

## IN THIS SECTION

- Pipelines and associated facilities
- Tank terminal
- Identifying potential accidental spills
- Spill response and clean-up

As with all Enbridge pipelines, Northern Gateway will be designed using today's most modern technology and the highest safety and environmental standards.



# 3 PROJECT DESCRIPTION

## PIPELINES AND ASSOCIATED FACILITIES

Operated by Enbridge to world-class standards, Northern Gateway represents an important opportunity to create an impressive new economic generator in British Columbia's northwest. Connecting Canada's energy industry to our key global markets, the project will create new jobs, new opportunities and new economic infrastructure.

**Pipelines:** The pipelines will run underground 1,171 kilometres from near Edmonton, Alberta to a new tank terminal and marine terminal in Kitimat, BC. They will pass through the Hoult-Clore tunnels and cross over several major rivers. The oil pipeline can transport around 525,000 barrels per day and the condensate pipeline can transport around 193,000 barrels per day.

The pipelines will have a 25 metre wide right-of-way and 20 to 25 metres of temporary work space. An overall, additional temporary work space allowance of 10 per cent has been estimated in places such as river crossings, roadways and significant side slopes to accommodate construction. Construction is expected to take two years of year-round work, and will include 11 construction camps to accommodate 500 to 700 workers.

**Pump stations:** The pipelines require 10 electric-powered pump stations, including an initiating station in Bruderheim for oil and at the Kitimat terminal for condensate. These stations will be four hectares in size, including a two-hectare buffer zone. However, the two initiating stations do not need a buffer zone, so will only be around two hectares in size.

**Note:** Details of the project's marine aspects are discussed in the marine environmental and socio-economic summary, a parallel discussion guide that is available online at [www.northerngateway.ca](http://www.northerngateway.ca) or from an Enbridge Northern Gateway Project office.

### Project features at a glance

- Over 4,000 construction jobs
- Thousands of indirect jobs to support the construction and operations
- Hundreds of millions of dollars in tax revenue throughout the life of the project
- Potential for BC shipyards to build up to six support tugs

### The westward pipeline

- Transport petroleum from near Edmonton to Kitimat
- 1,171 km in length
- 36 inches in diameter
- Carry an average of 525,000 barrels of petroleum per day

### The eastward pipeline

- Transport condensate from Kitimat to near Edmonton
- 1,171 km in length
- 20 inches in diameter
- Carry a daily average of 193,000 barrels of condensate (a thinner for petroleum products)

### Kitimat terminal

- Operated by Enbridge to world-class standards
- Two ship berths
- Storage tanks for petroleum and condensate
- Radar monitoring station
- First response capabilities
- Creation of new jobs to operate the new terminal and super-tugs

# PROJECT DESCRIPTION

**Construction spreads, camps and stockpiles:** The pipelines will require the operation of 11 construction camps and a variety of stockpile sites. Where possible, these facilities will be built on previously used sites. Each will be around 25 hectares in size and may include temporary access roads.

Staging areas will be used to mobilize construction teams along the right-of-way. They are relatively small and will be located primarily at construction spread breaks and tunnel openings. In addition, they are included in the environmental assessment.

Stockpile areas will be used to store pipe, materials and equipment. They will be eight to 27 hectares in size.

**Hoult-Clore tunnels:** The pipeline right-of-way will include two tunnels around 5.5 metres in diameter that will run through north Hope Peak and Nimbus Mountain to help cross the coastal mountains. They will be built using a combination of tunnel boring equipment, drilling and blasting. They will produce around 400,000 cubic metres of rock. Work will proceed simultaneously from both ends of each tunnel. Once open, work will largely occur within an enclosed space inside each mountain.

Rock from the tunnels will be moved to previously identified fill sites adjacent to the tunnel openings. Groundwater flow will be managed and there is a low likelihood of encountering acid-generating rock during construction.

Three permanent roads are needed to access the tunnel openings. The west and central roads will use existing forestry roads that will be upgraded by widening areas and building or improving bridges. A new east road will be built in cooperation with management agencies, as well as in line with the practices outlined in the EPMP.

Three camps will support 100 to 150 people, one at each end of the tunnels and a third between the two. Employees and contractors will work specific shifts and be bussed in from Terrace or Smithers to the construction camps. Use of personal vehicles will be limited and workers will be required to follow corporate policies on hunting, fishing and wildlife interaction. Each camp will be around five hectares in size. There will be five sites for excess rock, varying from 5 to 10 hectares in size.

**Valves and scraper trap facilities:** Block valves will be installed at pumping stations, on either side of selected watercourse crossings, and at sensitive receiving spots. Power for the valves will come from commercial and alternative sources. A combination of wide area network frame relay, telephone lines and satellite communication circuits will be used to provide main and back up communication.

Scraper trap facilities are facilities positioned within the pipeline network to launch and recover in-line inspection tools, or devices inserted into a pipeline to clean the inner walls of the pipe and monitor for critical conditions that could compromise pipeline integrity or operational efficiency, such as cracks, corrosion, or pipe deformations. They will be installed at both ends of the pipeline system and at selected intermediate pump stations.

## TANK TERMINAL

The land based facilities at the Kitimat terminal are referred to as the tank terminal. The tank terminal will be around 220 hectares in size and extend down to the marine foreshore. A security fence will surround the land part of the tank terminal, but not at the foreshore. A 60-metre wide area will be cleared around the perimeter of all major infrastructure as a firebreak and is included in the 220-hectare area within the security fence.

The tank terminal is designed to have 14 tanks (11 for oil and three for condensate). Each has a capacity of 496,000 barrels. Room for two additional tanks will be developed near the existing tank lot, within the security fence.

Four rows of tanks will be surrounded by separate concrete containment berms. Secondary containment berms will separate each tank to allow for localized containment in the unlikely event of released hydrocarbons. All tanks will have a below-grade collection sump, and all drainage will be directed to an oily water separator, if necessary. Following treatment, it will be go to a surface runoff containment reservoir. Water from this reservoir will be used for on-site purposes.

The tank terminal will also include a guard house, security gate, offices, storage and mechanical buildings, lab facilities, parking areas, an electric yard, storage tanks for drinking potable and grey water, a network of transfer pipelines and associated pumps and metering facilities. Gravel roads will connect the facilities and a lay-down area will be created for temporary storage of materials.

In the event of fire, water from the surface runoff containment reservoir will be used. There is also the option of using sea water to augment this supply. Water cannons and foam tanks provide coverage of the cargo loading arms and ship manifolds.

The tank terminal will also include a construction lay-down area, a soil disposal area, and topsoil storage. A 320-hectare area just outside the Kitimat terminal fence line is being considered.

**Physical works and activities:** Figure 3.1 outlines the physical works and activities during construction, operations and decommissioning that are considered in the Environmental and Socio-economic Assessment (ESA).

## KITIMAT TERMINAL

**Located on the west side of Kitimat Arm in the Douglas Channel, the terminal will include land-based facilities – the tank terminal – and marine-based facilities. It has hydrocarbon tanks, pump facilities, other land facilities, tanker berths and a utility berth. A minimum 60-metre firebreak buffer will be maintained around the facilities.**

**The hydrocarbon tanks and most of the main facilities will be on a level area around 180 metres above sea level. The berths and associated onshore facilities will be around 10 metres above sea level on a level area constructed at the base of the steep slope along the shoreline. Tree cover will be maintained between the main access road and the slopes above the berth facilities.**

**The terminal will include disposal areas for cut material like rock and marine clays from the tank terminal, a topsoil storage area for reclamation, a construction lay-down area and a security fence. Some of these areas may be outside the security fence.**

**The project development area includes part of Bish forest service road. Northern Gateway is evaluating how to reroute part of the existing road so the public can go around the tank terminal to access Bish Cove and surrounding areas.**

**Note: Details of the project's marine aspects are discussed in the marine environmental and socio-economic summary, a parallel discussion guide that is available online at [www.northerngateway.ca](http://www.northerngateway.ca) or from an Enbridge Northern Gateway Project office.**

# PROJECT DESCRIPTION

PHYSICAL WORKS AND ACTIVITIES CONSIDERED IN ESA		
PIPELINES AND ASSOCIATED FACILITIES		
Construction	Operations	Decommissioning
Surface and subsurface disturbance	N/A	N/A
Right-of-way and site preparation (clearing, slash burning/chipping, grading, blasting)	Physical footprint of right-of-way and infrastructure during operations (cleared surfaces, less permeable surfaces, storm water management systems)	Site restoration (infrastructure removal, site rehabilitation, reclamation)
Temporary and permanent road development (clearing, slash burning/chipping, grading, drainage control, blasting, structures for vehicle crossings)	Physical footprint of roads during operations (cleared surfaces, less permeable surfaces, drainage controls, in-stream structures for vehicle crossings)	Road removal (recontouring and reclamation, removal of vehicle crossing structures)
Powerline development (clearing, slash burning/chipping, grading, temporary structures for vehicle crossings)	Physical footprint of the powerline RoWs	Powerline removal and restoration of RoW
Infrastructure construction (tanks, pump stations, support buildings, etc.)	Hydrocarbon storage at terminal	Decommissioning equipment and traffic
Construction equipment and traffic	Operational equipment and traffic	Restoration and revegetation of footprint of right-of-way, infrastructure and roads
Pipeline construction (string pipe, set-up pipe, open ditch, blasting, backfill, clean-up)	Operations (pump stations, Kitimat terminal)	
Watercrossings (trenched and trenchless crossings)	Right-of-way maintenance (vegetation management, pipe maintenance, surveillance)	
Hydrostatic testing	Permanent road maintenance	
Right-of-way and facility site reclamation	Borrow extraction	
Camp operations		
Borrow extraction		
Tunnelling and waste rock disposal, ground water management		
TANK TERMINAL		
Construction	Operations	Decommissioning
On-shore infrastructure site preparation (clearing, burning, grading, blasting)	Physical footprint of on-shore infrastructure during operations (tank terminal and associated surfaces, less permeable surfaces, storm water management systems)	Facility removal
	On-shore site restoration (infrastructure removal, site rehabilitation, and reclamation)	Restoration and revegetation of the tank terminal site
On-shore infrastructure construction (tank terminal, inter-connector pipes, support buildings, pumps, etc.)	On-shore infrastructure operations (tank terminal and associated site water run-off, lights, noise, waste water disposal, emissions)	
	Note: marine vessel operations considered in the companion document "Marine Environmental and Social Summary"	

Figure 3.1

# PROJECT DESCRIPTION

## PIPELINE CONSTRUCTION

The key activities during pipeline construction include:

- Scheduling and right-of-way access
- Clearing
- Soil salvage
- Grading and trenching
- Lowering and backfilling
- Watercourse crossing
- Right-of-way clean up
- Pipeline testing
- Reclamation
- Restoration

**Scheduling and right-of-way access:** Construction will be scheduled to minimize environmental effects. Existing public and forestry roads will be used, wherever possible, to access the pipeline right-of-way. Work areas will be cleared in a way that minimizes erosion, removal of vegetation and optimizes reclamation (see Figure 3.2).

**Figure 3.2 Pipeline Construction Schedule**

Construction Component	Start Date (by quarter, post approval)	End Date (by quarter)
Hoult-Clore	Tunnels Q3/Year 1	Q2/Year 4
Powerlines	Q3/Year 1 (initial clearing)	Q2/Year 4
Pipelines	Q2/Year 2 (minor construction activities)	Q2/Year 4
Pump stations	Q2/Year 2	Q2/Year 4

**Clearing:** The pipeline RoW will require clearing of a 25 m permanent RoW, a 20-25 m wide temporary workspace and, in certain areas such as steep slopes or wet areas, some additional extra temporary workspace.

Merchantable timber will be salvaged. In addition, some timber will be used to help control soil erosion and aid in watercourse restoration. Tree stumps, roots and unsellable vegetation will either be burned or chipped to spread over the right-of-way.

**Soil salvage:** Topsoil and other organic material will be conserved where possible for future reclamation. This means taking measures to reduce compaction and rutting, as well as trying to avoid loss of organic matter and mixing of different soil types. Some topsoil and other organic soils will be salvaged or segregated.

**Grading and trenching:** Where grading on slopes is necessary, efforts will be made to restore the natural grade once pipeline installation is complete. Separate trenches will be dug to hold the two pipes, with a minimum of five metres between pipelines in most areas. In some cases, due to rocky terrain or other conditions, the trenches may be closer together or further apart.

The minimum distance from the edge of the permanent right-of-way will be four metres. Minimum depth of cover to grade will be 0.9 m, except in rock where it will be 0.6 m. At watercourse crossings it will be 1.2 m except in rock where it will be 0.6 m.

Agricultural and wildlife issues will be considered throughout construction to avoid disruption of movements and activities. Subsoil and topsoil will be segregated, protected and replaced.

**Lowering in and backfilling:** Pipes will be bent and welded on-site before being joint-coated, inspected and lowered in the trench.

**Watercourse crossings:** Watercourse crossings include isolation, directional drilling, aerial and open-trench methods, depending on conditions. For example, seasonal fisheries, wildlife limitations, terrain and geotechnical limitations all need to be taken into consideration to minimize environmental effects.

**Right-of-way cleanup:** The right-of-way and other areas will be cleaned up as quickly as possible to prepare the right-of-way for reclamation. All waste materials and debris will be removed. Subsoils and top soils will be replaced sequentially.

In agricultural areas, soils will be restored to allow previous farming practices to resume. Fencing will be installed where necessary.

Outside of agricultural areas, the permanent right-of-way will be seeded with grasses and other low growing vegetation. The temporary and extra temporary workspace will be revegetated and shrubs and trees will be allowed to re-establish.

**Pipeline testing:** The pipelines will be cleaned, pressure tested and inspected before commissioning. Damaged or defective sections will be repaired. The majority of the testing is done with water but some is tested with air. Details will be determined during engineering design.

**Reclamation:** Standard measures will be taken to reduce environmental effects, as well as to return land to a stable condition. For example, erosion, vehicle ruts and trench settlement will be regraded as required. The right-of-way will be contoured as close as possible to its previous profile, drainage patterns will be returned where practical and erosion control structures will be installed. Ultimately, the right-of-way will be restored as per landowner agreements and regulatory requirements.

**Restoration:** Beyond reclamation, land will be restored to its original ecological integrity. A restoration plan, developed in consultation with the appropriate regulatory agencies and stakeholders, will include site-specific details such as weed control, reseeding with native seed mixes, enhancing wildlife habitats, and restoring wetlands and watercourses. A post-construction monitoring and follow up program, including a tracking process, will be implemented to ensure environmental commitments and regulatory requirements are met.

## TANK TERMINAL CONSTRUCTION

Topsoil and other organic material will be salvaged, segregated and conserved as necessary for future reclamation activities at the tank terminal. The amount of blasting and grading to create a level area for the site has not yet been optimized, but will be finalized as we move into the design phase. Blasting will take place in daylight to reduce noise and follow all applicable safety regulations. Grading will generate around three million cubic metres of cut material, much of which will be used for construction fill. The rest will be placed in special areas on site, or if required, at an Environment Canada approved disposal at sea site.

The facilities themselves will be built to meet or exceed industry standards, as well as federal and provincial standards. They will be designed to withstand earthquakes and other natural events like flooding and tsunamis. Details on hydrostatic testing are forthcoming. Public access from Kitimat to Bish Cove will be maintained throughout construction and operations. This may include the construction of a new road segment around the tank terminal site.

# PROJECT DESCRIPTION

## PIPELINE OPERATIONS

Northern Gateway will employ a number of key risk control, monitoring, inspection and testing measures to ensure the pipeline's integrity during operations, as well strategies for containment and cleanup in the unlikely event of a spill.

**Routine operations:** Risk control measures are applied over the life cycle of the pipelines to maintain a constant safe integrity level. There are two main steps:

### **Ongoing right-of-way inspection and monitoring-**

Once the pipelines are commissioned, there will be regular right-of-way inspection programs, including aerial reconnaissance of the entire right-of-way. These will identify anomalies, like third party encroachments, construction activity near the pipelines, erosion problems, rock and snow slides. If anomalies are identified, appropriate repairs will be initiated. The aerial monitoring will also monitor the success of the revegetation program. Ground level assessments will follow to verify aerial monitoring and more closely assess revegetation success and soil erosion. Any structural or aesthetic defects will be corrected.

Tall vegetation along the permanent 25 m wide RoW will be cleared on a regular basis to ensure aerial visibility.

A Supervisory Control and Data Acquisition (SCADA) system will monitor the pipelines, pumps and block valves from a control centre. The system automatically monitors the pressure within the pipelines and the operator has the ability isolate areas of the pipelines as necessary.

### **Ongoing pipeline integrity maintenance and testing-**

The pipelines will be regularly cleaned and inspected with cleaning tools and in-line inspection tools, intelligent devices that are inserted in the pipeline through scraper trap facilities. Any material that is removed from the pipelines by scrapers will be disposed at the appropriate, licensed disposal facilities.

Special spill containment structures and mechanisms will be in place to ensure there are no off-site releases. All structural defects will be further evaluated and repaired as necessary. Valves are serviced several times a year. Access to the valves is provided by helicopter or road, depending on location.

**Hoult-Clore tunnels:** The tunnels are inspected on a regular basis. When possible, ground access will be used during the snow-free season. During winter, helicopters will be used to access the tunnels when practical.

**Access Management:** Access along the pipeline RoW and the powerline RoWs will be managed to minimize detrimental effects to wildlife and other values. Access on permanent project roads will also be controlled. Temporary project roads will be decommissioned. Access management will be further detailed in cooperation with management agencies and as a result of ongoing engineering and environmental work.

## TANK TERMINAL OPERATIONS

The schedule for operations, which includes operation of the hydrocarbon tanks, associated pumps and facilities, as well as equipment monitoring, preventative maintenance, routine equipment upgrades and inspections, will be confirmed as part of the detailed design.

The condensate tankers will discharge condensate to the terminal using steam or electric centrifugal pumps. The primary fuel for steam pumps is No. 6 fuel oil (bunker C), which is used to fire the tanker's auxiliary boiler. The primary fuel for the electric pumps is No. 3 fuel oil (marine diesel oil), which is used to power diesel generators on the tanker. Electric pumps in the tank terminal will pump condensate to the storage tanks. Oil is loaded onto the tankers using a combination of gravity and electric pumps.

The hydrocarbon tanks will be designed with external floating roofs to minimize emissions.

Oil and condensate tanks will have around 450 and 165 cycles per year respectively, where each cycle includes one filling and emptying of a tank, or vice versa. This is based on 80 per cent tank working capacity and average annual throughput.

Any oily water generated during loading of tankers will be pumped using electric pumps from the berths to the oily water separator. Following treatment to applicable federal and provincial standards, the water will be released into the surface water runoff reservoir. As mentioned earlier, water from the reservoir may be used for fire fighting.

## DECOMMISSIONING

At the decommissioning stage, it is assumed that the above-ground facilities will be removed. Underground pipelines and structures will be abandoned in place according to regulations and standards at the time of decommissioning. Unless government or local authorities decide to retain the facilities, it is assumed that all the facilities at the tank terminal will be removed. The site will then be reclaimed according to the regulations and standards at the time of decommissioning.

# PROJECT DESCRIPTION

## POTENTIAL ACCIDENTAL SPILLS

The *Canadian Environmental Assessment Act* requires proponents to consider “the environmental effects of malfunctions or accidents that may occur in connection with the project.” In addition, the National Energy Board’s environmental assessment includes requirements that address “soil and groundwater contamination” and “contingency plans for environmental emergencies.”

**Preventative measures and design features:** The pipeline will be designed, tested and operated to the highest environmental, health and safety standards.

In addition, most of the pipeline will be buried, which reduces the likelihood of damage from collisions, vandalism, avalanches or landslides.

The following measures will be in place:

- Routine aerial and ground inspections
- Maintenance of corrosion protection
- In-line inspection tool technology to spot potential problems with pipe integrity
- Continuous Supervisory Control and Data Acquisition (SCADA) monitoring
- Automated block valves
- 30-metre control zone on either side of the right-of-way
- Clearly marked right-of-way at public roads, railways and navigable watercourse crossings
- Local and regional seismic monitoring
- Environmental Protection and Management Plan (EPMP), Pipeline Integrity Management Program and Pipeline Security Management Programs

In the unlikely event of a leak from a pipeline, the SCADA system would immediately detect it and raise alarms. The control centre operator would determine the necessary course of action and would begin a system shutdown sequence which would include stopping pump stations and closing block valves along the route to minimize potential released volume. The maximum amount that could be released depends on the location of the valves, local topography, pressure equalization and emergency response time.

**Probability of spills:** The probability of spills is being determined based on a study to measure quantitative risk. This study will be based on recent statistical information for similar operations internationally and nationally. Aspects such as the design features of the project, safety plans, terrain type, soil conditions and the setting (such as urban or rural) will be considered.

**Spills and containment management:** An assessment of potential accidental spills is being completed for the pipelines and tank terminal. This information alongside other ongoing studies will be used to help determine the placement of control mechanisms like valves. It will also be used to help develop emergency response plans, as well as to identify personnel and equipment needs (for example, spill response trailers).

An emergency response program will be created for the pipelines and tank terminal to ensure readiness in the unlikely event of an accidental release. The plan will be activated to ensure containment and clean up of any hydrocarbon releases.

**Spill fate, transport and environmental protection:** Four hypothetical spill scenarios along the pipeline route have been selected to better understand how oil and condensate may behave on land and in fresh water.

These scenarios include a hypothetical spill in:

- an agricultural area (KP 55)
- a fen wetland area (KP 234)
- a forested region with a river crossing (KP 718 – Crooked River)
- a mountainous region with a river crossing (KP 1098 – Hunter Creek)

Samples of oil and condensate, similar to what might be transported in the pipelines, were analyzed to determine if they would evaporate or persist, float or sink, stick together or disperse in the environment. The information from this analysis is being used to plan preventative and response measures for potential spills.

Environmentally sensitive areas like watercourses and wetlands along the pipeline route have been identified, as have control points for each major watercourse crossing. This helps emergency response planning, as well as response and recovery of hydrocarbons.

## SPILL RESPONSE AND CLEAN-UP

Even with the best of preventative measures, accidents may happen as a result of material failures, third-party damage, or unforeseen natural events like avalanches and floods.

Northern Gateway is preparing a detailed response plan for such unlikely events, including:

- Incident management
- Spill preparedness, including response strategies and health and safety requirements for various spill scenarios
- Equipment requirements
- Training requirements
- Exercises
- Contact information for operations and service personnel
- Sensitive area maps for the pipeline
- Interception points for rivers which allow for spill countermeasures to be quickly deployed
- Mapping rivers for control points to enable deflection and containment booms to be installed

In the unlikely event of a spill, the following sequence of events will take place:

- SCADA system alerts the control system operator to immediately shut valves and pump stations
- Project staff notifies emergency response team
- Site specific emergency response plans are activated
- Containment and recovery response measures are deployed
- Clean-up
- Habitat is restored as required

**Note:** Similar information is discussed in the marine environmental and socio-economic summary, a parallel discussion guide that is available online at [www.northerngateway.ca](http://www.northerngateway.ca) or from an Enbridge Northern Gateway Project office.

## SPILLS CONTINGENCY PLANNING

To assess the potential effects of spills during operation of the pipelines and tank terminal, hypothetical scenarios were developed. Historic spills were reviewed during the development of scenarios to enable a thorough analysis of the potential environmental effects of spills associated with the project and to identify appropriate contingency measures.

Though the likelihood of these hypothetical spill scenarios is remote, each scenario provides an opportunity to realistically determine:

- Key design features to avoid the potential for a spill
- The probability of a spill
- Appropriate mitigation (or contingency) measures to minimize spills
- The behaviour of liquid hydrocarbons in the environment
- Effective spill response plans (and equipment) in the unlikely event of a spill
- The significance of potential social, economic and biophysical effects of hydrocarbon spills

Prevention, preparedness and response plans for environmental effects that might occur as a result of accidents and malfunctions (such as small-scale spills from equipment and fire) are detailed in the Environmental Protection and Management Plan.