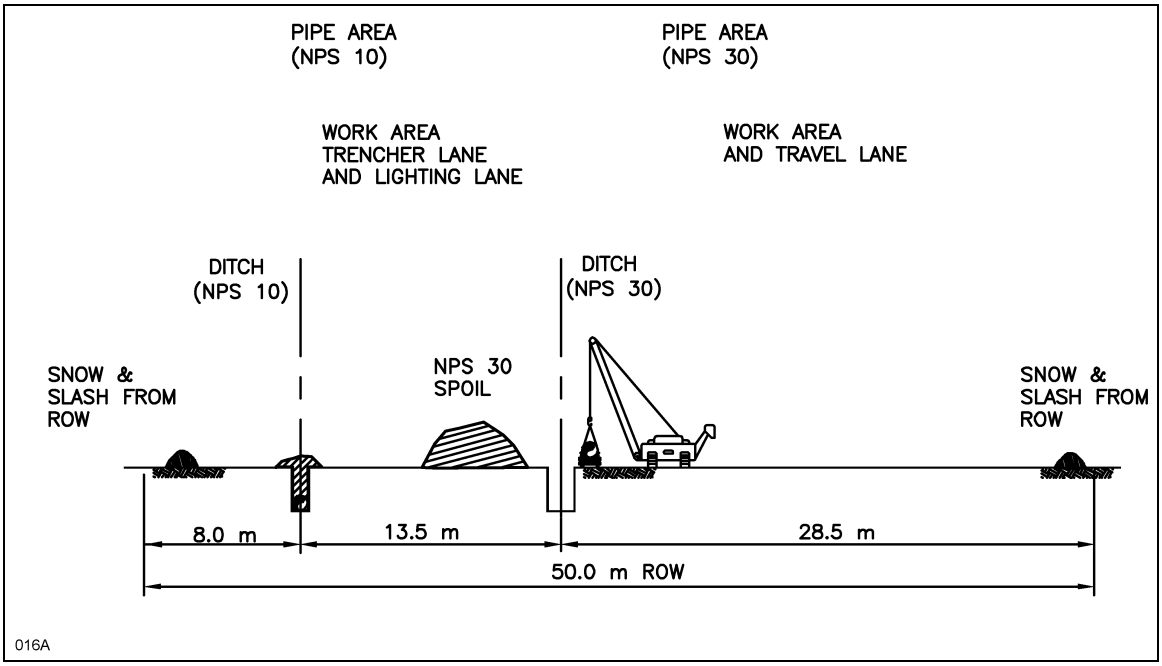

Figure 3-20: Typical Right-of-Way Configuration for Dual Pipelines (50 m)

Clearing and Subsurface Investigations

The right-of-way and temporary workspace will be cleared for pipeline construction when ground conditions allow. The full width of the right-of-way might not be cleared in some areas, such as the approaches to watercourse crossings with steep south-facing slopes. In the GSA, pipeline right-of-way clearing is expected to start in 2006 and end in 2009.

Before the start of right-of-way construction activities, the pipeline centreline will be located and staked within the identified route corridor and will require clearing a line-of-sight for surveying, using hand tools where necessary, in forested or bush areas.

Clearing and subsurface investigation activities include:

- surveying and marking the right-of-way and temporary workspace
- fencing or flagging areas to be avoided, such as environmentally sensitive sites
- clearing trees and shrubs from the right-of-way
- investigating subsurface conditions within the right-of-way

Figure 3-21: Example of a Right-of-Way During Construction

Trees and brush will be cut off at ground level. Non-merchantable timber and brush will be windrowed on the edge of the right-of-way. Timber will be stockpiled for project use in storage areas adjacent to the right-of-way. It might be used as a source of wood chips to insulate slopes along the right-of-way, for log corduroy, or to aid in bridge construction (see Figure 3-26). If requested, timber might also be stockpiled for community use, where practical.

Surface Preparation

The right-of-way surface will be leveled or graded to facilitate moving vehicles and equipment. Larger diameter pipe, such as the NPS 30 gas pipeline, typically requires larger construction equipment. This generally increases the extent of levelling that is required. Certain design locations such as side slopes, river crossings and steep gullies, typically require grading.