Volume 1: Overview and General Information

ENBRIDGE NORTHERN GATEWAY PROJECT

Sec. 52 Application

May 2010
Preface to Volume 1

Northern Gateway Pipelines Limited Partnership (Northern Gateway) proposes to construct and operate:

- an oil export pipeline
- a condensate import pipeline
- a tank terminal and marine terminal near Kitimat, British Columbia (referred to as the Kitimat Terminal)

The pipelines will be built in a common right-of-way (RoW) between an initiating pump station near Bruderheim, Alberta and the Kitimat Terminal near Kitimat, British Columbia. The marine terminal will accommodate transfer of oil into, and condensate out of, tankers.

These project components and activities are referred to collectively as the Enbridge Northern Gateway Project (the Project).

This volume introduces the Project and outlines:

- general project information, including project need and purpose, project alternatives and economic feasibility
- the regulatory framework
- land requirements, rights and acquisitions
- Enbridge management policies
- the structure of the Application, including a summary of each volume in the Application
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1 Introduction

To facilitate increased access to new, large and growing markets, Northern Gateway Pipelines Limited Partnership (Northern Gateway) proposes to construct and operate:

- an oil export pipeline and associated facilities
- a condensate import pipeline and associated facilities
- a tank terminal and marine terminal (the Kitimat Terminal) to be located near Kitimat, British Columbia

These project components and activities are collectively referred to as the Enbridge Northern Gateway Project (the Project). The Project will involve transporting oil from Alberta near Bruderheim (NE-4-56-21 W4M) to the Kitimat Terminal (UTM Zone 9 Easting 518436, Northing 5977703) for shipping to world markets. The terminal will also be the site for the import of condensate. The marine terminal will accommodate the transfer of oil into, and condensate out of, tankers.

1.1 Project Overview

In 1998, Enbridge Inc. (Enbridge) began an analysis of the need for, and feasibility of, a pipeline to meet the long-term needs of Western Canadian oil production and provide Canadian producers with access to alternative markets. The analysis considered a pipeline originating in Alberta and terminating at a marine terminal on the west coast of Canada—to open up access to markets in the Asia-Pacific Rim countries and in the western United States. The analysis also included a high-level comparison of potential pipeline route and marine terminal alternatives. In 2002, the need for a new oil export pipeline and for a pipeline to transport condensate to markets in Alberta progressed. Within two years, the Project was formally announced (see Figure 1-1 for the currently proposed route).

Since 2002, Enbridge has furthered project development at a technical and commercial level, with the support of potential Canadian and international shippers.

The oil pipeline is designed for an average annual throughput capacity of 83,400 m³ (525,000 barrels) per day, and will have an outside diameter (OD) of 914 mm (NPS 36). It will be designed to transport conventional light and heavy oil, synthetic oil, bitumen blended with condensate and bitumen blended with synthetic oil. The condensate pipeline is designed with an average annual throughput capacity of 30,700 m³ (193,000 barrels) per day and will have a 508 mm OD (NPS 20).
Oil sourced from the Alberta oil sands and other production sources in the Western Canadian Sedimentary Basin (WCSB) will be delivered to the Kitimat Terminal for marine transportation to international overseas markets and will be available for western United States markets. Condensate will be imported from a variety of supply areas in the Asia-Pacific and Middle East and will be transported to sources of bitumen and heavy oil production for blending purposes.

1.2 Purpose of the Project

The primary purpose of the Project is to provide access for Canadian oil to large and growing international markets, comprising existing and future refiners in Asia and the United States West Coast. Providing new pipeline transportation service to tidewater will allow Canada to diversify its market for oil production and, conversely, will allow Pacific Rim refiners to consistently access Canadian oil supply and diversify their own sources of supply. Increasing the number of transportation options and markets for Canadian oil supply will lead to higher netbacks for all Canadian producers and encourage innovation in Canada’s energy sector. A secondary purpose of the Project is to provide for the construction of a condensate import pipeline.

1.3 Project Benefits

Canada is dependent on a single market for exports of its oil. Demand for oil in the United States has peaked and is expected to steadily decline.

The Project is needed to diversify markets for Canadian oil by connecting Canadian oil supply to rapidly growing markets in northeast Asia and elsewhere, which are driving increasing global demand for oil. The Project allows Canada to increase the security of its markets and add significantly to the benefits that Canadians derive from oil exports.

Likewise, the Project creates the opportunity to diversify and significantly expand sources of condensate supply and availability. Historically, shortages of condensate supply have created risks and additional costs for Canadian oil sands producers. NEB forecasts for condensate requirements suggest that there might be future shortages of condensate import capacity. The Project’s condensate line is capable of meeting this forecast need.

By diversifying their markets, Canadian oil producers will substantially increase the netback price for all Canadian production. Muse Stancil was retained to provide an independent assessment of the net benefits that would accrue to the Canadian oil industry as a result of the Project proceeding. Over the 10 years after project start-up, Muse Stancil estimates that:

- sweet synthetic crude prices will rise, on average, $2.04/bbl more if the Project were to proceed
- Athabasca dilbit prices will similarly increase, on average, by $3.00/bbl

Significant volumes of synthetic oil and blended bitumen (diluted bitumen) will flow to markets in northeast Asia. Initially, almost half of the exports will be synthetic oil. Assuming no change to the upgrading capacity in Alberta, diluted bitumen volumes will increase over time as the total supply of diluted bitumen increases relative to that of synthetic oil.
Increased prices for Canadian oil would result in annual producer revenues increasing by $2.39 billion in the first full year of operations and growing to over $4.47 billion by 2025. When adjusted for transportation tolls on Northern Gateway, and after taking into account increased unit transportation costs on the Enbridge Mainline System, as well as increased Canadian refinery feedstock costs resulting from the Project, the net benefit to the Canadian oil industry would be $28 billion over the Project’s first 10 years of operations.

Although the net benefits to the Canadian oil industry resulting from the Project are very large, total benefits flowing to all Canadians are greater. Wright Mansell Research was retained to provide an independent assessment of the benefits of the Project from a Canadian public interest perspective. Over a 30-year operating period, Canadian gross domestic product (GDP) would increase by $270 billion. Additional labour income would be $48 billion, as a result of an additional 558,000 person years of employment. Federal and provincial governments could collect an additional $81 billion in revenue.

The Project has an estimated capital cost of about $5.54 billion (Q4 2009 Canadian dollars) plus allowance for funds used during construction (AFUDC). This investment alone will generate substantial economic benefits at local, regional, provincial and national levels.

The socio-economic effects of the Project, including national and provincial economic effects, are addressed in Volume 6 C. The Project will generate revenue by way of property taxes and corporate income taxes. In Alberta and British Columbia, annual property taxes for the oil and condensate pipelines and related facilities are estimated to total $36 million. Annual corporate income taxes are estimated to be $33 million. The Project will provide employment opportunities as long as it operates and will generate revenue for businesses by way of sale of goods and services. Government revenue from pipeline operations will exceed $85 million per annum.

Estimates of employment (direct, indirect and induced) generated during project construction total about 62,700 person-years. About 57% of the employment will be in British Columbia, 24% will be in Alberta and the remaining 19% will be in the rest of Canada. Direct, indirect and induced labour income related to project construction is estimated at about $4.3 billion (Q4 2009 Canadian dollars), with a similar pattern of distribution between provinces. The direct, indirect and induced impact on Canadian GDP (value-added) is expected to total about $6.3 billion, distributed as 55% British Columbia, 29% Alberta and 16% for the rest of Canada. Taxes paid during construction are estimated to exceed $913 million.

On a broader scale, access to Pacific Rim markets for Canadian oil production will create numerous and sustaining benefits for all of Canada, while providing secure and essential energy supplies to nations such as China and South Korea. These economic benefits are described in Volume 2 and are discussed in reports prepared by Muse Stancil and Wright Mansell Research Ltd. (see Volume 2, Appendix A and Appendix B). Natural resource development and marketing is a fundamental driver of the Canadian economy. Transportation infrastructure is essential to that activity and, by extension, is essential for Canadians to continue to enjoy, and continue to afford, sustainable economic, environmental and social progress.

At the local level, Northern Gateway has sought to establish positive relationships with communities and Aboriginal groups along the route, including developing a number of initiatives designed to build long-term, sustainable relationships with communities and participating Aboriginal groups. Northern
Gateway will continue Enbridge’s partnerships with, and support of, organizations that contribute to the economic and social development of communities where people live and work.

Northern Gateway is also developing an equity investment option so that participating Aboriginal groups can financially benefit from the Project. Northern Gateway will also develop initiatives that allow participating Aboriginal groups to:

- complete their own analysis of Northern Gateway's plans
- develop programs to provide medium-term and long-term opportunities in areas such as employment, training, business procurement and environmental protection

1.4 Sustainable Development

The JRP agreement for the Project states that “the objective of sustainable development is to achieve a balance between preserving environmental integrity, ensuring social equity and improving economic efficiency.” It further states that “the proponent shall strive to integrate and balance this objective within its application, and clearly outline how it has been incorporated.”

Northern Gateway’s approach to project development is grounded on achieving a fair and sustainable balance between project effects and benefits. Sustainability is an integral component of the public interest mandate conferred upon the NEB and concurs with Enbridge’s Corporate Social Responsibility commitments.

The design and operational measures proposed for the Project are consistent with past industry practices and lessons learned—they address issues listed in the NEB Filing Manual and they meet or exceed operational standards. The measures are described in detail throughout this multi-volume Application and will mitigate adverse environmental and socio-economic effects to levels considered to be not significant. Design and operational measures include:

- rigorous, multi-disciplinary route selection process designed to identify a corridor that will achieve an acceptable balance of engineering, environmental and economic considerations, and which will conform with land use and protected area plans in Alberta and British Columbia
- a model of world-class standards for:
  - engineering, design and materials procurement
  - the design, operation and maintenance of terrestrial and marine terminal facilities
  - tanker vetting and marine operational protocols and emergency response capability, training and execution
  - terrestrial emergency response capability, training and execution
- commitment to identify, mitigate and proactively manage potential project effects on the environment, including sensitive species such as caribou, grizzly bear and marine mammals
- commitment to mitigate project effects on traditional use throughout project design, construction, operations and decommissioning
compensation for individuals and businesses incurring losses attributable to project construction and operations, including compensation to trappers and guide-outfitters for losses incurred because of construction activities and losses to fishers because of potential interference with fishing activities by project-related tankers

• commitment to no-net-loss of fish habitat

Although committed to limiting adverse environmental effects, Northern Gateway acknowledges that no project of this magnitude can be constructed and operated without creating some level of environmental disturbance, and without creating a measure of risk in terms of accidents and malfunctions. Northern Gateway also recognizes that potential adverse effects from routine operations, and potential accidents and malfunctions, should be counterbalanced by lasting benefits for communities along the pipeline route, and in coastal areas close to project-related shipping. Therefore, Northern Gateway has developed a range of community investment initiatives with a goal of building long-term sustainable relationships with communities and participating Aboriginal groups. Concepts considered and confirmed to date are discussed below (see also Volume 4, Section 3.1.3 and Section 3.6 and Volume 5A, Section 3.1.2 and Section 3.2).

**Enbridge Northern Gateway Investment in Building Sustainable Communities**

Northern Gateway will support community projects or programs in education, health and safety, culture and community leadership, and the environment during project development and operations. Northern Gateway expects to work with a community advisory board, made up of northern residents, which will make recommendations on how the funds can be best allocated to meet the priorities of local communities.

**Aboriginal Equity Investment**

Northern Gateway will offer Aboriginal communities the opportunity to invest in 10% of the Project through equity participation. This will be an open opportunity for Aboriginal groups to become active business partners in the Project. Northern Gateway will work with each community that elects to execute an equity option to help facilitate the financial means to obtain the equity. The risk and cost of permitting, design and construction will be borne by Northern Gateway.

**Environmental Research**

Northern Gateway is prepared to fund a series of initiatives aimed at improving knowledge and research on the marine and terrestrial environment. Northern Gateway has initiated discussions with several coastal Aboriginal organizations to undertake cooperative marine research in support of the environmental and socio-economic assessment (ESA), as well as to provide an enhanced knowledge base for detailed design and operational planning and readiness. Initiatives that have been discussed include:

• providing additional information for revising the Coastal Operations and Sensitivity Mapping Technical Data Reports (TDRs) (Polaris 2010a, b)

• coordinating cooperative and independent marine research by coastal Aboriginal groups to support the ESA, associated local community information needs and future environmental monitoring
• involving coastal Aboriginal communities in the identification of important sites and response priorities as part of the development of site-specific, first-response plans
• investing in salmon enhancement projects

**Employment and Training Initiatives**
Northern Gateway is committed to employment and skills development in the communities along the project route and continues to develop initiatives related to:
• individualized employment and training workshops and programs for local communities and participating Aboriginal groups
• pre-employment training programs specific to the pipeline industry
• tools to enable communities and Aboriginal groups to establish baseline data on local skills, education and businesses
• participation in skill and career development workshops, events and meetings in communities throughout northern British Columbia and Alberta
• apprenticeship opportunities during construction

**Business Development Initiatives**
Northern Gateway places an emphasis on business development opportunities for communities and Aboriginal groups. Northern Gateway will focus on engagement with established businesses and those businesses that might need support through the business development phase. Initiatives include:
• conducting a business asset evaluation on First Nation reserves and Métis communities to identify future opportunities using established businesses and those operations that might meet the needs of the Project
• establishing progressive local employment and contracting targets for all northern communities to enhance local participation in terrestrial and marine operations
• ensuring an investment is made for a dedicated and improved first response marine infrastructure to improve the safety and security of communities on the north coast. It is the intent of Northern Gateway to make this an educational, training and employment opportunity for coastal First Nations.

**Contracting Opportunities for Aboriginal Groups**
Northern Gateway places an emphasis on contractual opportunities for Aboriginal groups. Northern Gateway will set aside scopes of work from major contractor bid packages and provide sole-sourcing opportunities to qualified Aboriginal businesses and joint venture companies who meet the required safety qualifications and offer regionally competitive pricing.

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1 Enbridge may offer sole-sourced contracting opportunities to qualified Aboriginal suppliers and contractors, where appropriate. Such sole-sourcing may be subject to competition among qualified Aboriginal providers and to bids reflecting regionally competitive rates.
Greening Initiatives

Northern Gateway is developing a greening initiative, which, if the Project receives regulatory approval, would offset the footprint of the Project. Through this initiative, Northern Gateway would work with communities and Aboriginal groups to identify opportunities. Examples of greening initiatives contemplated include:

- expansion of community forests
- biomass energy projects
- installation of a geothermal heating system in a new community facility
- support of local community investments in environmental projects

Enbridge Community Investment Initiatives

Enbridge community investment initiatives will also be available for the Project, including the Enbridge Natural Legacy Program, the Enbridge Safe Community Program and the Enbridge School Plus Program.

Natural Legacy Program

The Enbridge Natural Legacy Program is an opportunity to demonstrate Enbridge’s ongoing commitment to environmental stewardship, and habitat remediation and protection through initiatives such as elementary educational programs and the planting and care of native trees and plants throughout urban and rural areas along Enbridge rights-of-way. The Natural Legacy Program has involved collaboration with organizations such as the Nature Conservancy of Canada, Ducks Unlimited, Trout Unlimited and Tree Canada, as well as local schools, educators and volunteers.

Safe Community Program

The Enbridge Safe Community Program is designed to provide monetary grant support for first responders, police agencies, fire-fighters, emergency medical services and other related health providers who would respond to emergency situations along any of Enbridge’s pipelines in nearby communities throughout the Northwest Territories, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario and Quebec. The grant support provided by the Canadian program will help eligible organizations acquire new safety-related equipment, obtain professional training and deliver safety education programs in their communities.

School Plus Program

The Enbridge School Plus Program was established by Enbridge in partnership with the Assembly of First Nations to encourage First Nations youth to stay in school. Near major Enbridge pipeline routes, the program provides financial support to First Nations schools that wish to undertake programs and activities that are not fully funded as part of each school’s standard curriculum. Teachers are eligible to receive financial support for programs such as cultural camps, sports activities, traditional arts and crafts instruction and native language preservation. The program also funds the purchase of valuable instructional technology such as computers, SMART Boards and audiovisual equipment.
Improvements in Navigational Safety

Important measures to improve navigational safety being developed by Northern Gateway include:

- using a tethered escort tug and close escort tug for laden tankers, and close escort tugs for those in ballast
- using enhanced navigational aids as proposed by British Columbia Coastal Pilots
- installing radar along important sections of the Northern and Southern Approaches in the confined channel assessment area (CCAA, see Figure 1-2) where vessels will be transiting
- installing increased emergency response capacity
- using an Electronic Chart Display and Information System (ECDIS) together with standalone personal pilot units (PPUs), with a navigation capability independent of the vessels’ navigations systems
- vetting all tankers and assuring compliance with Canadian regulations and International Maritime Organization (IMO) standards (e.g., ECDIS on oil tankers, watch-keeping certification and port control inspections)
- reducing speed in the CCAA to 10 to 12 knots and, in certain areas, to 8 to 10 knots
- observing weather restrictions for entry of vessels into the CCAA and for berthing at the Kitimat Terminal

For discussions regarding these and other navigational measures, see Volume 8A.
ENBRIDGE NORTHERN GATEWAY PROJECT
Confined Channel Assessment Area

REFERENCE: NTDB Topographic Map sheets provided by Her Majesty the Queen in Right of Canada, Department of Natural Resources. All rights reserved.
1.5 Northern Gateway Pipelines Limited Partnership

Northern Gateway Pipelines Limited Partnership (the Partnership) was formed under Alberta law to design, develop, construct, own and operate the Project. The Partnership includes Enbridge Inc. (Enbridge), as limited partner, and Northern Gateway Pipelines Inc., as general partner. The partnership is offering an equity position to participating Aboriginal groups.

Enbridge operates—in Canada and the United States—the world’s longest oil and liquids pipeline system. Enbridge also owns Canada’s largest natural gas distribution company.

Enbridge has unique and extensive experience developing, managing, operating and optimizing liquids and natural gas pipelines, including:

- project design, construction and operation
- hydrocarbon transportation
- commodity batching
- tankage
- pipeline maintenance
- supervisory control and data acquisition system (SCADA)
- leak detection and pipeline integrity management
- terrestrial and marine terminal operations (Colombia and Venezuela)

Enbridge takes pride in its long-standing reputation as a socially responsible corporation and is committed to designing, constructing and operating the Project to meet strict environmental and safety regulatory requirements and applicable best practices.

1.6 Action Sought by Applicant

Northern Gateway hereby respectfully requests:

- a Certificate of Public Convenience and Necessity pursuant to Section 52 of the National Energy Board Act (NEB Act), authorizing the construction and operation of the oil pipeline and associated facilities, including tankage and terminalling at Kitimat
- a Certificate of Public Convenience and Necessity pursuant to Section 52 of the NEB Act, authorizing the construction and operation of the condensate pipeline and associated facilities, including tankage and terminalling at Kitimat
- an order pursuant to Part IV of the NEB Act approving the toll principles applicable to service on each of the oil and condensate pipelines, including tankage and terminalling at Kitimat
- such further and other related relief as Northern Gateway may request or the NEB may deem appropriate pursuant to Section 20 of the NEB Act
1.7 Contact Information

All notices and communications concerning this Application should be directed to:

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abby.dorval@enbridge.com

1.8 References

1.8.1 Literature Cited


2 Project Description

The Project includes constructing, operating and decommissioning two pipelines, associated facilities and the Kitimat Terminal. An overview is provided below; details are provided in Volume 3.

Marine transportation associated with the Project is described briefly in Section 2.6.3. Additional information is provided in Volume 8A.

2.1 Pipelines

Northern Gateway is applying for approval to install the pipelines within a 1-km wide corridor, which is approximately 1,172 km long. The pipelines will be located in a common, permanent 25-m wide right-of-way (RoW), extending from the initiating station near Bruderheim to the Kitimat Terminal.

The major components of the pipeline portion of the Project include:

- an oil export pipeline, 914 mm OD (NPS 36), designed for an average annual throughput capacity of 83,400 m³ (525,000 barrels) per day
- a condensate import pipeline, 508 mm OD (NPS 20), designed for an average annual throughput capacity of 30,700 m³ (193,000 barrels) per day

The delineation of the pipeline RoW in the applied-for corridor will be finalized in the NEB detailed route approval process. This delineation will incorporate:

- detailed engineering, construction and operations considerations
- further site-specific constraint mapping
- results of Aboriginal traditional knowledge community reports and further field investigations
- input from:
  - Aboriginal groups and communities
  - landowners
  - the public
  - other interested parties
  - government agencies

2.2 Pump Stations

Electric-powered pump stations at 10 locations will be required to operate the pipelines, including the initiating stations near Bruderheim (for oil) and Kitimat (for condensate) (see Table 2-1). The oil and condensate pumps are rated at 4,290 kW (5,750 hp). Intermediate pump station sites will occupy 4 ha. The site for the initiating station near Bruderheim will occupy about 2 ha. The condensate initiating site is located in the Kitimat Terminal. Power lines will be constructed to connect to existing transmission systems. In British Columbia, Northern Gateway will be responsible for supplying connection facilities to BC Hydro. In Alberta, utility providers will supply the connection facilities.
### Table 2-1 Pump Station Locations

<table>
<thead>
<tr>
<th>Station</th>
<th>Location (kilometre post [KP])</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bruderheim</td>
<td>0</td>
<td>Oil</td>
</tr>
<tr>
<td>Whitecourt</td>
<td>203.2</td>
<td>Oil/condensate</td>
</tr>
<tr>
<td>Smoky River</td>
<td>400.6</td>
<td>Oil/condensate</td>
</tr>
<tr>
<td>Tumbler Ridge</td>
<td>598.1</td>
<td>Oil/condensate</td>
</tr>
<tr>
<td>Bear Lake</td>
<td>716.0</td>
<td>Oil/condensate</td>
</tr>
<tr>
<td>Fort St. James</td>
<td>824.5</td>
<td>Oil/condensate</td>
</tr>
<tr>
<td>Burns Lake</td>
<td>925.5</td>
<td>Oil/condensate</td>
</tr>
<tr>
<td>Houston</td>
<td>1,002.0</td>
<td>Condensate</td>
</tr>
<tr>
<td>Clearwater</td>
<td>1,124.7</td>
<td>Condensate</td>
</tr>
<tr>
<td>Kitimat</td>
<td>1,172.2</td>
<td>Condensate</td>
</tr>
</tbody>
</table>

#### 2.3 Clore and Hoult Tunnels

Crossing the coastal mountains will require constructing two tunnels through the mountains between Clore River valley (KP 1072.9) and Hoult Creek valley (KP 1086.8) (see Figure 2-1). The Clore Tunnel will be approximately 6.5 km long and the Hoult Tunnel will be approximately 6.6 km long.

#### 2.4 Valves and Scraper Trap Facilities

Remotely operated pipeline block valves will be installed in the RoW at strategic locations, including pump stations and major watercourse crossings. The exact location of these valves will be finalized during detailed engineering design. Electrical power for the block valves will be provided by commercial or alternate power sources. A combination of wide area network, telephone lines and satellite and radio communication circuits will provide main and backup communication systems. Details on the required infrastructure, including radio towers, will be determined during detailed engineering studies.

Scraper trap facilities will be installed at both ends of the pipelines and at selected intermediate pump stations. Because these facilities will be in the pump stations, no additional land is required.

#### 2.5 Kitimat Terminal

The Kitimat Terminal is on the west side of Kitimat Arm (see Figure 2-2) and refers to the tank terminal (the area inside the security fence) and the marine terminal (see Figure 2-3), as well as the undeveloped area outside the security fence that also includes the excess cut disposal area.

The Kitimat Terminal will include oil and condensate tanks, pump facilities, other associated facilities, two tanker berths and one utility berth (see Figure 2-4).
Permanent road proposed along ROW, between tunnel portal and existing forestry road.

Permanent road proposed along ROW, between tunnel portals.

Kilometre Post for Tunnel Portal
Pipeline Route
Tunnel
Project Effects Assessment Area
Construction Camp
Staging Area
Excess Cut Disposal Area
Proposed Permanent Access Road
Existing Access Road

Reference: Pipeline Route R

REFERENCE: NTDB Topographic MapSheets provided by the Majesty the Queen in Right of Canada, Department of Natural Resources. All rights reserved.

REFERENCES:

FIGURE NUMBER: CONSTRUCTION:
PREPARED FOR:


Jacques Whitford AXYS Ltd.

Kilometre Post for Tunnel Portal
Pipeline Route
Tunnel
Project Effects Assessment Area
Construction Camp
Staging Area
Excess Cut Disposal Area
Proposed Permanent Access Road
Existing Access Road

Reference: Pipeline Route R
Kitimat Terminal Project Development Area

ENBRIDGE NORTHERN GATEWAY PROJECT

REFERENCE: Pipeline Route P: November 5, 2008
Z:\Clients\Enbridge\Gateway\Figures\MXD\JWA-CAL-049-Location_Kitimat_Terminal_Douglas_Channel\JWA-1038983-049-004.mxd

SCALE: 1:25,000
Projection: NAD 83
UTM 9

REFERENCE: Pipeline Route R

REFERENCE: SPOT REFERENCES:

PREPARED FOR:
Kitimat Terminal Project Development Area

PREPARED BY:
Jacques Whitford AXYS Ltd.

CONTRACTOR:
Jacques Whitford AXYS Ltd.

APPROVED BY:
JW-1038983-049-004

PROJECTION: NAD 83
UTM 9
ENBRIDGE NORTHERN GATEWAY PROJECT

Preliminary Layout of Kitimat Terminal
2.5.1  Tank Terminal

The tank terminal (see Figure 2-4) will occupy approximately 220 ha and will include 14 hydrocarbon tanks (11 oil and 3 condensate), each with a capacity of 78,800 m³ (496,000 barrels). A security fence will be built around the tank terminal. A 60-m wide firebreak area will be cleared around the outside perimeter of the terminal. A site adjacent to the tanks and within the tank terminal security fence will also be developed for two potential future tanks for product segregation purposes. The size and spacing of tanks will be optimized during detailed design. The main components of the tank terminal include:

- the oil transfer system, including an oil receiving station, tanks, an oil loading system, custody transfer metering and a recovered oil drain tank
- the condensate transfer system, including a condensate unloading system, custody transfer metering, booster pumps, tanks and a condensate initiating pump station
- ancillary systems, including electrical supply and distribution, fire protection, tank impoundment, water management, vapour recovery unit, corrosion control, potable water, utility air and emergency shutdown
- buildings
- control centre
- civil infrastructure including roads and fences

2.5.2  Marine Terminal

The marine terminal will include the marine-based infrastructure within the Kitimat Terminal and extends from the upper edge of the marine riparian area seaward. It includes a 150-m marine safety zone seaward from the berthing structures (a 100-m water lot is included in the safety zone). The marine terminal will comprise two tanker berths and one utility berth (see Figure 2-4). Both tanker berths will be equipped for loading oil tankers and unloading condensate tankers. Figure 2-4 illustrates a very large crude carrier (VLCC) and a Suezmax condensate tanker berthed at the marine terminal.

The main components of each tanker berth include:

- a loading platform with gangway tower
- access trestles and catwalks
- berthing and mooring structures
- a containment boom

The utility berth will have facilities that can accommodate the mooring of harbour tugs and two utility workboats. A davit system will be used to launch the utility boats from the utility berth deck and retrieve the boats for stowage and maintenance.

2.5.3  Marine Transportation

Marine transportation includes the routine operations of oil and condensate tankers, as well as construction vessels. Tankers transiting to and from the Kitimat Terminal will be chartered by other
interests. Compliance with Northern Gateway’s tanker vetting and operational protocols will be enforced for any tankers nominated to call at the Kitimat Terminal and these vessels will comply with all international safety conventions. Before entering Canadian waters, all tankers will have complied with the *Canada Shipping Act* ballast water management regulations.

### 2.5.4 Construction-Related Vessels

The number of supply vessels, coastal tugs and barges that will be required during construction of the tank terminal will be determined during detailed engineering. Routing and scheduling of these vessels will also be determined as part of this process.

### 2.5.5 Oil and Condensate Tankers

**Transit Areas**

During operations, Northern Gateway expects that between 190 and 250 oil and condensate tankers will call on the Kitimat Terminal each year. On average, this will likely comprise 50 VLCCs, 120 Suezmax tankers and 50 Aframax tankers. The average cargo capacity of these tankers ranges from 80,000 DWT for an Aframax tanker to 320,000 DWT for a VLCC. All tankers will be double hulled.

Tankers arriving from or departing to Asian ports will navigate the northern approach. The northern approach passes Haida Gwaii through Dixon Entrance and continues through Hecate Strait, Browning Entrance, Principe Channel, Nepean Sound, Otter Channel, Squally Channel, Lewis Passage, Wright Sound and Douglas Channel to the Kitimat Terminal.

Tankers arriving from or departing to ports south of Kitimat on the North American west coast will use one of the following routes (see Figure 1-2):

- **Southern Approach (direct)** – pass through Queen Charlotte Sound, and continue through Hecate Strait, Caamaño Sound, Campania Sound, Squally Channel, Lewis Passage, Wright Sound and Douglas Channel
- **Southern Approach (through Principe Channel)** – pass through Queen Charlotte Sound and north through Hecate Strait, before continuing through Browning Entrance and following the route to the Kitimat Terminal outlined previously

Project-related vessel traffic will be controlled and monitored within the Territorial Sea of Canada (see Figure 2-5)—an area that is generally referred to in Volume 8 of the Application as the open water area (OWA). It includes the Northern Approach and the Southern Approaches to and from the Kitimat Terminal and encompasses Hecate Strait, Dixon Entrance, Browning Entrance, Otter Passage, Queen Charlotte Sound and other coastal waters around Haida Gwaii to the 12 nautical mile (nm) limit on the western side of these islands.

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2 The name of Queen Charlotte Islands was changed to Haida Gwaii in December 2009. However, for consistency with source information used for mapping, Queen Charlotte Islands is used on all maps.
Vessel Operations Protocols

The Full Mission Bridge Simulator shows that tankers of the largest design size are capable of navigating the entire route unassisted. During vessel transits of the CCAA and OWA:

- a close escort tug will be used for all laden and ballasted tankers beginning at the pilot boarding stations (Triple Island and proposed sites in Browning Passage and Caamaño Sound) to and from the marine terminal
- a tethered tug, in addition to a close escort tug, will be used for all laden tankers in the CCAA. The tug will be tethered to the stern of the laden tanker at all times, ready to assist with steering or slowing down.
- the close escort tug will normally be positioned approximately 500 m astern of the tanker, or as directed by the shipmaster or pilot during the transit. Local pilots will board and assist all incoming and outgoing tankers. During transit of the CCAA, average tanker speeds will range between 8 to 12 knots.

Harbour tugs and line-handling boats will support berthing and unberthing operations at the marine terminal. All tankers using the Kitimat Terminal will follow requirements for ballast water management and discharge under the Canada Shipping Act and Canadian Ballast Water Control and Management Regulations (BWCMR), and implement an International Maritime Organization (IMO) approved Ballast Water Management Plan. Tankers will have segregated ballast on board that has been exchanged not less than 200 nautical miles from shore, as described by the Ballast Water Management Procedures under the BWCMR. Oily ballast water will not be discharged at the Kitimat Terminal. Solid waste and liquid waste will be managed according to the Canada Shipping Act.

2.5.6 Support Vessels for the Marine Terminal Operations

Line-handling boats will support the operations of the marine terminal and will be berthed and fuelled at the utility berth and used for pre-boomimg. When not active, escort tugs will berth at the utility berth or at a facility in Kitimat. Maintenance for escort and harbour tugs will be provided at existing facilities in Kitimat. Escort and harbour tugs will be fuelled at the utility berth or at existing facilities in Kitimat. Harbour tugs will be on standby at the utility berth but may be berthed at a facility in Kitimat if there is no tanker at the Kitimat Terminal.

Each tanker berth will be equipped with a containment boom. The containment boom will be deployed during all oil loading operations. It will extend from shore, out around the tanker and back to shore. Because condensate dissipates quickly, the containment boom will not be used during condensate off-loading.
2.6 Construction Spreads, Camps and Stockpile Sites

Preliminary plans provide for the pipelines to be constructed using 12 construction spreads. Three construction spreads will be constructed concurrently during four construction seasons: the summer and winter of the first pipeline construction year and the summer and winter of the second pipeline construction year. Pipeline construction will require 11 camps, each with an area of approximately 25 ha to support 500 to 700 workers. Some of the construction camps will require new temporary access roads, the details of which will be determined during detailed engineering in conjunction with local stakeholder and Aboriginal input.

Preliminary pipe stockpile locations and construction staging areas have been selected to provide the best logistical support for construction. Pipe will be transported primarily by rail to sidings that are located as close as possible to the RoW. Pipe will then be transported to stockpile sites and to the RoW by truck.

Staging areas are used primarily for mobilizing construction teams along the RoW. The sites are relatively small, located primarily at construction spread breaks and tunnel portals, and have been included in the environmental assessment. Stockpile sites are used for the temporary storage of pipe, materials and equipment and each will require from 8 to 27 ha.

The construction of the Clore and Hoult tunnels will also require the temporary use of land for construction camps, staging areas and stockpile sites. Three camps will be needed during tunnel construction, each with a capacity of 100 to 150 persons. One camp will be located near the east portal of the Clore Tunnel, a second camp located near the west portal of the Hoult Tunnel, and a third camp between the two tunnels near the west portal of the Clore Tunnel. Each camp will occupy approximately 3 to 5 ha. An excess cut disposal area of about 20 ha will be required near each tunnel portal. Staging areas of various sizes will be required at both ends of the tunnels as well as between the two tunnels.

A construction safety manual will be developed and implemented for the Project. A copy of this manual will be submitted to the NEB before project construction starts.

2.7 Project Schedule

Construction of the Project is scheduled for a 42-month period to achieve the planned in-service date, and to provide for a safe and efficient work progression while limiting adverse environmental and socio-economic effects. An additional six months might be required to complete construction of the Kitimat Terminal. Clearing activities for the first construction season will begin the year before pipeline construction. A comprehensive construction plan will be developed during detailed engineering and construction planning. The plan will take into account environmental and other issues to be managed, and available pipeline industry construction capacity. This might result in changes to the current plans, including changing the season of construction at some locations.

Key project milestones estimated at the time of filing are set out in Table 2-2.
Table 2-2  Project Milestones

<table>
<thead>
<tr>
<th>Project Milestone</th>
<th>Start Date</th>
<th>Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEB Application submission</td>
<td>–</td>
<td>Q2, 2010</td>
</tr>
<tr>
<td>Detailed design</td>
<td>Q1, 2011</td>
<td>Q1, 2015</td>
</tr>
<tr>
<td>Joint Review Panel hearing</td>
<td>Q1, 2011</td>
<td>Q2, 2011</td>
</tr>
<tr>
<td>Governor in Council (GIC) decision</td>
<td>NA</td>
<td>Q2, 2012</td>
</tr>
<tr>
<td>Commercial sanction</td>
<td>Q2, 2012</td>
<td>Q3, 2012</td>
</tr>
<tr>
<td>Procurement of major material and equipment</td>
<td>Q3, 2012</td>
<td>Q3, 2016</td>
</tr>
<tr>
<td>Kitimat Terminal construction</td>
<td>Q2, 2013</td>
<td>Q3, 2017&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Tunnel construction</td>
<td>Q2, 2013</td>
<td>Q4, 2016</td>
</tr>
<tr>
<td>Oil and condensate pipeline construction</td>
<td>Q4, 2013</td>
<td>Q4, 2016</td>
</tr>
<tr>
<td>Pump station construction</td>
<td>Q3, 2014</td>
<td>Q4, 2016</td>
</tr>
<tr>
<td>Leave-to-open and commissioning</td>
<td>Q3, 2016</td>
<td>Q4, 2016</td>
</tr>
<tr>
<td>Project in-service</td>
<td>NA</td>
<td>Q4, 2016&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

NOTES:
<sup>a</sup> A limited number of tanks will see construction extend beyond the in-service date to Q3, 2017.
<sup>b</sup> Q4, 2016 is the earliest in-service date. In-service date will depend on various factors, including timing of the regulatory decision, timing of commercial sanction for the Project, detailed engineering and construction progress.

2.8  Project Cost Estimate

The estimated capital cost for the Project is $5.54 billion (Q4, 2009 Canadian dollars) plus allowance for funds used during construction (AFUDC, see Table 2-3). This estimate is based upon Enbridge and consultant construction experience over the past several years. The estimate differs from that contained in the Preliminary Information Package (PIP) because there have been:

- changes to the project scope
- adjustments to material and labour costs
- new findings from:
  - consultation with stakeholders and participating Aboriginal groups
  - engineering and environmental field studies
Table 2-3  Estimated Capital Cost for the Project

<table>
<thead>
<tr>
<th></th>
<th>Pipelines ($ millions)</th>
<th>Pump Stations ($ millions)</th>
<th>Kitimat Terminal (Includes Tankage and Metering) ($ millions)</th>
<th>Total$ ($ millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land$^1</td>
<td>47</td>
<td>1</td>
<td>4</td>
<td>52</td>
</tr>
<tr>
<td>Materials$^2</td>
<td>926</td>
<td>245</td>
<td>172</td>
<td>1,343</td>
</tr>
<tr>
<td>Construction</td>
<td>2,740</td>
<td>310</td>
<td>481</td>
<td>3,531</td>
</tr>
<tr>
<td>Project Execution</td>
<td>470</td>
<td>66</td>
<td>79</td>
<td>615</td>
</tr>
<tr>
<td>TOTAL</td>
<td>4,183</td>
<td>622</td>
<td>736</td>
<td>6,650$^3</td>
</tr>
</tbody>
</table>

NOTES:
$^1 Land includes property taxes.
$^2 Materials include provincial sales tax (PST) in British Columbia.
$^3 This total includes and AFUDC amount of $1,109 million.
$^4 Goods and services tax (GST) is excluded.
3  Project Need and Purpose

Energy delivery is Enbridge’s core business. Enbridge routinely reviews the capacity of existing infrastructure to meet the take-away requirements of producing areas and the delivery requirements of markets. Enbridge’s analysis determined the need for, and feasibility of, a new pipeline to provide access for WCSB production and oil sands production to new international markets. The Project was conceived to meet these needs (see Section 7 and Volume 2, Section 1.6).

 Providing new pipeline transportation service to tidewater on the west coast will allow Canada to diversify its market for oil, providing increased competition and additional transportation options for producers by connecting Canadian supply to large, long-term and strategic markets in northeast Asia and elsewhere. Increasing the number of transportation options and markets for Canadian oil supply will lead to higher netbacks for all Canadian producers and encourage innovation in Canada’s energy sector.

The Project will also include an import condensate pipeline. Historically, shortages of condensate supply have created risks and additional costs for Canadian oil sands producers. The NEB forecasts for future condensate requirements suggest that there may be future shortages of condensate import capacity. The Project’s condensate pipeline is capable of meeting this forecast need.
4 Alternatives and Justification

Northern Gateway has considered alternatives to the Project, including alternative locations for the inland terminus and the marine terminal (see Figure 4-1).

For the conceptual alternatives considered, the general criteria used by Northern Gateway to evaluate the viability and relative benefits of the Project included:

- overall project life-cycle costs, including design, construction and operations
- acceptability to potential shippers of product receipt and delivery locations and tolls
- suitability for tankage
- suitability and safety for tanker berthing and manoeuvring
- constructability of the pipelines, associated facilities, tank and marine terminals, and associated infrastructure
- safety during construction and operations
- likelihood of the Project to affect sensitive environmental and socio-economic components

4.1 Eastern (Alberta) Pipeline Terminus Alternatives

Siting the eastern (Alberta) pipeline terminus was based primarily on:

- economic feasibility based on providing receipt of oil and delivery of condensate locations acceptable to potential shippers
- technical feasibility based on distance to tie-in facilities and availability of suitably zoned land

The technical, economic and environmental advantages of locating the oil and condensate pipelines in a single RoW also supported the selection of a single eastern pipeline terminus.

Enbridge initially considered the areas around Fort McMurray and Edmonton as possible termini for the oil pipeline, but market response clearly showed shipper preference for a terminus near the Edmonton hub. As well, the need for condensate delivery was centred on the blending terminals in the Edmonton and Hardisty areas.

Given this, Northern Gateway determined that an eastern pipeline terminus near Edmonton would be viable and the preferred alternative for meeting the needs of the Project.

4.2 Marine Terminal Alternatives

Northern Gateway initially considered alternative locations for the marine terminal in Alaska (i.e., Bradfield Canal), Washington (i.e., Ferndale and Anacortes) and areas in British Columbia, including Stewart, Alice Arm, the Mylor Peninsula, Port Simpson, Prince Rupert, Kitimat, Bella Coola, Squamish, and Vancouver (Burrard Inlet, Roberts Bank and Fraser Port).
4.2.1 **Comparison of Marine Terminal Alternatives**

During the 1970s, a working group was established by Fisheries and Oceans Canada (DFO) and Environment Canada to compare the relative vulnerability of 11 potential west coast ports to the effects of accidental oil releases.\(^3\) Ports were compared based on navigational, biological, economic and social risk, and included Port Simpson, Ridley Island (Prince Rupert), Kitimat, Bella Coola, Britannia Beach (Squamish), Port Moody, Roberts Bank, Esquimalt, Cherry Point (Ferndale), Burrows Bay and Port Angeles. The working group concluded that the ports with the lowest relative risks were Port Simpson, Ridley Island (Prince Rupert), Kitimat and Port Angeles.

Of the four ports ranked as having the lowest relative risks, Northern Gateway eliminated Port Simpson and Port Angeles from further consideration based on the criteria noted in Section 4.2.3. Prince Rupert and Kitimat were further evaluated.

4.2.2 **Evaluation of Prince Rupert and Kitimat Terminal Locations**

Having determined that a marine terminal would be feasible at either Kitimat or Prince Rupert, Northern Gateway considered the feasibility of pipeline access to these potential termini. Pipeline route alternatives were considered from the Terrace, British Columbia area westward to Prince Rupert, and through various mountain passes south and east from Terrace southward to Kitimat. The evaluation focused on pipeline constructability, operability, safety, environmental sensitivity, mitigation measures and lifecycle costs.

The route to Prince Rupert is characterized by steep topography and narrow river valleys, which constrain large diameter pipeline construction and heighten operational issues. Pipelines constructed along these rivers would be exposed to challenging hydrotechnical issues, and to avalanches and rock slides in the narrow valleys. Access and watercourse crossing construction, particularly over the Kasiks, Khyex and Skeena Rivers, was anticipated to be difficult. The Skeena River, characterized by unstable channels and deep scour holes, is also too wide for directional drilling using current technology.

The Prince Rupert route was expected to result in a disproportionate number of moderate to serious environmental constraints and issues, compared with the Kitimat alternative. Challenging silt and erosion control requirements would result from varying water flows in high-value fish habitat, and potentially serious issues could result from exposure to avalanches and rockslides in the narrow valleys. Costs to mitigate the potential environmental effects were anticipated to be high.

The pipeline route southward to Kitimat through the Kitimat River valley would possibly encounter slide-prone marine clays and would likely require watercourse crossings in potentially boulder-prone material. However, this pipeline route alternative was determined to be viable and preferable.

Northern Gateway concluded that Kitimat was the preferred alternative for the marine terminal, based on environmental considerations and other matters resulting from the:

- high-level comparative analysis of marine terminal alternatives
- findings of the Port Working Group port comparison report
- findings of the pipeline route alternatives analysis

\(^3\) The final report of the working group was “Potential Pacific Coast Oil Ports: A Comparative Environmental Risk Analysis” and was released in 1978.
4.2.3 **Considerations in the Kitimat Terminal Siting**

Important considerations in siting the Kitimat Terminal included:

- the need for year-round, ice-free access
- sufficient channel width and water depth and a suitable turning basin to permit safe transit by large tankers
- a tanker berth area sheltered from the effects of open water wave conditions
- feasibility of pipeline access to the terminal
- an area accessible from the existing road system without major road construction
- ease of access to and development of marine infrastructure
- the need to limit environmental effects
- availability of suitable land to locate the tank and marine components of a terminal
- availability of nearby existing onshore and marine infrastructure

4.3 **Alternative Means**

Having determined that a pipeline route between an inland terminus located near Edmonton and a marine terminal located near Kitimat would be viable and the preferred alternative, Northern Gateway considered the alternative means of carrying out the Project. This analysis focused on siting and route alternatives for the terminals and pipeline route and other alternative design considerations (see Volume 3, Section 2).