

## IN THIS SECTION

- Kitimat marine terminal
- Routine vessel operations
- Accidental spills
- Spill response and clean-up

As with all Enbridge projects, Northern Gateway will be designed and constructed using the best technologies and the highest safety and environmental standards. To ensure that our products are moved safely through the marine terminal and to our markets overseas, Northern Gateway will construct a world-class marine terminal. All vessels moving to and from the Kitimat terminal will meet the world's highest safety and operational requirements. All vessels will be double-hulled, thereby greatly reducing the risk of large spills.

The Kitimat terminal will be equipped with state-of-the-art spill prevention and containment equipment, reducing to a minimum not only the risk of spills, but also the potential for impact from even low-risk spills. All shore crews handling vessels and oil transfer will have extensive training in the safe handling of petroleum and spill response protocols.

# 3 PROJECT DESCRIPTION

## KITIMAT MARINE TERMINAL

Operated by Enbridge to world-class standards, Northern Gateway's Kitimat marine terminal 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 Kitimat marine terminal will create new jobs, new opportunities and new economic infrastructure.

The Kitimat terminal will be located on the west side of Kitimat Arm, about seven kilometres south of the town of Kitimat, and will feature two ship berths, one utility berth and storage tanks for petroleum and condensate (Figure 3.1 and Figure 3.2). The terminal area includes a 150-metre safety zone from the ship berths to the sea. A 100-metre water lot is included within the safety zone.

Both ship berths will be equipped for loading oil tankers and unloading condensate tankers. These berths will be able to accommodate vessels up to and including Very Large Crude Carriers (VLCCs). Each tanker berth will consist of:

- Loading arms, gangways and connecting trestles
- Berthing and mooring structures
- A storage area for containment boom

**Note:** The tank terminal is discussed in the pipeline environmental and socio-economic summary, a parallel discussion guide that is available online at [www.northerngateway.ca](http://www.northerngateway.ca).

### Project features at a glance

- Over 4,000 construction jobs
- Thousands of indirect jobs to support 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 (used as a thinner for petroleum products)

### Kitimat marine 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

## Marine terminal construction

The marine terminal facilities are expected to be built between autumn 2012 and summer 2016. Key activities include dredging, blasting and construction of berths and facilities.

**Dredging:** Dredging to build the berth foundations will likely be performed by a derrick barge with a clamshell bucket and will take roughly eight to nine weeks. Dredged material and overburden from the tank terminal site will be disposed of on land or at sea near the tank terminal site. Total material dredged will be about 30,000 cubic metres (m<sup>3</sup>). The dredged area and volume may change to suit the final design of the structures, but is not anticipated to exceed these volumes.

**Blasting:** Underwater blasting is needed to provide a level surface for piles. Based on the preliminary engineering design, some 40,000 m<sup>3</sup> of material must be blasted for the berths. Ongoing engineering design may reduce the number of piles needed and the requirements for blasting.

The majority of blasting will take place in water that is 10 to 32 metres deep. However, some minor blasting may take place in water less than 10 metres deep. Blasting equipment will include a drill derrick with drill rigs used for boring holes for explosive charges. The derrick barge will likely be used to move the blasted materials.

Blasting will follow all applicable safety regulations. It will be scheduled in daylight to minimize noise disturbances to adjacent industry and residents.

As with the dredging plan, the sub-marine blasting plan is based on a preliminary berth structure design and configuration. The area and volume of blasting may change to suit the final design of the structures, but is not anticipated to exceed the volumes noted.

**Construction of berths and facilities:** The number of piles and other structures required for the berths will be determined as a result of ongoing engineering design.

**Construction camp:** Another economic activity supporting the construction of the Kitimat terminal will be a construction camp capable of supporting 200 to 300 workers. It will be either at an existing camp facility in the Kitimat town area or at the Kitimat terminal. The construction camp will need to operate year-round from the fall of the first year of construction 2012 to the summer of 2016.

## Marine terminal operations

Terminal operations will consist of:

- Tanker berthing and unberthing
- Tanker loading and unloading
- Testing of hydrocarbons before unloading or loading
- Monitoring
- Preventative maintenance
- Routine equipment upgrades
- Regularly scheduled safety and security inspections

The estimated types and numbers of vessels that will use the Kitimat terminal each year are provided in Figure 3.5.

Vessels to support the marine terminal operations (such as tugs and line-handling boats) will be berthed at the utility wharf when in active use. The line-handling boats will also be used for pre-booming the tankers. When not in active use, the tugs will return for maintenance and refuelling to a base in Kitimat. Maintenance and refuelling of the line-handling boats will occur in Kitimat.

An inflatable containment boom will be deployed around each of the loading berths before oil is loaded from the terminal onto tankers. The containment boom will not be used during condensate off-loading. The containment boom will extend from shore, out around the tanker and back to shore. It will remain in place until all loading of oil is complete and the tanker is ready to depart.

The berthing and unberthing operations, and to some extent, the loading and unloading operations, at Kitimat terminal will be governed to some degree by environmental conditions.

All vessels using Kitimat terminal will be required to follow the Canadian Ballast Water Management Guidelines (Transport Canada 2000). Solid waste and liquid waste will be managed according to the *Canada Shipping Act* (Transport Canada 2001). Oil tankers will have segregated ballast on board that has been exchanged not less than 200 nautical miles from shore, as described by these guidelines.

Northern Gateway is reviewing the need for oily water reception facilities.

## Decommissioning

For the ESA, it is assumed that the above ground facilities will be removed. Underground pipelines and structures will be abandoned in place, or as required, 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 in Kitimat terminal will be removed to the mud-line (the top of the soil underwater) and reclaimed according to the regulations and standards at the time of decommissioning.

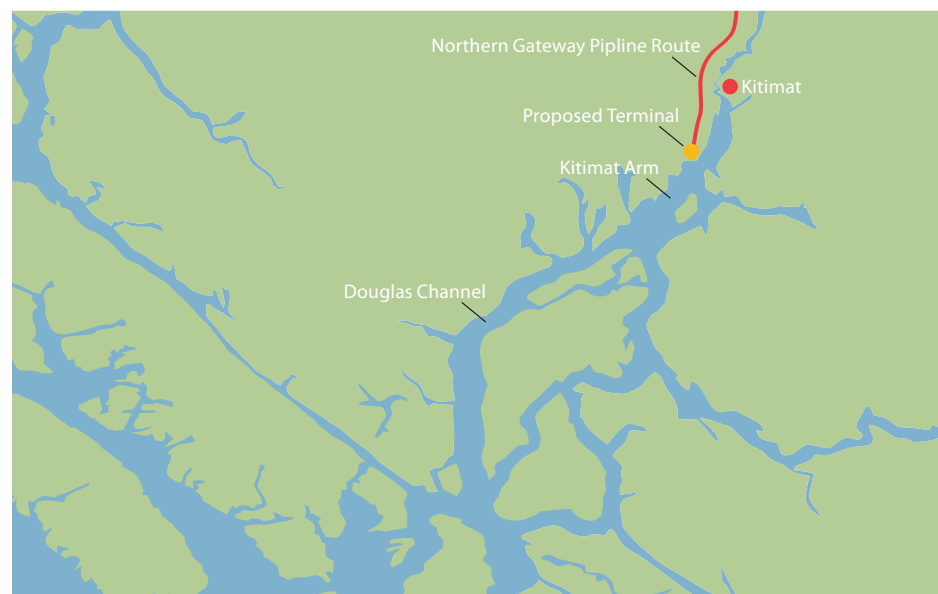


Figure 3.1 Proposed terminal in Kitimat Arm.



Figure 3.2 Model of Northern Gateway Marine Terminal Project Development Area.

# PROJECT DESCRIPTION

PHYSICAL WORKS AND ACTIVITIES CONSIDERED IN ESA		
KITIMAT TERMINAL		
Construction	Operations	Decommissioning
On-shore infrastructure site preparation (clearing, burning, grading, blasting)	Physical footprint of in-water infrastructure during operations (marine terminal, docking berth and associated shading, underwater structures)	On-shore site restoration (infrastructure removal, site rehabilitation, reclamation)
In-water infrastructure site preparation (dredging, blasting, pile drilling)	In-water infrastructure operations (marine terminal, docking berth and associated lights, noise)	In-water infrastructure site restoration (infrastructure removal)
In-water infrastructure construction (marine terminal, permanent jetty, construction jetty, pile installation)	In-water infrastructure maintenance (piling inspection)	Decommissioning support vessels (for piling, berth removal)
Construction support vessels (barges, tugs, ocean disposal barges)	Moored tankers (and associated combustion emissions, inert gas exchange, prop wash, noise, boom deployment)	
Ocean disposal (waste, overburden, drill cuttings)	Bilge and ballast water management	
Camp operations (water disposal)	Inert gas exchange at the tanker berth	
CONFINED CHANNEL ASSESSMENT AREA (CCAA) VESSEL TRAFFIC		
Construction	Operations	Decommissioning
Marine vessel traffic (wake, noise, collisions)	Tanker traffic (wake, noise)	N/A
	Tug traffic (wake, noise, prop wash)	

Figure 3.3

**Physical works and activities:** Figure 3.3 (left) outlines the physical works and activities during construction, operations and decommissioning that are considered in the ESA.

## Vessel traffic during construction and operations in the Confined Channel Assessment Area

**Construction-related vessels:** The economic activity generated by terminal construction will include the work of construction-related vessels such as supply barges. It is assumed that one tug will be required for each barge transit. The detailed engineering design process will determine the number of supply vessels, tugs and barges that will be required as well as their routes and schedules (Figure 3.4).

CONSTRUCTION BARGE TRAFFIC				
Construction Year	Construction Quarter	Trips from Vancouver to Kitimat Terminal	Trips from Kitimat Terminal to Vancouver	Total Barge Trips
1	1	7	0	7
1	2	0	4	4
1	3	9	5	14
1	4	8	6	14
2	1	0	0	0
2	2	4	2	6
2	3	0	0	0
2	4	0	0	0
3	1	0	11	11
<b>Totals</b>		<b>28</b>	<b>28</b>	<b>56</b>

Figure 3.4

# PROJECT DESCRIPTION

## ROUTINE VESSEL OPERATIONS

### Oil and condensate vessels

While the tankers moving to and from Kitimat terminal will be vessels chartered by other companies, all ships calling at Kitimat terminal will be required to comply with Northern Gateway Pipelines Limited Partnership's vessel vetting and operational protocols. All vessels using the Kitimat terminal will be required to be double-hulled.

### Vessel routes and operations

Vessel routes include both northern and southern approaches to Douglas Channel, as well as alternative routes within the outer channel areas.

Ships navigating the northern approach will transit through Browning Entrance, Principe Channel, Otter Channel, Lewis Passage, Wright Sound and Douglas Channel to Kitimat terminal. The transit distance from Browning Entrance is 105 nautical miles, requiring a one-way transit time of 10 to 13 hours.

Ships navigating the south approach will transit through Caamaño Sound, Squally Channel, Lewis Passage, Wright Sound and Douglas Channel to Kitimat terminal. The transit distance from Caamaño Sound is 95 nautical miles, requiring a transit time of 9 to 12 hours.

During transit of the confined channel assessment area (CCAA), average vessel speeds will be in the range of 8 to 12 knots. Vessel speeds in Principe Channel, the western area of Caamaño Sound and Douglas Channel will not exceed 12 knots. Vessel speeds in Otter Channel, the eastern area of Caamaño Sound, Squally Channel, Lewis Passage and Wright Sound will not exceed 10 knots.

Local pilots will board and assist all incoming and outbound vessels during the transit of the CCAA. If boarding is not viable at the existing stations (due to weather or other reasons), helicopter transport may allow a pilot to board approximately 12 nautical miles seaward of Caamaño Sound or north of Browning Entrance.

During transit, laden vessels will be escorted by tug boats from the entrance of the CCAA to Kitimat terminal (condensate) or from Kitimat terminal to the entrance of the CCAA (oil). Tugs will also be available for emergency response outside the CCAA.

There is an existing anchorage north of Anger Island in Principe Channel. The need for and viability of providing additional anchorages for tankers inside the CCAA en route to Kitimat terminal is being evaluated. If additional sites are identified, the environmental effects of these anchorages will be assessed as part of a supplemental filing.

If weather or other factors prevent vessels from berthing which have already committed to the transit, and if no suitable anchorage is available, vessels in Kitimat Arm will enter a holding pattern, with the assistance of support tugs, until safe berthing can be achieved.

OIL AND CONDENSATE TANKER SPECIFICATIONS AND TRAFFIC			
Parameter	Vessel Class		
	VLCC	Suezmax	Aframax
Annual oil product by ship class (m <sup>3</sup> )	16,000,000	11,000,000	4,000,000
Annual condensate product by ship class (m <sup>3</sup> )	0	9,000,000	2,000,000
Total cargo per ship class (m <sup>3</sup> )	16,000,000	20,000,000	6,000,000
Minimum and maximum vessel size (dwt)	200,000 to 320,000	120,000 to 200,000	80,000 to 120,000
Overall length (m)	340	274	240
Beam (m)	58	48	42
Depth (keel to main deck) (m)	30	23	20
Loaded draft (m)	23	17	15
Average cargo capacity (t)*	300,000	160,000	100,000
Average cargo capacity (m <sup>3</sup> )	320,000	170,000	110,000
Average cargo capacity (bbl)	2.0 million**	1 million**	0.75 million***
Main engine power rating (kW)	30,000	20,000	15,000
Auxiliary engine power rating (kW)	1,500	1,000	750
Number of vessels per year (range)	40 to 60	110 to 130	40 to 60
Number of vessels per year (average)	50	120	50
Average transits per day in Douglas Channel	0.3	0.6	0.3
Total time transit and maneuvering (rounded h/yr)	1,500	2,900	1,300
Estimated average cargo transfer rate (m <sup>3</sup> /h)	12,800	8,000	6,400
Total time at berth (rounded h/yr)	1,700	2,900	1,200
Primary ship engine fuel type	No. 6 bunker	No. 6 bunker	No. 6 bunker

Figure 3.5

### NOTES:

- \* Average capacity relates to the average ship size in the 2008 double-hulled tanker fleet.
- \*\* Assumes diluted bitumen density of 0.93 tonnes/m<sup>3</sup> and a synthetic oil density of 0.88 tonnes/m<sup>3</sup>.
- \*\*\* Assumes condensate density of 0.73 tonnes/m<sup>3</sup> and vessel capacity is limited by its volume capacity.
- bbl – barrel
- h/yr - hours per year
- kW – kilowatt
- m - metre
- m<sup>3</sup> - cubic metre
- m<sup>3</sup>/h - cubic metre per hour
- t - tonne

# PROJECT DESCRIPTION

## ACCIDENTAL SPILLS

Located at the end of the Douglas Channel, one of the widest and deepest waterways on North America's West Coast, the Northern Gateway Kitimat terminal will employ the highest worldwide safety and navigational standards. Safety will be a top priority for both the terminal and vessels.

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, Transport Canada regulates spill response protocols for the marine environment and has established standards for oil tankers in Canadian waters.

### Preventative measures

To fulfill Northern Gateway's commitment to accident prevention and environmental protection, as well as these regulatory requirements, Northern Gateway is undertaking a planning process as part of the project to prevent accidents and malfunctions, and develop a comprehensive spill response plan for both the Kitimat terminal and shipping in the Confined Channel Assessment Area.

### Preventative measures at Kitimat terminal:

Designed to world-class standards, the terminal will be operated to minimize environmental effects during construction and operations. Particular attention will be paid to implementing operational and mechanical measures to avoid spills. A wide range of measures will be employed to avoid or minimize the risk of spills. They include:

- Allowing only double-hulled tankers to use the marine terminal
- Deploying booms around oil tankers before cargo transfer begins
- Fail-safe valves for connection of vessels to the transfer pipe
- Use of automatic shut-off valves and emergency release coupling on loading and unloading arms

- Catchment trays for loading and unloading arms and associated fittings to intercept inadvertent droplets and minor spills
- Specific loading and unloading protocols, including sequential procedures for hose coupling and valve control prior to pumping oil or condensate
- Specific operational procedures for unloading and loading
- Electronic sensors linked to a shut-off valve if the vessel drifts too far from the dock
- On-board spill retention capability
- Continuous system monitoring by the Supervisory Control and Data Acquisition (SCADA) system
- Routine visual inspection and checks of valves
- Using tethered harbour and escort tugs to assist in berthing and unberthing each vessel
- An exclusion zone and associated navigational restrictions while oil tankers are berthed
- Strict bilge and ballast water management procedures

### Prevention measures within the Confined Channel Assessment Area will include:

- All vessels will meet the highest construction, safety and environmental standards, and be vetted by independent, third party agencies
- All vessels must be double-hulled
- All vessels will have a segregated ballast
- All vessels will be under the command of certified ship officers and guided by experienced British Columbia coastal marine pilots to ensure safe passage through coastal waterways
- Powerful custom-built super-tugs, the largest in Canada, will be tethered to all laden vessels to ensure safe passage through coastal routes
- The super-tugs will have first response and firefighting capabilities to provide immediate assistance if required
- Operational safety limits will be established to cover visibility, wind and sea conditions

- Northern Gateway will install and monitor a radar system to cover critical route sections and a monitoring station at Kitimat for all marine traffic to provide guidance to pilots and other vessels in the area
- Vessel speeds will be reduced in the marine channels to between 8 and 12 knots
- First response stations and personnel will be established at the Kitimat terminal and in communities along the shipping routes

Additionally, Northern Gateway has also voluntarily committed the project to the TERMPOL review process (TRP), coordinated by Transport Canada. The TRP addresses a broad range of topics, including:

- Effects of the project on shipping traffic
- Navigational safety of vessel routes
- Services required to facilitate safe navigation (such as pilotage and navigation aids)
- Suitability of ship design
- Vessel manoeuvring characteristics, navigation and communication equipment
- Pollution prevention programs
- Assessment of environmental concerns associated with hydrocarbon transport
- Marine contingency planning and emergency counter-measures

More details on the TERMPOL review process are in *section 2, Project lifecycle*.

### Understanding the probability of spills

Determining the probability of a spill or accident is an important aspect of spill response planning and assessment. Quantitative Risk Assessment (QRA) studies help determine spill probability based on recent statistical information for similar operations internationally and nationally. Additionally, aspects such as a project's design features and safety plans are also taken into account.

To assist in this process, Northern Gateway has initiated a roundtable process including First Nations and stakeholders to:

- Identify issues of concern
- Develop a scope of work for the QRA at the terminal and along coastal routes
- Select an appropriate qualified consultant to complete the assessment

More information on QRA can be found in *section 5, Next steps*.

### Understanding spill behaviour

Three types of studies have been conducted to understand how spills might behave and the actions required to avoid or minimize spill risk:

#### 1. Local ocean and weather conditions:

Historical records and new field surveys provide information on climate, winds, currents, waves and salinity to identify construction and operations measures needed to avoid or minimize effects.

#### 2. The physical properties of oil and condensate:

These analyses provide answers to questions such as whether oil and condensate float or sink, evaporate or persist, stick together or disperse. This information is required to assist in the planning of both preventative and spill response measures, and as input for the predictive modeling of hypothetical spills.

#### 3. Predictive modeling of hypothetical spills at the terminal and at locations within the CCAA:

Studies on local ocean and weather conditions and the properties of oil and condensate are used to predict the potential behaviour of spills based on the volume handled and the season. These studies look at questions such as:

- How far a spill would travel
- Where it would travel
- How long it would persist
- How it might affect the marine environment

# PROJECT DESCRIPTION

## SPILL RESPONSE AND CLEAN-UP

To be well prepared in the unlikely event of a spill, Northern Gateway is in the process of preparing a detailed Oil Pollution Emergency Plan (OPEP) for Kitimat terminal and marine shipping in coastal areas. The two OPEPs will meet requirements of the Response Organizations and Oil Handling Facilities Regulations, and Environmental Response Arrangements Regulations pursuant to Part 8 of the *Canada Shipping Act, 2001*.

The plans will address:

- Notification (fire, police and emergency response)
- Incident management
- Preparedness (pre-emergency planning)
- Equipment
- Training
- Emergency response exercises
- Response strategies, including health and safety of response personnel

The plans will describe response strategies for various hypothetical spill events. Information will be included from the environmental sensitivity atlases for the area surrounding the marine terminal and along the coastal shipping routes. Trajectory maps based on spill models also form part of the response materials. Shoreline locations for deployment of spill countermeasures will be identified and mapped based on reviews of the sensitivity atlases and trajectory maps.

All ships visiting the marine terminal will need to have an OPEP that meets Transport Canada requirements.

## Environmental Protection

In addition to careful attention to project planning and design, Northern Gateway has completed detailed studies on how to best protect the coastal environment within the CCAA, in the unlikely event that a spill of oil or condensate occurs. These have included:

- Preparation of both a digital and hard copy environmental atlas of the entire CCAA
- Digital videotaping of the entire coastline
- Development of an emergency response plan that is linked with the atlas and video footage

The environmental atlas documents the type of coastal habitats that occur along each segment of the waterways within the CCAA.

To support the environmental atlas, digital video footage was also recorded for the entire coastline within the CCAA. This video information was then spatially linked with the environmental atlas so that a viewer can quickly see what a specific coastal segment looks like, while also being able to access other information on that segment.

Recommended measures to protect specific coastal segments in the unlikely event of a spill have also been identified. These include measures to boom off areas and means to protect sensitive resources and features. These measures have also been linked to the electronic atlas and video footage.

An early version of the environmental atlas and response plan was given by Northern Gateway to the BC Ferry Corporation to assist in the response to the Queen of the North sinking on Gill Island. Information from the atlas was used to deploy protective booms around areas such as river deltas and commercial clam beds.

## Response measures

Response measures undertaken for spills will depend on the severity of the event. In the event of a spill, the first response will be immediate and involve the following sequence of events:

- Immediate valve shut off using a SCADA system (if at the terminal)
- Notification of emergency response team by project staff
- Notification of response organizations
- Implementation of site-specific emergency response plans
- Deployment of the response measures with an emphasis on containment and recovery
- Shoreline clean-up
- Shoreline restoration

Northern Gateway must provide an initial response to all spills at Kitimat terminal, regardless of spill size.

As required under the Response Organizations and Oil Handling Facilities Regulations of the *Canada Shipping Act, 2001*, Northern Gateway will retain a certified response organization to provide containment and clean-up services in the unlikely event of a spill at the terminal or from a vessel.

## SPILLS CONTINGENCY PLANNING

**To assess the potential effects of spills during operation of the terminal and shipping, 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.**