



Environmental Impact Statement

Volume 2: Project Description

Submitted to:
National Energy Board
and the Joint Review Panel

Submitted by:
Imperial Oil Resources Ventures Limited

IPRCC.PR.2004.07

August 2004



Table of Contents

1	INTRODUCTION.....	1-1
1.1	Purpose of this Volume.....	1-1
1.2	Scope of this Volume.....	1-3
1.3	Project Overview.....	1-5
1.4	Project Phases.....	1-9
1.4.1	Feasibility Study Phase.....	1-9
1.4.2	Project Definition Phase.....	1-9
1.4.3	Design and Construction Phase.....	1-10
1.4.4	Operations Phase.....	1-10
1.5	Project Schedule.....	1-13
1.5.1	Summary Schedule.....	1-13
1.5.2	Anchor Field Development.....	1-14
1.5.3	Pipeline and Facilities Development.....	1-14
1.6	Grouping Components for Impact Assessments.....	1-21
1.7	Project Alternatives.....	1-27
1.7.1	Gas Transportation Studies.....	1-27
1.7.2	System Alternatives.....	1-27
1.7.3	Development Alternatives.....	1-29
1.7.4	Selected Concept and Design.....	1-32
2	ROUTE AND SITE SELECTION.....	2-1
2.1	Introduction.....	2-1
2.1.1	Objectives.....	2-1
2.1.2	Selection Process.....	2-1
2.1.3	Route Selection.....	2-1
2.2	Anchor Fields.....	2-5
2.2.1	Site Evaluation Criteria.....	2-5

	2.2.2	Site Selection.....	2-5
2.3		Pipelines	2-7
	2.3.1	Gathering Pipelines Route.....	2-7
	2.3.2	Gas and NGL Pipeline Route.....	2-10
	2.3.3	Route Alternatives.....	2-12
	2.3.4	NGTL Northwest Mainline (Dickins Lake Section).....	2-42
2.4		Pipeline Facilities	2-45
	2.4.1	Site Selection Process.....	2-45
	2.4.2	Site Locations and Alternatives.....	2-47
2.5		Infrastructure	2-51
	2.5.1	Site Evaluation Criteria	2-51
	2.5.2	Site Locations and Alternatives.....	2-51
2.6		Borrow Sites.....	2-55
	2.6.1	Site Evaluation Criteria.....	2-55
	2.6.2	Site Locations and Alternatives.....	2-55
3		ANCHOR FIELDS	3-1
	3.1	Introduction	3-1
	3.2	Niglintgak.....	3-3
		3.2.1 Development Drilling.....	3-5
		3.2.2 Production Facilities.....	3-7
		3.2.3 Gas Conditioning Facility	3-10
		3.2.4 Environmental Design Considerations.....	3-16
		3.2.5 Construction	3-19
		3.2.6 Operations and Maintenance.....	3-20
		3.2.7 Abandonment and Reclamation	3-21
		3.2.8 Design Alternatives	3-22
	3.3	Taglu.....	3-25
		3.3.1 Development Drilling.....	3-25
		3.3.2 Production Facilities.....	3-29

3.3.3	Gas Conditioning Facility	3-30
3.3.4	Environmental Design Considerations.....	3-32
3.3.5	Construction	3-34
3.3.6	Operations and Maintenance.....	3-35
3.3.7	Abandonment and Reclamation	3-36
3.3.8	Design Alternatives	3-36
3.4	Parsons Lake	3-39
3.4.1	Development Drilling.....	3-41
3.4.2	Production Facilities.....	3-44
3.4.3	Gas Conditioning Facility	3-46
3.4.4	Environmental Design Considerations.....	3-51
3.4.5	Construction	3-53
3.4.6	Operations and Maintenance.....	3-55
3.4.7	Abandonment and Reclamation	3-56
3.4.8	Design Alternatives	3-56
4	PIPELINES.....	4-1
4.1	Scope	4-1
4.2	Gathering Pipelines	4-3
4.2.1	Niglintgak Lateral	4-3
4.2.2	Taglu Lateral	4-6
4.2.3	Parsons Lake Lateral	4-7
4.2.4	Storm Hills Lateral.....	4-7
4.3	Natural Gas Liquids Pipeline	4-9
4.4	Gas Pipeline.....	4-13
4.5	Construction	4-17
4.5.1	Construction Activities.....	4-17
4.5.2	Site Preparation	4-17
4.5.3	Pipeline Installation.....	4-22
4.5.4	Watercourse Crossings	4-24
4.5.5	Highway, Road and Pipeline Crossings	4-30

4.5.6	Pressure Testing	4-31
4.5.7	Clean-up and Reclamation	4-31
4.6	Operations and Maintenance	4-33
4.6.1	Pipelines	4-33
4.6.2	Emergency Response	4-37
4.6.3	Post-Construction Monitoring.....	4-37
4.6.4	Abandonment and Reclamation	4-37
4.7	Future Expansion.....	4-39
4.7.1	Gathering Pipelines	4-39
4.7.2	Gas Pipeline.....	4-39
4.7.3	NGL Pipeline.....	4-39
5	PIPELINE FACILITIES	5-1
5.1	Scope of Facilities	5-1
5.2	Storm Hills Pigging Facility.....	5-5
5.2.1	Purpose.....	5-5
5.2.2	Facility Description.....	5-5
5.2.3	Safety and Control Systems	5-5
5.3	Inuvik Area Facility	5-9
5.3.1	Purpose.....	5-9
5.3.2	Facility Description.....	5-9
5.3.3	Process Description.....	5-10
5.4	Compressor Stations.....	5-17
5.4.1	Purpose.....	5-17
5.4.2	Facility Description.....	5-17
5.4.3	Safety and Control Systems	5-21
5.5	Other Facilities	5-23
5.5.1	Meter Stations	5-23
5.5.2	Interconnection to Enbridge.....	5-23
5.5.3	Trout River Heater Station	5-23

5.5.4	Block Valves	5-27
5.5.5	NGTL Interconnect Facility	5-36
5.6	Facility Environmental Design Considerations.....	5-39
5.6.1	Site Development	5-39
5.6.2	Air Quality.....	5-39
5.6.3	Noise.....	5-40
5.6.4	Waste Management.....	5-40
5.7	Construction	5-45
5.7.1	Site Preparation	5-45
5.7.2	Foundations	5-45
5.7.3	Module Installation	5-46
5.8	Site Testing and Commissioning.....	5-47
5.9	Operations and Maintenance.....	5-49
5.9.1	Pipeline Facilities	5-49
5.9.2	Inuvik Area Facility	5-49
5.9.3	Other Facilities	5-49
5.9.4	Maintenance Bases.....	5-50
5.10	Abandonment and Reclamation	5-51
6	INFRASTRUCTURE	6-1
6.1	Infrastructure Components.....	6-1
6.2	Barge Landing Sites	6-7
6.2.1	Permanent Barge Landing Sites	6-7
6.2.2	Temporary Spud Barge Landing Sites	6-8
6.3	Stockpile Sites.....	6-11
6.4	Fuel Storage Sites.....	6-13
6.4.1	Fuel Transportation	6-13
6.4.2	Site Preparation and Tank Design.....	6-13
6.5	Camps and Permanent Living Quarters	6-17

6.5.1	Stationary Camps	6-17
6.5.2	Mobile Camps	6-22
6.6	Potable Water Supply	6-25
6.7	Access Roads	6-27
6.7.1	Existing Roads	6-27
6.7.2	New Roads	6-27
6.7.3	Road Construction	6-30
6.7.4	Road Maintenance	6-30
6.8	Airstrips and Helipads	6-31
6.8.1	Existing Airstrips	6-32
6.8.2	New Airstrips and Helipads	6-33
6.9	Communication Centres	6-35
6.10	Abandonment and Reclamation	6-37
7	BORROW SITES	7-1
7.1	Introduction	7-1
7.1.1	Requirements	7-1
7.1.2	Location	7-1
7.1.3	Access	7-2
7.1.4	Pit Development Plans	7-2
7.2	Borrow Requirements by Project Phase	7-15
7.2.1	Construction Phase	7-15
7.2.2	Operations Phase	7-15
7.2.3	Abandonment and Reclamation	7-15
8	LOGISTICS AND TRANSPORTATION	8-1
8.1	Introduction	8-1
8.2	Transportation Methods	8-3
8.2.1	Barges	8-3
8.2.2	Rail	8-5
8.2.3	Aircraft	8-6

8.2.4	Vehicles.....	8-7
8.3	Anchor Field Drilling and Facility Construction	8-9
8.3.1	Niglintgak.....	8-9
8.3.2	Taglu.....	8-10
8.3.3	Parsons Lake	8-12
8.4	Pipelines and Pipeline Facilities.....	8-13
8.5	Infrastructure	8-17
8.6	Operations	8-19
8.6.1	Transportation Requirements	8-19
8.6.2	Abandonment and Reclamation	8-19
9	EXPENDITURES AND WORKFORCE	9-1
9.1	Project Expenditures	9-1
9.1.1	Capital Expenditures	9-1
9.1.2	Operations Expenditures	9-2
9.2	Workforce Requirements	9-3
9.2.1	Engineering Design and Construction.....	9-3
9.2.2	Operations	9-13
9.2.3	Abandonment and Reclamation	9-19

Glossary

List of Figures

Figure 1-1: Regional Overview Map of the Mackenzie Gas Project Production Area 1-6

Figure 1-2: Regional Overview Map of the Mackenzie Gas Project Pipeline Corridor 1-7

Figure 1-3: Summary Schedule..... 1-13

Figure 1-4: Mackenzie Gas Project Preliminary Construction Schedule..... 1-20

Figure 2-1: Route Development Process..... 2-2

Figure 2-2: Anchor Fields to Inuvik..... 2-9

Figure 2-3: Inuvik to Norman Wells Route Map 2-13

Figure 2-4: Norman Wells to Willowlake River Route Map 2-14

Figure 2-5: Willowlake River to Northwestern Alberta Route Map..... 2-15

Figure 2-6: Ikhil Route Alternatives 2-23

Figure 2-7: Travaillant Lake Route Alternatives 2-25

Figure 2-8: Bear Rock to Great Bear River Route Alternatives 2-29

Figure 2-9: Wrigley Route Alternatives..... 2-31

Figure 2-10: Willowlake River Route Alternatives 2-33

Figure 2-11: Ebbutt Hills Route Alternatives 2-37

Figure 2-12: Mackenzie River Crossing Route Alternatives 2-39

Figure 2-13: Alberta Boundary Route Alternatives 2-41

Figure 2-14: NGTL Dickins Lake Section Route Alternatives..... 2-44

Figure 2-15: Facility Site Selection..... 2-46

Figure 3-1: Location of Niglintgak Field Development 3-4

Figure 3-2: Artist’s Impression of a Niglintgak Well Pad 3-8

Figure 3-3: Niglintgak Well Pad Facilities Plot Plan..... 3-9

Figure 3-4: Artist’s Impression of Niglintgak Barge-Based Gas Conditioning Facility..... 3-13

Figure 3-5: Niglintgak Production Barge Deck Plot Plan..... 3-14

Figure 3-6: Niglintgak Production Barge Roof Plot Plan 3-15

Figure 3-7: Artist’s Impression of Niglintgak Land-Based Gas Conditioning Facility..... 3-17

Figure 3-8: Location of Taglu Field Development 3-26

Figure 3-9: Artist’s Impression of a Taglu Field Development Site..... 3-27

Figure 3-10: Location of Parsons Lake Field Development 3-40

Figure 3-11: Artist’s Impression of Parsons Lake North Pad and Gas Conditioning Facility..... 3-42

Figure 3-12: Artist’s Impression of Parsons Lake South Pad 3-43

Figure 3-13: Parsons Lake North Pad and Gas Conditioning Facilities Plot Plan..... 3-47

Figure 3-14: Parsons Lake South Pad Plot Plan 3-48

Figure 3-15: Parsons Lake South Pad Flow Lines 3-50

Figure 4-1: Location of Gathering Pipelines..... 4-4

Figure 4-2: Gathering Pipeline Facilities 4-5

Figure 4-3: Gathering Pipeline Design Volumes 4-6

LIST OF FIGURES

Figure 4-4:	NGL Pipeline Facilities.....	4-11
Figure 4-5:	Location of Gas and NGL Pipelines	4-14
Figure 4-6:	Gas Pipeline Facilities.....	4-15
Figure 4-7:	Pipeline Construction Spreads	4-18
Figure 4-8:	Typical Right-of-Way Cross-Sections	4-20
Figure 4-9:	Water Crossing Technique Decision Process.....	4-26
Figure 4-10:	Water Crossing Using Conventional Open Cut Method.....	4-26
Figure 4-11:	Open Cut with Fluming.....	4-27
Figure 4-12:	Open Cut with Dam and Pump	4-27
Figure 4-13:	Horizontal Directionally Drilled	4-28
Figure 5-1:	Pipeline Facilities in Mackenzie Valley North	5-2
Figure 5-2:	Pipeline Facilities in Mackenzie Valley South	5-3
Figure 5-3:	Storm Hills Pigging Facility Plot Plan	5-7
Figure 5-4:	Artist's Impression of Storm Hills Pigging Facility.....	5-8
Figure 5-5:	Inuvik Area Facility Plot Plan.....	5-11
Figure 5-6:	Artist's Impression of the Inuvik Area Facility	5-12
Figure 5-7:	Typical Compressor Station Plot Plan	5-19
Figure 5-8:	Artist's Impression of a Typical Compressor Station	5-20
Figure 5-9:	Trout River Heater Station Plot Plan	5-25
Figure 5-10:	Artist's Impression of Trout River Heater Station.....	5-26
Figure 5-11:	Gathering Pipeline Block Valve Plot Plan	5-29
Figure 5-12:	Typical NGL Pipeline Block Valve Plot Plan.....	5-30
Figure 5-13:	Typical Intermediate Pipeline Gas Block Valve Plot Plan	5-31
Figure 5-14:	Artist's Impression of a Typical NGL Pipeline Block Valve	5-32
Figure 5-15:	Artist's Impression of a Typical Intermediate Gas Pipeline Block Valve	5-33
Figure 5-16:	NGTL Interconnect Facility Preliminary Plot Plan.....	5-37
Figure 6-1:	Infrastructure Sites in Mackenzie Valley North.....	6-2
Figure 6-2:	Infrastructure Sites in Mackenzie Valley South.....	6-3
Figure 6-3:	Artist's Impression of a Typical Temporary Spud Barge Landing Site...	6-9
Figure 6-4:	Artist's Impression of a 120-Person Camp	6-19
Figure 6-5:	Artist's Impression of a 950-Person Camp	6-20
Figure 7-1:	Locations of Borrow Sites in Inuvialuit Settlement Region	7-4
Figure 7-2:	Locations of Borrow Sites in Gwich'in and Sahtu Settlement Areas	7-5
Figure 7-3:	Locations of Borrow Sites in Deh Cho Region.....	7-6
Figure 7-4:	Artist's Impression of a Typical Borrow Site	7-13
Figure 8-1:	Barge Requirements from 2005 to 2010	8-5

List of Tables

Table 1-1:	Niglintgak Construction and Drilling Activities for Barge-Based Option.....	1-15
Table 1-2:	Niglintgak Construction and Drilling Activities for Land-Based Option.....	1-16
Table 1-3:	Taglu Construction and Drilling Activities.....	1-17
Table 1-4:	Parsons Lake Construction and Drilling Activities.....	1-18
Table 1-5:	Mackenzie Gas Project Pipeline and Pipeline Facilities Construction Activities.....	1-19
Table 1-6:	Project Components within Production Area.....	1-21
Table 1-7:	Project Components within Pipeline Corridor.....	1-23
Table 1-8:	Project Components by Region.....	1-24
Table 2-1:	Route and Site Evaluation Criteria.....	2-3
Table 2-2:	Proposed Sites for Anchor Field Facilities.....	2-5
Table 2-3:	Gathering and NGL Pipeline Lengths by Region.....	2-7
Table 2-4:	Gas Pipeline Lengths by Region.....	2-10
Table 2-5:	Route Refinement by Route Segment – 2002.....	2-17
Table 2-6:	Route Refinements to Connect Project Facilities.....	2-40
Table 2-7:	Proposed Sites for the Pipeline Facilities.....	2-47
Table 2-8:	Proposed Valve Sites.....	2-49
Table 2-9:	Selection of Proposed Infrastructure.....	2-53
Table 2-10:	Alternative Infrastructure Sites.....	2-54
Table 3-1:	Estimated Niglintgak Land Requirements.....	3-3
Table 3-2:	Estimated Peak Niglintgak Facility Continuous Air Emissions.....	3-18
Table 3-3:	Estimated Peak Niglintgak Waste Generation.....	3-18
Table 3-4:	Estimated Taglu Land Requirements.....	3-25
Table 3-5:	Estimated Peak Taglu Facility Continuous Air Emissions.....	3-32
Table 3-6:	Estimated Peak Taglu Waste Generation.....	3-33
Table 3-7:	Estimated Parsons Lake Land Requirements.....	3-39
Table 3-8:	Estimated Peak Parsons Lake Facility Emissions.....	3-52
Table 3-9:	Estimated Peak Parsons Lake Waste Generation.....	3-53
Table 4-1:	Inuvik Area Facility Volumes.....	4-3
Table 4-2:	Niglintgak Lateral Design.....	4-6
Table 4-3:	Taglu Lateral Design.....	4-7
Table 4-4:	Parsons Lake Lateral Design.....	4-8
Table 4-5:	Storm Hills Lateral Design.....	4-8
Table 4-6:	NGL Pipeline Design Volumes.....	4-9
Table 4-7:	NGL Pipeline Design.....	4-10
Table 4-8:	Gas Pipeline Design Volumes.....	4-13
Table 4-9:	Gas Pipeline Design.....	4-16
Table 4-10:	NGTL Pipeline Design.....	4-16
Table 4-11:	Location and Length of Pipeline Construction Spreads.....	4-19
Table 4-12:	Watercourse Crossings by Region.....	4-25

LIST OF TABLES

Table 4-13:	Primary Watercourse Crossing Techniques by Region.....	4-25
Table 4-14:	Proposed Horizontal Directionally Drilled Watercourse Crossings	4-29
Table 5-1:	Pipeline Inlet Temperatures	5-21
Table 5-2:	Gathering Pipeline Block Valve Sites.....	5-34
Table 5-3:	Intermediate NGL Pipeline Block Valve Sites	5-34
Table 5-4:	Intermediate Gas Pipeline Block Valve Sites	5-36
Table 5-5:	Estimated Facility Emissions	5-42
Table 5-6:	Estimated Waste Generation for the Inuvik Area Facility	5-43
Table 5-7:	Estimated Waste Generation for the Gathering and NGL Pipelines.....	5-43
Table 5-8:	Estimated Waste Generation for the Gas Pipeline	5-43
Table 5-9:	Estimated Waste Generation for Gathering and NGL Pipeline Facilities	5-43
Table 5-10:	Estimated Waste Generation for Gas Pipeline Facilities	5-44
Table 5-11:	Estimated Waste Generation for Infrastructure.....	5-44
Table 6-1:	Infrastructure Components by Site.....	6-4
Table 6-2:	Barge Landing Site Requirements.....	6-8
Table 6-3:	Construction Stockpile Locations and Materials	6-12
Table 6-4:	Fuel Storage Locations.....	6-14
Table 6-5:	Location and Capacity of Permanent Living Quarters.....	6-17
Table 6-6:	Location and Estimated Size of Camps.....	6-18
Table 6-7:	Estimated Potable Water Requirements.....	6-25
Table 6-8:	All-Weather Road Requirements	6-28
Table 6-9:	Winter Roads Required to Support Infrastructure Sites.....	6-29
Table 6-10:	Airstrip and Helipad Requirements.....	6-31
Table 7-1:	Primary Borrow Source Demand and Supply Estimate	7-7
Table 7-2:	Borrow Sites in the Inuvialuit Settlement Region.....	7-7
Table 7-3:	Borrow Sites in the Gwich'in Settlement Area.....	7-8
Table 7-4:	Borrow Sites in the Sahtu Settlement Area – K'ahsho Got'ine District.....	7-9
Table 7-5:	Borrow Sites in the Sahtu Settlement Area – Tulita District	7-10
Table 7-6:	Borrow Sites in the Deh Cho Region	7-11
Table 8-1:	Summary of Project Cargo by Location (tonnes).....	8-4
Table 8-2:	Preliminary Estimate of Monthly Transportation Requirements	8-14
Table 9-1:	Estimated Capital Expenditures for Anchor Fields (\$Millions).....	9-1
Table 9-2:	Capital Expenditures for Pipeline and Pipeline Facilities (\$Millions)....	9-2
Table 9-3:	Operations Expenditures by Project Component (\$Millions).....	9-2
Table 9-4:	Estimated Construction Employment for Pipelines and Facilities.....	9-3
Table 9-5:	Construction Employment – Niglintgak (Barge Option)	9-4
Table 9-6:	Construction Employment – Niglintgak (Land Option)	9-5
Table 9-7:	Construction Employment – Taglu	9-5
Table 9-8:	Construction Employment – Parsons Lake	9-5
Table 9-9:	Drilling, Completions and Related Employment – Niglintgak	9-6
Table 9-10:	Drilling, Completions and Related Employment – Taglu.....	9-6
Table 9-11:	Drilling, Completions and Related Employment – Parsons Lake.....	9-7
Table 9-12:	Construction Employment – Gathering Pipelines.....	9-8

Table 9-13:	Construction Employment – NGL Pipeline	9-8
Table 9-14:	Construction Employment – Gas Pipeline	9-9
Table 9-15:	Construction Employment – Pipeline Facilities.....	9-10
Table 9-16:	Construction Employment – Inuvik Area Facility	9-10
Table 9-17:	Typical 35-Person Infrastructure Site Development Crew	9-11
Table 9-18:	Estimated Construction Camp Staffing.....	9-12
Table 9-19:	Camp Personnel Requirements for a 950-Person Camp	9-12
Table 9-20:	Ongoing Estimated Operations Employment – Anchor Fields.....	9-13
Table 9-21:	Ongoing Operations Employment – Pipelines and Facilities.....	9-14

