WHITE ROSE OILFIELD

COMPREHENSIVE STUDY REPORT

SUBMITTED BY:

HUSKY OIL OPERATIONS LIMITED (AS OPERATOR)
SUITE 801, SCOTIA CENTRE
235 WATER STREET
ST. JOHN'S, NF, A1C 1B6
TEL: (709) 724-3900
FAX: (709) 724-3915

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PREFACE

This Comprehensive Study Report has been prepared in relation to the proposed White Rose oilfield development, in accordance with the requirements of the *Canadian Environmental Assessment Act* (CEAA). It provides a summary of the project and an overview of its potential effects. For more detailed information on the proposed development and its effects, the reader is referred to the White Rose Oilfield Comprehensive Study, which is comprised of an Introduction/Project Description, Environmental Impact Statement (Part One) and Socio-Economic Impact Statement (Part Two) (Husky Oil 2000a), and a Comprehensive Study Supplemental Report (Husky Oil 2001a).

TABLE OF CONTENTS

Page No.

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

This Comprehensive Study Report describes the potential environmental effects (including cumulative effects as contemplated by the *Canadian Environmental Assessment Act* (CEAA)) of the White Rose oilfield development, a proposed energy project that will recover oil reserves off Newfoundland's east coast. The White Rose field is located approximately 350 km east of the Island of Newfoundland on the eastern edge of the Jeanne d'Arc Basin, and is approximately 50 km from both the Terra Nova and Hibernia fields (Figure 1.1). The Jeanne d'Arc sedimentary basin is recognized as the principal oil-producing basin off the eastern coast of North America.

Husky Oil Operations Limited (Husky Oil) is one of the leading operators and interest holders in the Canadian east coast offshore oil industry, holding an approximate 32 percent net working interest in the Significant Discovery License areas in the Jeanne d'Arc Basin. The current land holdings are a result of substantial investment and an extensive exploration program initiated in 1982, as well as a series of inter-company and land sale acquisitions undertaken over the past 18 years. White Rose is one of five Significant Discovery Areas operated by Husky Oil in the Newfoundland offshore. Husky Oil is a wholly owned subsidiary of Husky Energy Inc., based in Calgary, Alberta, Canada.

The White Rose Significant Discovery Area consists of several oil and gas pools, including the South, West and North Avalon pools. The pools cover approximately 40 km^2, with an estimated 36 million m^3 (230 million barrels) of recoverable oil. Husky Oil, in a co-venture with Petro-Canada, proposes to develop this significant oil discovery in the White Rose Significant Discovery Area. Petro-Canada is the operator of the Terra Nova oilfield and, like Husky Oil, holds substantial interests in the Newfoundland offshore. The average interest of the co-venture parties in the White Rose oilfield development are 72.5 percent and 27.5 percent for Husky Oil and for Petro-Canada, respectively.

1.1 REGULATORY CONTEXT

Husky Oil and its co-venturer Petro-Canada (the proponents) are seeking the appropriate regulatory approvals for the White Rose oilfield development.

The White Rose project is subject to the CEAA. The Canada-Newfoundland Offshore Petroleum Board (C-NOPB) must issue a production licence respecting the project, and thereby performs a duty relating to "the administration of federal lands and …disposes of those lands or any interest in those lands…for the purpose of enabling the project to be carried out" within the meaning of paragraph 5(1)(c) of CEAA. The C-NOPB is a "Responsible Authority" respecting the project, and therefore requires an environmental assessment to determine if the project will have a significant adverse effect. The principal tool for this assessment under CEAA is the Comprehensive Study.

Figure 1.1 White Rose Location

The Department of Fisheries and Oceans (DFO) has determined that the project will result in the harmful alteration, disruption or destruction of fish habitat and therefore requires an Authorization for Works or Undertakings Affecting Fish Habitat under Section 35(2) of the *Fisheries Act*. As Section 35(2) authorization requirement is a Law List trigger under CEAA, DFO is also a Responsible Authority with respect to the environmental assessment of the project. Further, as a condition of this authorization, the proponents will be required to develop a fish habitat compensation plan that will be used by DFO in the development of a compensation agreement to compensate for losses of productive fish habitat in accordance with DFO's Policy for the Management of Fish Habitat.

Similarly, Environment Canada has determined that the construction of glory holes during the project and the deposition of spoils upon the surrounding seabed likely will require a Disposal at Sea Permit under the *Canadian Environmental Protection Act*, and that Environment Canada is a Responsible Authority. Finally, Industry Canada has determined that the radio equipment on the production installation will require its approval pursuant to Section 5(1)(f) of the *Radiocommunications Act,* and that it therefore also is a Responsible Authority respecting the proposed project. The project is subject to a "comprehensive study" level of assessment under CEAA since it falls within the *Comprehensive Study List Regulations*, Part IV, Oil and Gas Projects, Section 11. The C-NOPB is the lead Responsible Authority respecting the assessment, and in that role, is responsible for coordinating the review activities of the other responsible authorities as well as those of other expert government departments and agencies that participate in the review.

The Comprehensive Study for the proposed White Rose oilfield development is comprised of an Introduction/Project Description, an Environmental Impact Statement (EIS) (Part One) and a Socio-Economic Impact Statement (SEIS) (Part Two) (Husky Oil 2000a), as well as a Supplemental Report (Husky Oil 2001a).

In addition to the Comprehensive Study environmental assessment process under CEAA, the White Rose oilfield development is subject to review, coordinated by C-NOPB, under the *Atlantic Accord Acts*. A Development Application (Husky Oil 2001b) consisting of a Canada-Newfoundland Benefits Plan, Development Plan, EIS, SEIS and Preliminary Safety Plan/Concept Safety Assessment was submitted in January 2001, and is currently under review. As part of this process, the C-NOPB has appointed a Commissioner to conduct a review of the Development Application. This review will include: considerations of human safety and environmental protection incorporated into the proposed design and operation of the project; the general approach to the proposed and potential development and exploitation of the petroleum resources within the White Rose Significant Discovery Area; and the resulting benefits that are expected to accrue to the Province of Newfoundland and Labrador and to Canada, having particular regard to the requirements for a Canada-Newfoundland benefits plan. A key element of this process will include a thorough public review.

1.2 SCOPE OF THE PROJECT

Husky Oil submitted a project description to C-NOPB on March 21, 2000, indicating its intention to initiate the environmental assessment process (Husky Oil 2000b). On July 21, 2000, C-NOPB, DFO, Environment Canada and Industry Canada provided a scoping document to assist in the preparation of the Comprehensive Study Report. The project description is summarized below.

The White Rose oilfield development is anticipated to recover an estimated 36 million m^3 (230 million barrels) of recoverable oil from an approximately 40 km^2 area in the Jeanne d'Arc Basin. A ship-shaped floating production, storage and offloading (FPSO) facility, similar to that selected for Terra Nova, is proposed to be used to develop the oilfield. This ship-shaped facility will be able to store between approximately 111,000 and 135,000 m^3 (700,000 and 850,000 barrels) of oil (approximately 8 to 10 days of oil production) and will contain topside processing units, accommodations and a turret to facilitate the positioning and emergency response of the vessel.

There will be three to four drill centres on the seafloor, with production and water and gas injection wells located at each centre. These drill centres will be located in three to four excavated glory holes that lie below the seabed to protect the wells from iceberg scour. The drill centres will be connected to the FPSO facility with flexible flowlines and risers. The FPSO's turret is designed to allow the facility to disconnect from the subsea drill centres and move in the event of an emergency.

Developing the White Rose oilfield will require drilling up to 10 to 14 production wells in the South Avalon reservoir. The production from the combined wells is estimated between 12,000 to 18,000 m^3 (75,000 and 110,000 barrels) of oil daily. Up to an additional 8 to 11 water and gas injection wells will be drilled to maintain the reservoir pressure and for purposes of resource conservation. The wells will be drilled in phases over a four to six-year period. Up to four to six production wells, one to three water injection wells and one gas injection well will be required for First Oil production.

Seawater will be treated and then injected into the geological reservoir for pressure maintenance. Produced gas will be preserved through reinjection for conservation purposes and, if necessary, for reservoir pressure maintenance. There is no intention to flare produced gas, except for specific and limited operational, maintenance or safety requirements. The South Avalon pool has an estimated production life of approximately 14 years.

The scope of the project being assessed therefore includes the:

- construction, installation, operation, maintenance, modification, decommissioning and abandonment of a petroleum production facility respecting the White Rose oilfield (as described in the White Rose Oilfield Project Description prepared by Husky Oil and dated March 17, 2000);

- construction, installation, operation, maintenance, modification, decommissioning and abandonment of subsea facilities associated with the White Rose oilfield, including drilling and workover of development wells, subsea flow lines and any related excavation of the seabed and associated spoil deposition; and
- operation of support craft associated with the above facilities, including but not limited to mobile offshore drilling units, platform supply and standby vessels and helicopters, and shuttle tanker activity that is incremental to that already in existence or expected to be in existence.

No new onshore facilities are expected to be required to support the above activities. All onshore construction and fabrication activities are expected to be carried out at existing industrial sites.

The proposed project is described in more detail in Chapter 2 of this report.

1.3 SCOPE OF THE ENVIRONMENTAL ASSESSMENT

This Comprehensive Study Report provides an assessment of the potential effects of the proposed development. Environmental effects, as defined in subsection 2(1) of CEAA, are changes that the project may cause in the environment, including any effect of such change on human health and socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources for traditional purposes by Aboriginal persons, and on any structure, site or thing that is of historical, archaeological, palaeontological or architectural significance, as well as changes to the project that may be caused by the environment. CEAA does not require assessment of socio-economic effects unless they result from biophysical effects, or unless the Terms of Reference for the project are written to specifically include them if they are not addressed elsewhere. As identified during the White Rose public consultation process (Section 3.1), a number of socio-economic issues not specifically resulting from changes to the environment were raised by stakeholders. These potential socio-economic effects (both positive and adverse) also are discussed for completeness, but will be addressed through the *Accord Acts* Development Application review process.

The assessment also considers the environmental effects of malfunctions or accidents that may occur in connection with the project, as well as any cumulative effects that are reasonably likely to result from the project in combination with other projects or activities that have been or are identified to be carried out. Other projects and activities considered in assessing cumulative effects include: the Hibernia project, the Terra Nova project, offshore oil exploration activity, commercial fisheries, marine transportation, and (for marine birds) hunting activities.

Subsection 16(2) (d) of CEAA states that every Comprehensive Study carried out under the Act must consider the capacity of renewable resources that are likely to be significantly affected by the project to meet the needs of the present and those of the future. As will be demonstrated, the proposed White Rose oilfield development is not likely to cause significant adverse environmental effects As renewable resources are not likely to be significantly affected by the project, consideration of this factor is not relevant to this assessment.

This Comprehensive Study Report is a general summary of the White Rose Oilfield Comprehensive Study (Husky Oil 2000a; 2001a). It focuses primarily on the specific requirements of CEAA, and synthesizes and consolidates sections of the Comprehensive Study. The Comprehensive Study itself was prepared in accordance with the detailed requirements of the scoping package discussed above, as indicated in Table 1.1.

Table 1.1 Table of Concordance with the Scoping Document for the White Rose Oilfield Environmental Assessment

Factors to be Considered	Section(s) Where Addressed
General	
The purpose of the project	Comp. Study, Section 1.3
The need for the project	Comp. Study, Section 1.3
Alternatives to the project	Comp. Study, Section 1.3
Alternative means of carrying out the project which are technically and economically feasible (and the environmental effects of any such alternatives)	Comp. Study, Section 1.4
Environmental assessment methodology	Part One, Section 4.2 Part Two, Section 2.2 Supplemental Report
Identification of testable hypotheses	Part One, Sections 4.3.5, 5.9.3, 7.1, 8.11
The environmental effects of the project (including those due to malfunctions or accidents)	Part One, Chapters 4, 5 Part Two, Chapters 3, 4, 5, 6, 7 (Integrated throughout Parts One and Two) Supplemental Report
Cumulative environmental effects	Part One, Sections 4.2.5, 4.3.4, 4.4.4, 4.5.4, 4.6, 5.9.2.5 Part Two, Sections 2.2, 4.3, 5.2, 5.3, 5.4, 5.5, 5.6, 6.2, 6.3, 6.4, 7.2.2 (Integrated throughout Parts One and Two) Supplemental Report
The significance of the environmental effects of the project (including significant criteria)	Part One, Sections 4.2, 4.3, 4.4, 4.5, 4.6, 5.9 Part Two, Sections 2.2, 4.3, 5.2, 5.3, 5.4, 5.5, 5.6, 6.2, 6.3, 6.4, 7.2, 7.3 Supplemental Report
Measures to mitigate any significant adverse effects (including contingency and compensation measures)	Part One, Chapters 4, 5 Supplemental Report
The significance of any adverse environmental effects following mitigation (including the feasibility of additional or augmented mitigative measures)	Part One, Sections 4.3, 4.4, 4.5, 4.6, 4.7, 5.9, Chapter 6 Part Two, Sections 4.4, 5.2.3, 5.3.3, 5.4.3, 5.5.3, 5.6.3, 6.2.3, 6.3.3, 6.4.3, 7.3
The capacity of renewable resources that are likely to be significantly affected by the project to meet the needs of the present and those of the future	**Not relevant as referenced by comment pertaining to Subsection 16(2)(d) on page 5**
The need for, and requirements of, any follow-up programs	Part One, Sections 4.2.7, 4.3.5, 4.4.5, 4.5.5, 5.9.3, 6.10.4, 8.11, 8.12, Chapter 7 Part Two, Sections 4.4, 5.2.3, 5.3.3, 5.4.3, 5.5.3, 5.6.3, 6.2.3, 6.3.3, 6.4.3, 7.3.2 Supplemental Report

Factors to be Considered	Section(s) Where Addressed
Comments from the public	Comp. Study, Section 1.5 Part One, Section 4.2.1 Part Two, Section 2.2.1 JWEL (2000)
Address factors included in appropriate sections of the C-NOPB *Development Application Guidelines* (1988)	Comp. Study, Section 1.5 Part One, Section 4.2.1 Part Two, Section 2.2.1
Address issues and concerns identified through regulatory, stakeholder and public consultation	Comp. Study, Section 1.5 Part One, Section 4.2.1 Part Two, Section 2.2.1 JWEL (2000)
Definitions of identified VECs (including components or subsets thereof) and the rationale for their selection	Part One, Section 4.2.2 Part Two, Section 2.2.2 Supplemental Report
The spatial and temporal boundaries of the environmental assessment	Part One, Section 4.2.3 Part Two, Section 2.1 Supplemental Report
The cumulative effects of the project in combination with other projects or activities, including: fishing activities; (for marine birds) hunting activities; marine transportation activities; the Hibernia project; the Terra Nova project; and petroleum exploration activity.	Comp. Study, Section 1.8 Part One, Sections 4.2.5, 4.3.4, 4.4.4, 4.5.4, 4.6, 5.9.2.5 Part Two, Sections 2.2, 4.3, 5.2, 5.3, 5.4, 5.5, 5.6, 6.2, 6.3, 6.4, 7.2.2 (Integrated throughout Parts One and Two) Supplemental Report
Significance criteria for evaluating adverse environmental effects	Part One, Sections 4.2.4, 4.2.6 Part Two, Section 2.2 Supplemental Report
Air Quality	
Air emissions (including annual estimates)	Part One, Sections 4.3.1.16, 4.3.2.13, 4.4.1.5, 4.4.2.6, 8.8.3.1 Supplemental Report
Health and safety implications of air emissions	Part One, Appendix 4.A
"Greenhouse gas" emissions (including annual estimates and means for their reporting and reduction)	Part One, Sections 4.3.1.16, 4.3.2.13, 8.8.3.1, Appendix 8.A
Marine Resources	
The seabed area predicted to be affected by dredging, trenching and dredge spoil disposal, drill cuttings and other discharges	Part One, Sections 4.2.1.1, 4.3.1, 4.3.2 Supplemental Report
Quantification of the spatial area of affected seabed	Part One, Section 4.3.1.3 Supplemental Report
Marine/Migratory Birds	
Species distributions (spatial and temporal)	Part One, Sections 3.1.4, 3.9 Supplemental Report
Species habitat, feeding, breeding and migration	Part One, Section 3.9
Particularly sensitive (i.e., threatened / endangered) bird species	Part One, Section 3.9.4.4
Potential attraction of birds	Part One, Section 4.4
Potential for bioaccumulation of heavy metals associated with project discharges by birds	Part One, Section 4.4
Effects of aircraft overflights on bird concentrations and/or colonies	Part One, Sections 4.4.1.7, 4.4.2.8
Effects of oil spills on birds, as well as any sheens that may be associated with regulated discharges	Part One, Sections 4.4.1, 4.4.2, 4.4.3, 4.4.4, 5.9.2.2 Supplemental Report
Means for assessing and documenting any bird mortalities	Part One, Section 7.1.2

Factors to be Considered	Section(s) Where Addressed
Design and/or operational procedures for mitigating effects to birds	Part One, Section 4.4, Chapters 6, 8
Marine Fish, Shellfish, Reptiles and Marine Mammals and Their Respective Benthic and Water-Column Habitat	
Existing conditions in the project area, affected area and region (including species distribution and abundance, life stages)	Part One, Chapters 2, 3 Supplemental Report
Location, type, diversity and extent of marine fish habitat in the project and affected areas (particularly those supporting fishing activity and including any critical habitats)	Part One, Chapters 3, 4 Part Two, Chapter 7 Supplemental Report
Environmental (including cumulative) effects (considering lethal and sublethal effects, species interrelationships, fish health, productivity, and affected habitat)	Part One, Sections 4.3, 4.5, 5.9, 7.2 Supplemental Report
Marine Use	
Size and location of exclusion zones	Comp. Study, Section 1.2 Part One, Section 4.3 Part Two, Section 7.2
Project-related traffic (including routings, volumes, schedules, and vessel types)	Comp. Study, Section 1.2.1 Part One, Sections 4.3, 4.4, 4.5 Part Two, Sections 7.2, 7.3
Effects on access to fishing grounds	Part Two, Sections 7.2, 7.3
Effects on marine traffic/navigation (including research surveys)	Part Two, Sections 7.2, 7.3 Supplemental Report
Traditional, existing and potential commercial, recreational and Aboriginal/subsistence including foreign fisheries (including underused species, species under moratoria and the traditional and changing nature of the fishery)	Part One, Section 3.8 Part Two, Chapter 7 Supplemental Report
Effects of project operations and accidental events on current and potential fisheries	Part Two, Sections 7.2, 7.3 Supplemental Report
Effects of real/perceived shellfish taint	Part One, Sections 4.3, 5.9.2 Part Two, Sections 7.2, 7.3
Cumulative effects to fisheries	Part Two, Section 7.2.2
Discharges and Emissions	
Effects of electromagnetic emissions from radio equipment on personnel safety and mitigation/elimination measures	Part One , Section 8.8.3.6
Planned project discharges to the marine environment (including dredge spoil, drilling fluids and cuttings, produced water, bilge water, “grey” and “black” water, cooling water, deck drainage)	Comp. Study, Section 1.2.1 Part One, Sections 4.3, 4.4, 4.5 Supplemental Report
Characterization, quantification and modelling of expected discharges (including a description of models employed)	Comp. Study, Section 1.2.1 Part One , Sections 4.3.1.4, 4.3.2.5 Hodgins and Hodgins (2000) Supplemental Report
Means for the reduction, reuse and recovery of wastes	Comp. Study, Section 1.2.1 Part One, Sections 4.3.1, 4.3.2, 8.8.3
Feasibility of subsurface re-injection of produced water and drill cuttings associated with organic-phase drilling fluids	Part One, Section 4.3.1.4, 4.3.2.5\ Supplemental Report (Supporting Document)
Accidental Events	
Quantification of blowout risk	Part One, Sections 5.2, 5.7
Quantification of risk of oil spills of all volumes	Part One, Sections 5.3, 5.4, 5.5, 5.6, 5.7
Modelled physical fate of oil spills (including models, analyses and data)	Part One, Sections 5.8, 6.10 Supplemental Report
Environmental effects of oil or chemical spills	Part One, Sections 4.3, 4.4, 4.5, 5.9 Part Two, Sections 7.2, 7.3 Supplemental Report
Cumulative effects of “chronic” oil pollution on the Grand Banks	Part One, Sections 4.3.4, 4.4.2, 4.4.4, 4.5.4, 5.9.2

Factors to be Considered	Section(s) Where Addressed
Effectiveness of spill countermeasures	Part One, Section 6.10, Chapter 8
Physical Environment	
Meteorological, oceanographic and seabed conditions (including extreme conditions)	Part One, Chapter 2 Supplemental Report
Sea ice and iceberg conditions (including iceberg scour)	Part One, Sections 2.5, 2.6.3 Supplemental Report
Physical environment monitoring, observation and forecasting programs	Part One, Section 2.5.4, Chapter 6
Ice management/mitigation procedures (including criteria for disconnection and an assessment of the efficiency of detection/deflection techniques)	Comp. Study, Section 1.7 Part One, Section 2.5.4, Chapter 6
Environmental Management	
Proponent's/Project environmental management system	Part One, Chapter 8
Pollution prevention policies and procedures	Part One, Section 6.10, Chapter 8
Environmental effects monitoring programs	Part One, Sections 4.2.7, 4.3.5, 4.4.5, 4.5.5, 5.9.3, 6.10.4, 8.11, Chapter 7 Part Two, Section 7.3.2 Supplemental Report
Environmental compliance monitoring	Part One, Section 8.12
Provisions for management system auditing	Part One, Section 8.8 Supplemental Report
Environmental training for employees and contractors	Part One, Section 8.2.5
Chemical selection and management procedures	Part One, Section 4.3.1.4 Supplemental Report
Fisheries liaison/interaction policies and procedures	Part One, Sections 8.8, 8.14 Part Two, Section 7.3
Program(s) for compensation of affected parties for accidental damage	Part One, Sections 4.3.4, 8.14 Part Two, Sections 7.2, 7.3
Fish habitat compensation strategy and options	Part One, Sections 4.3, 7.2 Supplemental Report
Emergency response plans	Part One, Chapter 6
Environmental Effects Monitoring (EEM)	
Characteristics of EEM programs for routine and accidental events (including their design process)	Part One, Sections 4.2.7, 4.3.5, 4.4.5, 4.5.5, 5.9.3, 6.10.4, 8.11, Chapter 7 Part Two, Section 7.3.2 Supplemental Report
Parameters to be monitored and the rationale for their choice (including consideration of marine birds, reptiles and mammals, fisheries, fish and shellfish health/productivity and taint, fish habitat, and marine environmental quality)	Part One, Sections 4.2.7, 4.3.5, 4.4.5, 4.5.5, 5.9.3, 6.10.4, 8.11, Chapter 7 Part Two, Section 7.3.2 Supplemental Report
Linking of monitoring hypotheses to testable hypotheses	Part One, Section 7.1 Supplemental Report
Site-specific baseline information	Comp. Study, Appendix 1.B Part One, Section 7.6 Supplemental Report
Integration into a regional EEM program	Part One, Section 7.3 Supplemental Report
Distinction of "signal" from "noise" in monitoring programs	Part One, Section 4.3.5
Independent/peer review of monitoring results	Part One, Section 7.6 Supplemental Report
Linkage of monitoring results into environmental management system	Part One, Sections 7.1, 8.11
Potential requirements for fish habitat compensation and post-dredging monitoring	Part One, Sections 4.3.1.3, 7.2 Part Two, Section 7.3.2 Supplemental Report

Factors to be Considered	Section(s) Where Addressed
Abandonment/Decommissioning	
Plans for abandonment/decommissioning of the project area following termination of production, including any requirements for post-abandonment monitoring	Part One, Sections 4.3.3, 4.4.3, 4.5.3, Chapter 7 Part Two, Chapter 13 Supplemental Report

1.4 PROJECT PURPOSE AND NEED

Both Husky Oil and its co-venturer Petro-Canada believe that the White Rose oilfield development can meet favourable international market demands for oil and generate economic benefits for the local and provincial economies of Newfoundland and Labrador, and of Canada. The development will increase employment and training opportunities for people of the province and contribute to the growth in petroleum industry infrastructure and business opportunities through the increased demand for necessary goods and services. This will ultimately attract new investment to the province, contributing to the sustained growth of the provincial and Canadian economies.

1.5 ALTERNATIVES TO THE PROJECT

Several alternatives for servicing the market demand for energy include development of other energy projects, such as hydroelectric, nuclear power and co-generation. An additional alternative would be for consumers to reduce their requirement for energy. Given the present circumstances in the Province of Newfoundland and Labrador, including the existence of already developed infrastructure to support offshore oil and gas development, and the present state of knowledge with respect to the recoverable resources, the proposed White Rose oilfield development is an appropriate vehicle through which to help meet overall, market demands for energy.

An alternative to the White Rose project would be to proceed with alternative projects in another area. However, the proponents have determined that market conditions, and the development of infrastructure to support the Newfoundland offshore industry, currently favour investment in the White Rose oilfield development. Engineering and economic analyses of the White Rose oilfield development have been undertaken to determine that it is technically, economically and environmentally feasible.

1.6 ALTERNATIVE MEANS OF CARRYING OUT THE PROJECT

Eight options were initially assessed to identify the potential alternative means of developing the White Rose oilfield:

- steel FPSO facility;
- concrete FPSO facility;
- steel floating, production, drilling, storage, offloading (FPDSO) facility;
- concrete gravity-base structure (GBS);

- steel semi-submersible facility with and without integral storage;
- concrete semi-submersible facility;
- disconnectable concrete tension leg platform (TLP); and
- concrete barrier wall with floating production unit (FPU).

The evaluation criteria included:

- technical requirements;
- capital costs;
- construction time;
- concept maturity;
- concept deliverability; and
- risk considerations.

A two-stage process was used to evaluate the options. The first stage involved qualitative screening, whereby options that were either insufficiently developed or clearly failed to satisfy primary technical criteria were identified. As a result of this first stage, the disconnectable concrete TLP, concrete barrier wall with FPU, and steel FPDSO facility were not carried forward, as they either did not meet technical requirements or were prototype development concepts with no operating history in harsh-environment offshore locations.

These remaining five options (steel FPSO facility, concrete FPSO facility, steel semi-submersible facility with and without integral storage, concrete semi-submersible facility and concrete GBS) were further analyzed with respect to construction time, capital costs, concept maturity, concept deliverability, and risk considerations. The only two development concepts that were shown to be technically and economically feasible were the steel semi-submersible with or without integral storage and steel FPSO options. The steel FPSO option was found to be the most cost-effective option and to have the least technical risk. The development, operations, decommissioning and accidental events for both an FPSO and a semi-submersible are not markedly different with respect to their interaction with the environment. For example, construction activities and disturbance, operational discharges, structural presence, and support activities are very similar for both options. Therefore, effects predictions for both alternatives would be the same.

The evaluation of the options concluded that the preferred option for developing the White Rose oilfield was a steel FPSO facility using subsea wells located in glory holes, similar to that selected for the Terra Nova Development. This system was evaluated as top preference on project cost and time to First Oil.

As the steel FPSO was determined through rigorous evaluation to be the preferred option, and since the potential interactions with the environment are not markedly different than those of the semi-submersible option, the potential environmental effects of the FPSO have been assessed and are described in this Comprehensive Study Report.

1.7 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

The White Rose oilfield project is to be specifically designed to withstand the harsh sea and weather environment of the North Atlantic. The physical environment of the White Rose site, including the sea state, ocean currents, ice, winds, waves, and weather variables, are described in detail in Part One of the Comprehensive Study (Chapter 2). The appropriate data were used in developing the Basis for Design. For example, physical considerations, such as ice accretion, are to be built into any loadings calculated for above-surface structures. Ice is a serious consideration, and because of the presence and likelihood of icebergs, well manifolds will be protected in glory holes, flowlines may be trenched and will be able to be flushed, and the turret will be designed to enable disconnection of the FPSO to allow it to move off location. Ice management will also be part of the contingency planning undertaken for the project, including ice monitoring, as well as countermeasures such as ice deflection or disconnection and movement (additional details are provided in the Comprehensive Study (Part One)). A joint industry ice management plan will also be in place to facilitate ice monitoring and management and provide guidance for decisions relating to vessel disconnection. Biofouling, or the colonization of structures by epibenthic communities, is also considered in engineering design. Procedures will be developed to remove the biofouling in order to protect the asset from deterioration.

1.8 ASSESSMENT OVERVIEW

The following sections outline the scope of the project, the assessment of its potential environmental and socio-economic effects, as well as mitigation and follow-up measures proposed by the proponents. This is followed by an overall conclusion that the proposed White Rose oilfield development is not likely to cause significant adverse environmental effects.

2 THE PROPOSED WHITE ROSE OILFIELD DEVELOPMENT

2.1 PROJECT DESCRIPTION

The White Rose oilfield will be developed using subsea completions tied back to a mono-hull type FPSO unit, moored in approximately 125 m of water, with the crude oil transported to market by shuttle tankers. The following sections provide a description of the various components and activities associated with the proposed project. A more detailed project description is provided in the Comprehensive Study (Husky Oil 2000a; 2001a).

2.1.1 Production System

The FPSO is a floating, production, storage and offloading ship-shaped vessel (a typical North Sea steel FPSO facility is illustrated in Figure 2.1). Production facilities are mounted on raised supports above the vessel deck. Reservoir fluids pass from subsea production wells, via flowlines and risers, up into the turret and then to the production facilities. Produced oil is stored in the vessel cargo tanks and periodically offloaded onto a shuttle tanker via a loading hose.

The FPSO hull will be approximately 200 to 300 m in length, 40 to 45 m in breadth and 22 m in depth, ice-strengthened and have a lightship weight of approximately 31,000 t supporting a topside process plant, with a dry weight of approximately 7,300 t. The FPSO will be moored using a geo-stationary turret, which is anchored to the seabed. The turret mooring will be disconnectable to allow the FPSO to move to avoid iceberg threat. The vessel will rotate (‘weather vane’) around the turret to take up a position of least resistance to the ambient conditions with the bow heading into the prevailing wind and waves.

The FPSO will have a storage capacity of approximately 111,000 to 135,000 m^3 (700,000 to 850,000 barrels) representing about 8 to 10 days of oil production. It will be capable of handling peak oil production of between 12,000 to 18,000 m^3 (75,000 to 110,000 barrels) per day, peak gas production of between 6 million and 7 million m^3 per day, and peak water production of between 15,000 and 30,000 m^3 per day. Due to the presence of icebergs at the field location, the FPSO will have the added capability to disconnect and move off location under its own power.

The FPSO will be positioned between the glory holes and will receive production via flowlines that deliver reservoir fluids through the turret located near the bow of the vessel. Stabilized oil will be offloaded to a shuttle tanker from the stern of the FPSO via a loading hose. For conservation purposes, produced gas will be compressed and re-injected back into geological formations through the turret via dedicated flowlines.

Figure 2.1 Typical North Sea Steel FPSO Facility

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While facility designs are very preliminary at this point, the proponents expect that the processing requirements will be based on a single processing train and will not require any unconventional facilities. The oil will be stabilized in a conventional separation train and de-watered in an electrostatic coalescer. The gas will be compressed for re-injection in a multi-stage compression train. The proposed configuration comprises a two or three-stage compression system driven by gas turbines.

Accommodations will be located either at the stern or the bow of the vessel to enhance segregation from process facilities. The facilities containing oil and gas will be located a safe distance from the accommodations. Typical personnel levels will range from 45 to 50 permanent crew and up to 80 to 85 with temporary crew. The accommodations requirement for the FPSO will consider the requirements for normal operation and also offshore hook-up and commissioning and maintenance operations.

The topside facilities will primarily be located on a horizontal plane raised above the vessel deck. It is envisaged that the topsides will be configured in pre-assembled units, modules or pallets. The number and size of units will be determined as design engineering is undertaken. Some of the topsides utilities include: produced and oily water treatment; seawater filter and injection systems; power generation; cooling and heating systems; fuel and inert gas systems; flare and vent system; drain systems; chemical injection; potable, service and fire water; nitrogen; diesel and jet fuel; compressed air; hydraulic power; de-icing; and safety and control systems.

Personnel safety and environmental protection will be important considerations in designing the facilities. This will apply to layout and construction and to the provision of safety systems, which will include: emergency shutdown valves; emergency flare and blowdown; hazardous waste drain; fire and gas detection; active and passive fire protection; personnel escape routes; temporary safe refuge and evacuation; energy conservation; and gaseous and liquid discharges.

Communications are a critical component in the operation of an offshore oil facility, ensuring both the safety of the facility and its competent operation. The FPSO, on-shore facilities, and all support craft will be linked by state-of-the-art communications systems for voice, data and video. Generators will be sized to meet the electrical loads of the FPSO vessel, both for normal and emergency operation. They will be able to function on produced gas or diesel. As well, there will be provision for further diesel-driven power generation for emergencies.

2.1.2 Subsea Facilities

The subsea facilities for White Rose will include all equipment necessary for the safe and efficient operation and control of the subsea wells and transportation of production and injection fluids between the wells and the FPSO. The subsea facilities include all wellhead completion equipment, trees, manifolds, flowlines, umbilicals, risers, seabed structures, control systems and all interfaces required to control and operate the facilities and associated test, installation, inspection and maintenance equipment.

Subsea wellheads will be located in glory holes to protect them from iceberg scour. Equipment within the glory hole will be designed such that the top is a minimum 2 to 3 m below the mudline, below maximum observed scour depths. Manifolds and flowlines will be designed fail-safe to minimize any harmful environmental consequences should they fail or be damaged. Flowline systems will be designed to allow the flushing/purging of production lines in the case of iceberg scour risk. Their location on the seafloor will provide ease of access for inspection, testing, repair, replacement or removal. Emergency shutdown valves will be provided to ensure the safety of personnel and minimize environmental effects in the event of accidental damage to the production facilities.

A conceptual layout of the subsea facilities is shown in Figure 2.2. The current basic conceptual field layout for the White Rose Project contains three glory holes which are to be excavated and located in proximity to the FPSO:

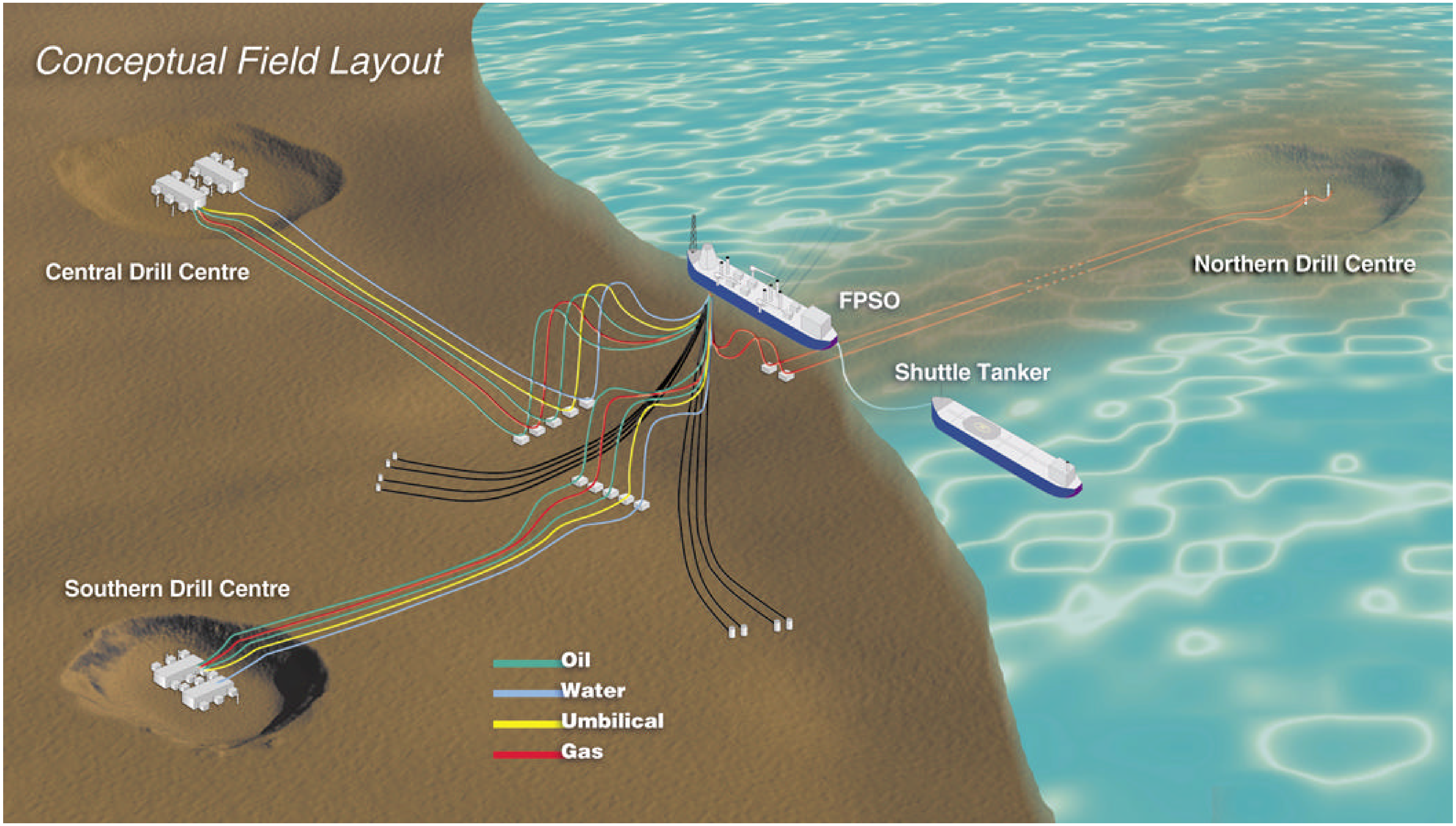
- 1 – to the north (approximately 7 km);
- 2 – to the south (approximately 2.5 km); and
- 3 – to the west (approximately 2.5 km).

Each glory hole is a rectangular excavation of approximately 30 m long x 20 m wide x 11 m deep, with sloping sides of 3:1 gradient.

2.1.3 Export/Transportation System

The offloading facilities will be located at the stern of the FPSO and incorporate a fiscal metering system as an integrated package. The offloading system and offloading rate will be designed with regard to the environmental conditions in the field, such that the availability of the facility is not compromised by weather limitations relating to the shuttle tanker connecting or remaining connected.

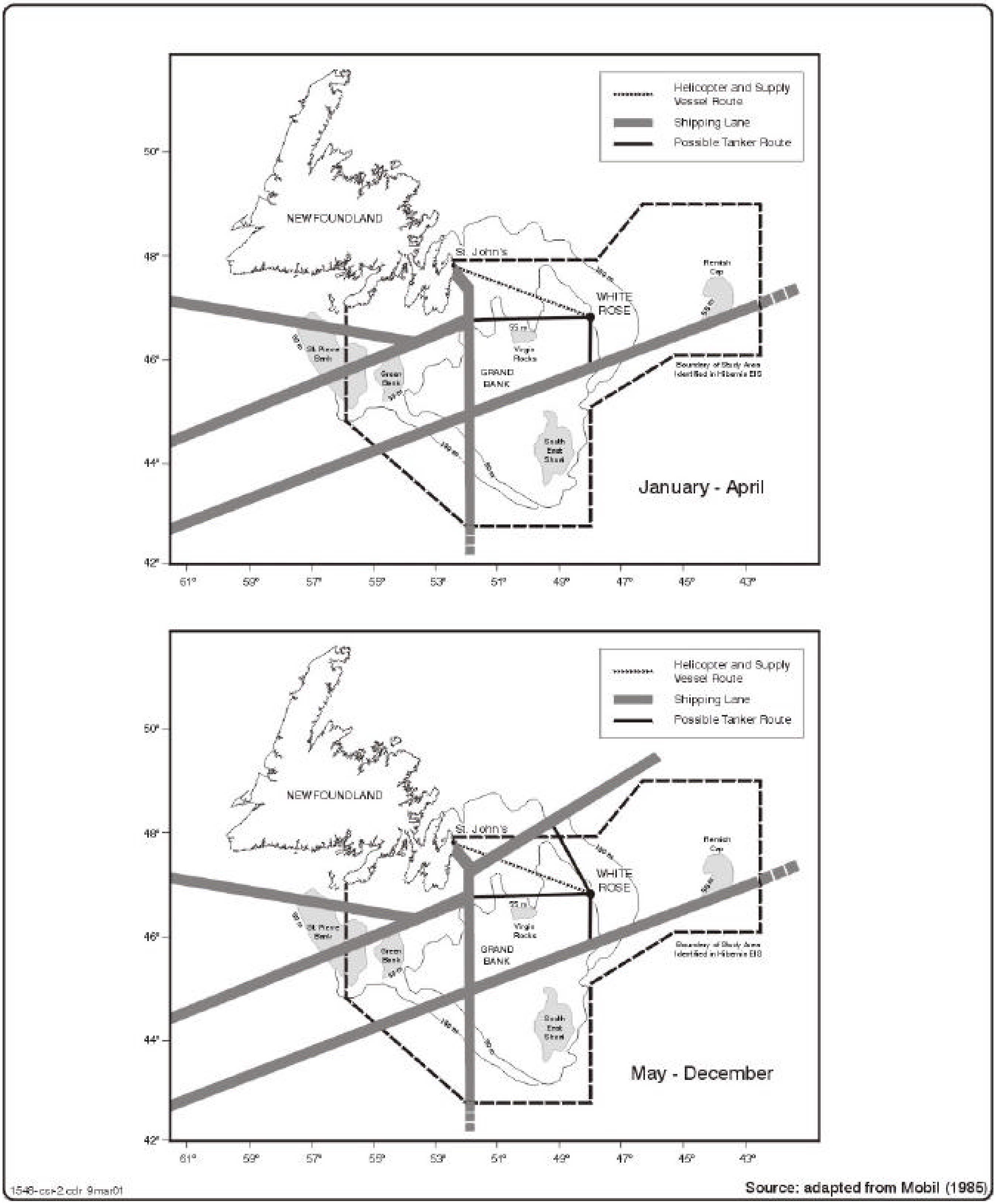
Figure 2.1 White Rose Conceptual Field Layout



The proponents have not determined the ultimate destination of the crude. Shuttle tankers will be used for exporting White Rose crude to markets in Eastern North America, the U.S. Gulf Coast, other international destinations as well as to a transshipment facility, such as the ones currently operating at Whiffen Head, Newfoundland or Statia, Nova Scotia. Depending on the distance to market and on the volumes of crude to be exported, one to three tankers will be required. They will be double hulled, and sized appropriately for the transportation requirements. The incremental shuttle tanker traffic associated with this project (and thus, that which is assessed in this report) will occur within transportation routes over the Grand Banks area to the entrance to the International Shipping Lanes. Those shipping lanes used by international ship traffic are governed by international conventions, and mariners transporting White Rose crude will be contractually bound to follow those conventions (such as the *International Convention for the Prevention of Pollution from Ships* (MARPOL), and the *International Convention on Oil Pollution Preparedness, Response and Cooperation* (OPRC)), as applicable, and relevant Canadian federal legislation (such as the *Canadian Shipping Act*). The transportation routes to the major shipping lanes relevant to White Rose are depicted in Figure 2.3.

The decision as to whether or not the shuttle tankers will be Canadian flagged will be determined by the ultimate contracting strategy for the vessels. In any case, cargoes lifted from White Rose will be done using 1st Class Tonnage and reputable operators. Cargoes being shipped into Canadian destinations on a regular basis would most likely involve Canadian flagged vessels.

Figure 2.2 Transportation Routes Relevant to White Rose



Source: adapted from Mobil (1985)

2.2 CONSTRUCTION AND INSTALLATION

Initial design engineering is forecast to start several months prior to project sanction in order to meet the target date for First Oil and enhance project viability. Any procurement decisions that must be made prior to receiving regulatory approvals would be subject to the successful outcome of the regulatory review process and project sanction. Project sanction by the proponents, which is conditional upon receiving regulatory approval and confirming commercial viability, would initiate the project and lead into construction, installation and commissioning. The target date for First Oil is approximately 36 months following project sanction. All onshore construction and fabrication activities are expected to be carried out at existing industrial sites.

2.2.1 Floating Production, Storage and Offloading Facility Construction

Historically, the hull or superstructure and topsides of FPSO vessels have been built in separate facilities in different locations, which is also expected to be the case for White Rose. Currently, there is no Canadian shipyard with a drydock capacity large enough to construct the hull. A modular approach will be followed for fabrication of the topsides. The size of individual modules depends on the lifting capacity available at the shipyard and Canada-Newfoundland benefits considerations. The turret is normally fabricated in two sections; the lower is incorporated into the hull and the upper is lifted on later. Structural sections are prefabricated and assembled, either on the hull or separately for later lift into place. The topside facilities are normally manufactured in pre-assembled units, modules or pallets. The hull and upper turret, topside facilities and other equipment are delivered to an at-shore assembly site for hook-up, mechanical completion and testing prior to proceeding to the production site.

2.2.2 Subsea Facilities

Specialized manufacturers will supply flexible line production and injection risers, suitable for use in the harsh environment at White Rose. The risers are typically supplied fully equipped and tested, and ready for installation. Subsea manifolds and flowlines will gather the production and convey it to the risers. Manifolds include headers, piping, valves, and control equipment, mounted on a base.

Many proprietary well components will comprise high quality forgings requiring heat treatment, special welding procedures and precision machining. Tree installation will require special running and testing tools. Flowlines will be either flexible or rigid steel pipe. Flexible flowlines will be prepared by the manufacturer, ready for installation. Rigid steel pipe will be manufactured by mills in lengths appropriate to transportation and handling constraints, and the limitations of the lay barge. Consideration will be given to the option of installing the flowlines in cased bundles. In that event, the flowline bundle will be fabricated on-shore at a suitable construction site. Another option, which may be examined for rigid steel pipe, is welding them into long strings on-shore and winding them onto spools on a reel lay vessel for offshore installation.

Depending on their size, manifolds may be installed either directly through the moonpool of a semi-submersible drilling unit or, if small enough, from the deck of a support vessel with sufficient lifting capacity to handle lowering them to the seafloor, where they could be picked up and placed by a drilling unit.

A dynamically positioned vessel, equipped for flexible pipe and cable installation, will be used to install the risers and flowlines. Divers may be required to make the subsea connections.

Wellheads will be installed in the glory holes through the moonpool of the drilling unit. Upon completion of the well-drilling operation, the drilling unit will also be used to install the subsea trees. Final connection of the wells to the manifolds by jumper spools may be carried out by divers.

2.2.3 Marine Support Vessels

The proponents are proposing to charter existing marine support vessels from contractors for resupply services, standby duties and ice management functions.

2.2.4 Drilling Services

One or more semi-submersible drilling units will be used throughout the life of the field for drilling, re-entering and completing wells. These units will be chartered. The unit or units will be moored at each well location supported by onboard chain and anchors. Marine support vessels, with anchor-handling capability, will be used to deploy and retrieve anchors in conjunction with rig anchor-handling equipment.

2.3 DEVELOPMENT DRILLING AND WELL COMPLETIONS

Since the discovery in 1984 of the White Rose field, with the drilling of the N-22 well, eight additional delineation wells have been drilled and suspended or abandoned.

Of the up to approximately 18 to 25 wells required to develop the White Rose oil reservoir, up to 10 to 14 will be producing wells, six to eight will be water injection wells and two to three will be gas injection wells.

Initially, up to 10 wells will be drilled before field production begins. Plans are for wells to be drilled in clusters. Semi-submersible mobile offshore drilling units will be used to drill and complete these wells before the arrival of the FPSO. The remainder will be drilled in parallel with producing operations to meet the depletion plan objectives. The current plan is to start drilling several months after project sanction is received.

White Rose development well completions design is intended to maximize well productivity, while achieving appropriate levels of risk and well integrity. Well performance modelling based on the reservoir properties of the discovery and delineation wells has been conducted for both flowing and artificial lift (gas lift) scenarios. The flowing well model suggests that initial oil rates of between 2,800 and 4,200 m^3/d are possible from horizontal development wells completed with 140-mm tubing. A well with average reservoir properties should flow at 3,600 m^3/d of oil prior to water or gas breakthrough.

Water production associated with White Rose oil production is expected to increase gradually for the first 8-9 years, followed by a steady decline. The flow modelling mentioned above indicates that oil wells will require artificial lift when water cut exceeds 40 percent. Gas lift will be a readily available means of artificial lift, with gas compression facilities required for the reinjection of produced gas. Gas lift also has advantages over other means of artificial lift because it has high reliability and efficiency.

Prior to the start of production, all wells in a given glory hole will likely be batch completed after being drilled and temporarily suspended. At the end of batch drilling operations, the wells will be left with proper barriers in place and the subsea trees will be fitted with back pressure plugs and external debris covers.

2.4 PRODUCTION OPERATIONS

Husky Oil will be the Operator of the White Rose oilfield on behalf of itself and its co-venturer Petro-Canada. The operation will be managed from the Husky Oil office in St. John's, where the operations management will be located. The day to day management and control of all offshore operations will be the responsibility of the Offshore Installation Manager (OIM), who will be located on the FPSO.

The on-shore organization will be structured to provide total support for all offshore operations during the development and operations phases. The on-shore organization will include personnel with all the requisite skills, knowledge, and experience for ensuring competent support to the offshore operation, even in emergency situations. It will be focused on flexibility, efficiency and cost-effectiveness. The permanent core of the on-shore organization team is expected to be 45 to 50 people. There will be additional personnel on-shore, including: helicopter air and ground staff; dockworkers and crane operators for supply vessel operations at the shorebase; and support for the supply and standby vessels.

The offshore organization will consist of skilled personnel in all disciplines required for safe, efficient, and environmentally responsible operation of all offshore facilities. The OIM will be responsible for managing the FPSO facility. Semi-submersible drilling units, each of which will be the responsibility of a dedicated onboard OIM, will carry out all drilling. The FPSO OIM will, however, have responsibility for coordinating all offshore activities. These include drilling workover, diving and ice management, in addition to the FPSO-related activities of production, storage, offloading and shipping.

The normal crew complement for the FPSO is expected to be approximately 45 to 50 people at any one time. Provision for rotation requires that this number be doubled, giving an FPSO staff strength of some 90 to 100 personnel. Each drilling vessel will require some 70 to 100 drilling and support staff during drilling and testing operations. To provide for rotation, this means a requirement of some 140 to 200 personnel per drilling unit.

Specific operations and maintenance management systems will be in place for the White Rose oilfield development. The systems will comply with all regulatory requirements, and personnel will be trained to operate in accordance with the manuals and procedures. The systems will cover the following topics: systems and equipment; reporting relationships; maintenance; production and marine operations; ice management; health and safety; emergencies; alert and contingency plans; and environmental control and monitoring.

Husky Oil already has an Ice Management Plan in place for its offshore exploration program. This plan will be reviewed, updated and/or modified, as appropriate, for application to the production phase of the White Rose oilfield development. It will be integrated with and draw upon the experience of other operators on the Grand Banks, together with the latest techniques and developing technologies, to produce the optimum plan for ice management/avoidance for the White Rose development. It will cover both sea ice and icebergs, and will be flexible in recognition of the fact that the sea ice and iceberg conditions at the South White Rose area vary considerably from year to year.

The proponents intend to investigate all possibilities of cooperation with other operators in the prospective use of shared services and facilities to support offshore operations.

Contingency plans will be prepared for dealing with major emergencies threatening personnel safety or facility integrity. These plans will comply with the requirements of Section 51 (3) of the *Newfoundland Offshore Area Production and Conservation Regulations*. Contingency plans and standard operating procedures to be implemented for White Rose include: emergency response; vessel specific emergency response; collision avoidance; ice management; oil spill response; ship's oil pollution emergency; and emergency communications and family support.

The proponents will cooperate with other operators and agencies in all emergency situations through resource sharing and mutual aid, and will also participate in joint training exercises with other operators.

A loss management program will be in place specific to the White Rose development which will be in keeping with Husky Oil's corporate loss control management philosophy. This philosophy is based on eliminating or reducing risks to personnel, assets, production, and environment through a continuous and systematic approach. It covers all aspects related to health and safety, environment, reliability, management of process hazards, risk assessment and loss control (additional information is provided in the Comprehensive Study, (Part One) Chapter 8).

2.5 DECOMMISSIONING AND ABANDONMENT

At the end of the production life of the White Rose oilfield development, the operator will decommission and abandon the site according to C-NOPB requirements and *Newfoundland Offshore Area Production and Conservation Regulations*. The floating production facility will be removed from the oilfield. Subsea infrastructure will be removed and the wells will be plugged and abandoned.

2.6 PROJECT SCHEDULE

A project development schedule is provided in Figure 2.4.

2.7 ENVIRONMENTAL MANAGEMENT SYSTEM

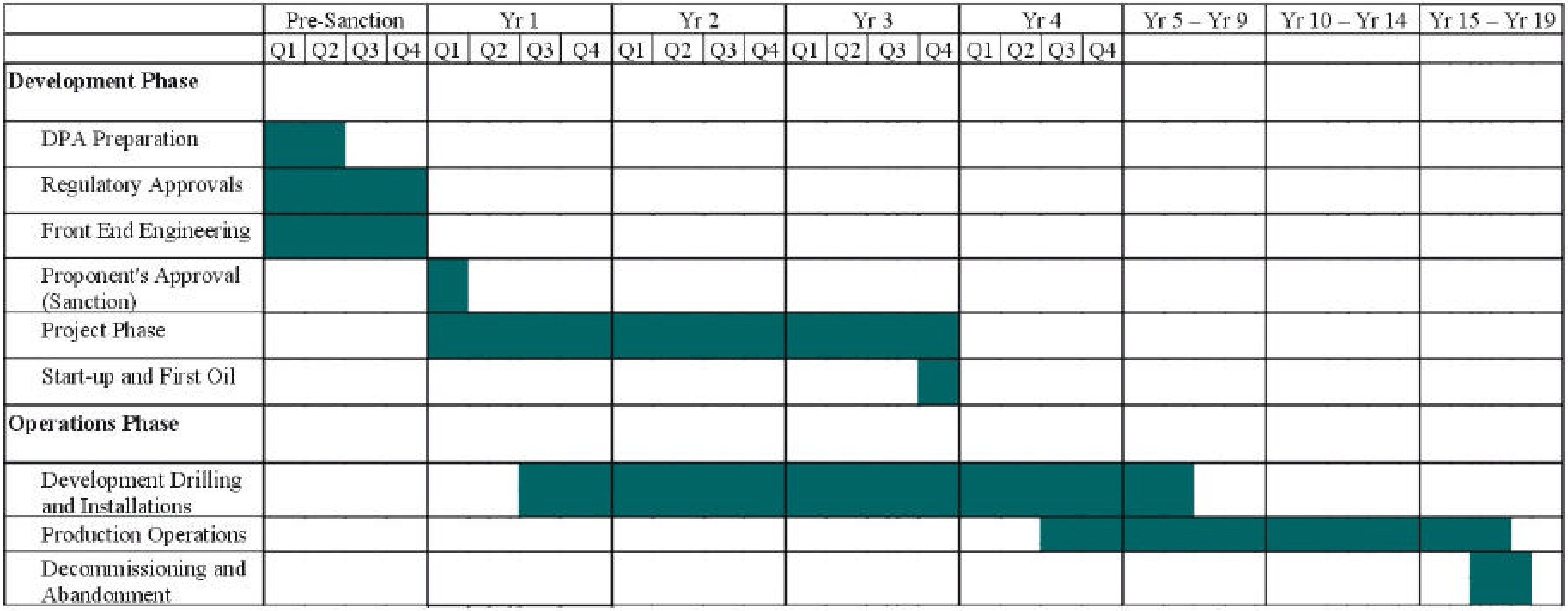
Husky Oil has developed and implemented a Health, Safety and Environment Policy that guides the company in all aspects of its business. The policy is endorsed by the Chief Executive Officer and the Manager of East Coast Development and Operations. The Health, Safety and Environment Policy statement is supported by Husky Oil's East Coast Operations *Health, Safety and Environmental Loss Control Management Performance Standards*.

The key elements of Husky Oil's environmental management system include:

- functional/departmental responsibility for health, safety and environment;
- employee rights;
- individual responsibility for health, safety and environment;
- quality assurance;
- organizational rules;
- environmental clauses for contractors;
- environmental audits, including health, safety and environment inspections and preventative maintenance;
- environmental performance targets for atmospheric emissions, discharges, solid wastes and hazardous/dangerous materials handling;
- mitigation measures for routine activities;
- chain of command for environmental decision-making;
- environmental protection procedures;
- environmental effects monitoring (EEM) procedures and reporting;
- environmental compliance monitoring practices and reporting; and
- optimization measures for the fishing industry.

Details of the environmental management system are provided in the Comprehensive Study (Part One, Chapter 8).

Figure 2.3 Project Development Schedule



3 ASSESSMENT METHODOLOGY

Methods of effects assessment conform with the requirements of CEAA and its associated guidance documents (CEAA 1994a; 1997; 1998a; 1998b). They are generally comparable to those used in both the Hibernia (Mobil 1985) and Terra Nova (Petro-Canada 1995) EISs, and conform to the C-NOPB guidelines (C-NOPB 1988). Cumulative effects are incorporated within the procedures in accordance with CEAA (1994b; 1999) and as adapted from Barnes and Davey (1999). The specifications and spirit of the documents have been followed in conducting the assessment.

3.1 ISSUES SCOPING AND STAKEHOLDER CONSULTATION

The focus (or scope) of an assessment must be identified early in the environmental assessment process. The scope of the project to be assessed and the scope of factors to be considered are important for conducting an effective and efficient environmental assessment (CEAA 1998a). The components of the environment that are valued by society are the recommended focus of an assessment (Beanlands and Duinker 1983). These components are called Valued Environmental Components (VECs).

The proponents conducted an extensive issues scoping and stakeholder information/consultation program in relation to the White Rose oilfield development. This program allowed for the identification of the VECs that are the focus of the environmental assessment.

The scoping/consultation program involved:

- reviewing relevant legislation and guidelines;
- reviewing the scoping document issued by the C-NOPB, DFO, Environment Canada and Industry Canada;
- reviewing documents prepared for the Terra Nova and Hibernia oilfield developments;
- reviewing issues raised during the Terra Nova Development environmental assessment review process;
- consulting community, fishing, business, women's and non-governmental organizations, and the general public (key informant workshops, open houses and meetings/presentations);
- holding meetings with government departments and agencies;
- conducting media briefings and preparing press releases;
- tracking articles/stories from media sources;
- distributing project information (two mail distributions);
- establishing a project information telephone number (724-7244 and 1-877-724-7244);
- setting up a project-specific website (www.huskywhiterose.com);
- documenting issues and concerns, and following up when necessary; and
- using professional judgement based on the particular characteristics of the White Rose oilfield development.

The scoping/consultation program focused primarily on the areas most likely to be affected by the project. However, it also reached a geographically wider audience through meetings in other communities, with groups and organizations with a particular interest in the White Rose development, and through general solicitation of input from press releases, advertisements, the website and the project information telephone number at Husky Oil's St. John's office.

Further information on this public consultation program is provided in JWEL (2000). Comprehensive lists of the issues raised through the issues scoping and stakeholder consultation process, and included in the scoping document provided to the proponents by the C-NOPB, DFO, Environment Canada, and Industry Canada, are provided in the Comprehensive Study (Sections 1.2 and 1.5).

3.2 VALUED ENVIRONMENTAL COMPONENTS

The VECs considered in the environmental and socio-economic assessment, as determined through the issues scoping exercise described above, are:

- fish and fish habitat;
- marine birds;
- marine mammals and sea turtles;
- business and employment;
- community infrastructure (social infrastructure and services; physical infrastructure); and
- fisheries.

These VECs were selected based upon expressed public concerns as well as previous project experience related to social, cultural, economic, or aesthetic values and scientific community concerns.

The commercial fishery is an acknowledged and important element in the society, culture, economic and aesthetic environment of Newfoundland and Labrador. The fish and fish habitat upon which the commercial fishery is based is a typical VEC assessed in an EIS for a project impinging on aquatic environments. Fish and fish habitat are considered as a single VEC, as they are clearly interrelated. This approach allows for a more comprehensive, ecosystem-based approach. Fish and fish habitat is of prime concern from both a public and scientific perspective, locally, nationally and internationally.

Newfoundland supports some of the largest seabird colonies in the world and the Grand Banks hosts very large populations during all seasons. They are important socially, culturally, economically, aesthetically, ecologically and scientifically. Also, this VEC is more sensitive to oil on water than other components of the environment.

Whales and seals are key elements in the social and biological environments of Newfoundland and Labrador. The economic and aesthetic importance of whales is evidenced by the large number of tour boats that feature whale watching as part of a growing tourist industry. Historically, seals have played an important economic and cultural role due to the large annual seal hunt. While sea turtles are scarce on the Grand Banks in general, they attain the status of a VEC because of their endangered and threatened status in Canada, the United States and elsewhere.

Business and employment are valued by individuals who may benefit directly or indirectly from work in its own right, changes in income and standards of living, and development of skills and expertise. New projects are generally beneficial from an economic perspective insofar as more people are employed, and successive rounds of employee and business expenditures generate employment and income multiplier effects in the local and provincial economies. However, particular socio-economic effects can be both positive and negative where different segments of society are differentially affected.

Local residents value infrastructure and services insofar as their quality and capacity in a community contribute to the overall standard of living and quality of life.

Commercial fisheries were also selected as a VEC because historically the fishery has played an integral role in Newfoundland and Labrador's economy, and has helped to define much of the province's character.

3.3 BOUNDARIES

Effects are assessed for the three-year development phase to First Oil and the expected 12 to 14 year production lifespan of the White Rose Development. Effects that could continue after decommissioning are also considered. In addition, the potential effects of accidental events are assessed.

For the biophysical VECs (fish and fish habitat, marine birds, and marine mammals and sea turtles), the spatial boundaries used in the environmental assessment include the project area, the affected area, and a regional study area. The project area is that area directly disturbed by construction, installation, operation and related activities, including physical works (that is, locations of glory holes, production facility moorings, drilling unit moorings and subsea flowlines) and any vessel and/or fishery exclusion zones (Figure 3.1). The affected area, or that which could potentially be affected by project activities beyond the project area, was also considered in formulating effects predictions. These zones of influence (ZOI) were determined using comprehensive models of drill cuttings and produced water discharges (Comprehensive Study (Part One) Section 4.3.2). For accidental events, effects were assessed for areas potentially affected, as determined through oil spill modelling. (For detailed information on the drill cuttings, produced water and oil spill modelling exercises and predicted ZOIs, see Part One of the Comprehensive Study, Chapters 4 and 5). The regional study area, extending beyond the "affected" area, is considered to be the Grand Banks ecosystem (Figure 3.2). In addition, for each VEC there is a defined study area based on its specific nature and characteristics (Comprehensive Study (Part One, Chapter 3). These various spatial boundaries are described in more detail in the Comprehensive Study (Husky Oil 2000a; 2001a).

Figure 3.1 Project Area

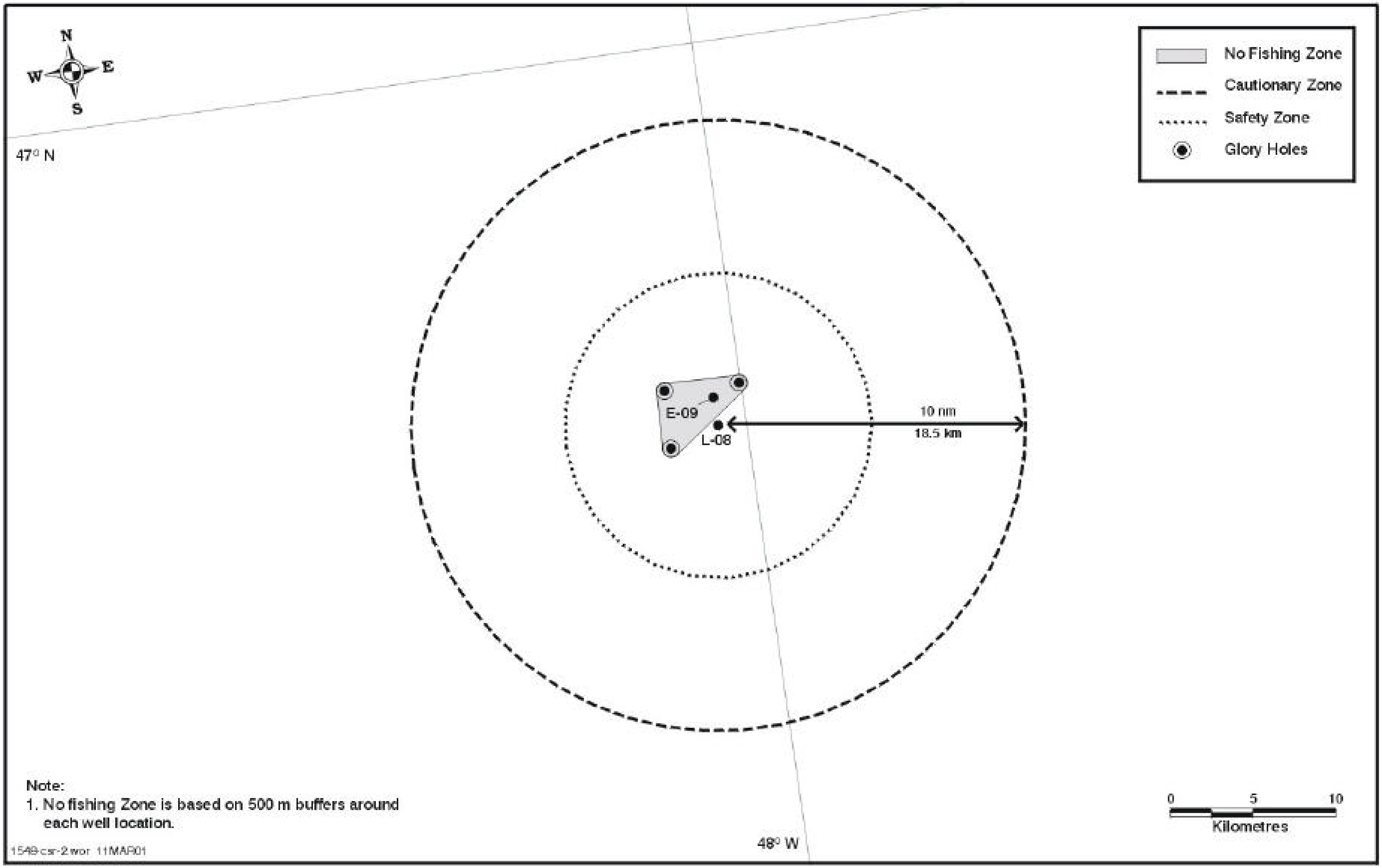
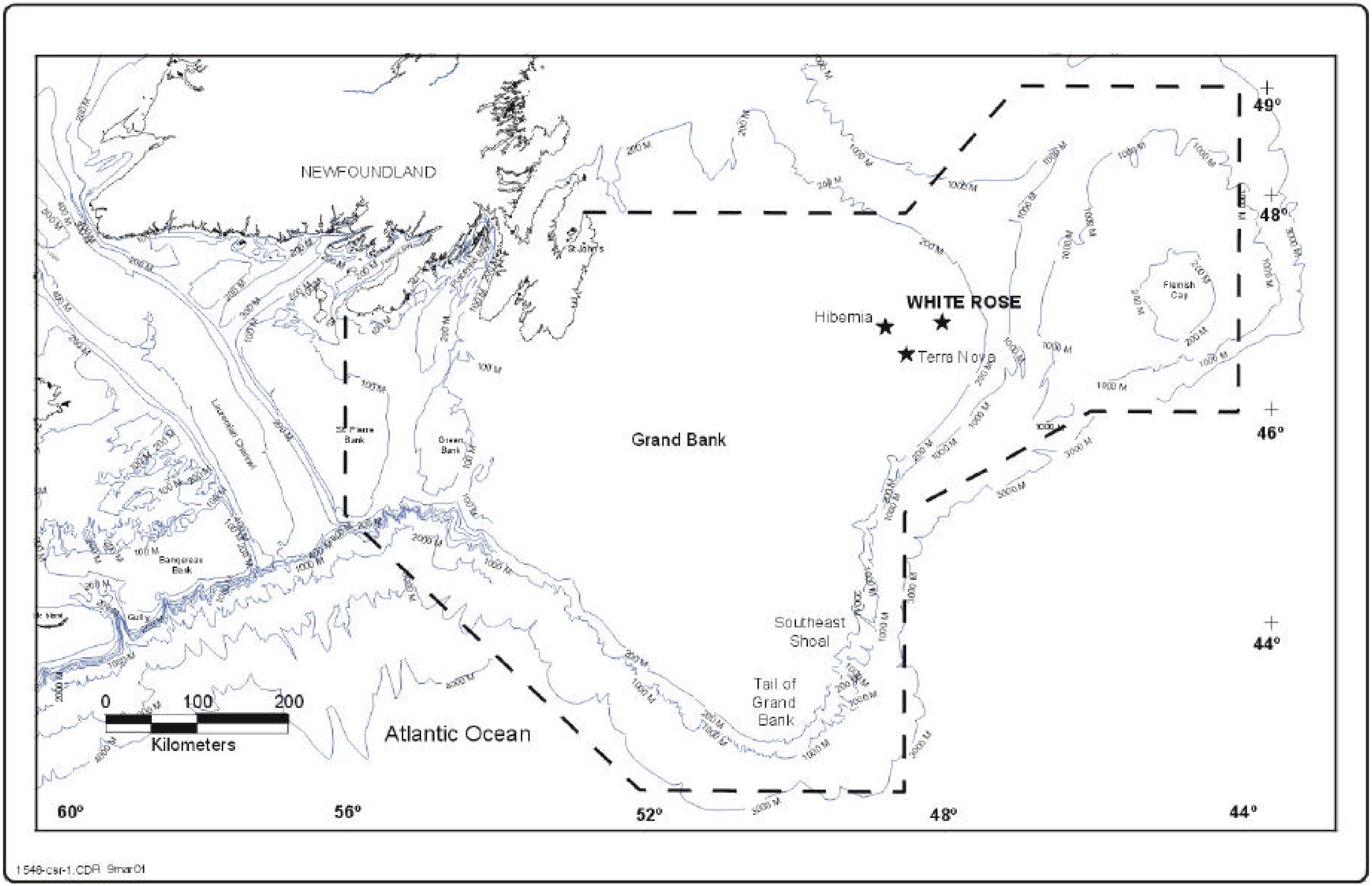


Figure 3.2 Regional Area



For the socio-economic VECs (business and employment, community social infrastructure and services, community physical infrastructure, and fisheries), the geographic scope of the assessment is primarily provincial, with more detailed studies of areas which may likely experience direct effects from the White Rose oilfield development. These areas include the St. John's Census Metropolitan Area, the Isthmus of Avalon area (an approximate 50-km zone centred on Bull Arm) and the Marystown area (a 50-km commuting zone from Marystown). Other communities, geographic areas, and administrative divisions are referred to as relevant. For example, for the fisheries VEC, fishing activity in Northwest Atlantic Fisheries Organization (NAFO) Divisions and Unit Areas adjacent to the White Rose project area is considered.

3.4 EFFECTS ASSESSMENT PROCEDURES

The approach used to assess the potential effects of the project involved:

- describing the existing environment;
- identifying potential interactions between the environment and the various phases and components/ activities associated with the proposed project;
- identifying and evaluating anticipated environmental effects;
- classifying anticipated environmental effects (adverse or positive);
- identifying mitigative measures;
- application of evaluation criteria for assessing environmental effects (magnitude, geographic extent, frequency, duration, reversibility, and ecological, socio-cultural and economic context);
- assessing cumulative environmental effects (considering those projects and activities that are ongoing or likely to proceed as outlined in the Responsible Authorities Guide (CEAA 1994b);
- assessing the residual environmental effects of the project after mitigation;
- determining the significance of predicted residual effects; and
- identifying follow-up initiatives.

In evaluating the predicted residual environmental effects of the project, an effect is rated as significant, not significant or positive. For fish and fish habitat, marine birds, and marine mammals and sea turtles, a significant effect is defined as one having a high or medium magnitude for a duration of greater than one year, over an area greater than 100 km^2. Magnitude was defined as follows (effects can be outright mortality, sublethal or exclusion due to disturbance):

Low Affects 0 to 10 percent of individuals in the area determined to be affected.

Medium Affects 10 to 25 percent of individuals in the area determined to be affected.

High Affects greater than 25 percent of individuals in the area determined to be affected.

For the socio-economic VECs, definitions for the rating criteria used differ between the fishery and other VECs because of the type, location and group of individuals affected. For example, magnitude is defined in terms of current capacity to accommodate change in the case of social and physical infrastructure and services, while in the case of the fishery, magnitude reflects the proportion of fishers affected by Project-related changes. For the business and employment and community infrastructure VECs, magnitude is defined as follows:

Low	Within current capacity, standard or threshold.
Medium	Approaches current capacity, standard or threshold.
High	Exceeds current capacity, standard or threshold.

For the fishery, the magnitude of potential adverse effects is defined as follows:

Low	Affects 0 to 5 percent of Grand Banks fishers.
Medium	Affects 5 to 25 percent of Grand Banks fishers.
High	Affects greater than 25 percent of Grand Banks fishers.

For each of the socio-economic VECs, an adverse residual effect is considered significant if it has a predicted magnitude of medium or high, and more so when its geographic extent or temporal nature increases, where it is irreversible, or when it occurs in an area previously unaffected by human activity. Geographic extent, duration, frequency, reversibility and context are each defined in ways relevant to the community related or fishery-related VECs.

The level of confidence for each residual effect prediction, and the likelihood of the effect occurring, are also indicated.

4 ENVIRONMENTAL EFFECTS ASSESSMENT

The following sections provide a summary description of the existing biophysical environment in the White Rose area, focusing on the specific VECs being considered in this assessment (an extensive overview of the existing physical and biological environments is provided in Part One of the Comprehensive Study (Chapters 2 and 3) and in the Supplemental Report). It also includes a summary of the assessment of the potential effects of each project phase and its associated components/activities, including mitigation measures, residual environmental effects, and proposed follow-up initiatives. A detailed effects assessment is provided in Part One of the Comprehensive Study (Chapters 4 and 5).

4.1 FISH AND FISH HABITAT

The Grand Banks ecosystem is a complex and dynamic system, driven by numerous physical, chemical, biological and anthropogenic influences.

4.1.1 Existing Conditions

Plankton refers to those organisms that more or less drift with water currents, including micro-organisms, algae, juvenile and adult invertebrates, and many species of fish eggs and larvae. Aggregations of plankton are often exploited by feeding fish, seabirds, baleen whales and other predators. Benthos refers to plants and animals that live in or on the sea bottom. At least 370 species of polychaetes, echinoderms, crustaceans, and molluscs occur on the Grand Banks (Hutcheson et al. 1981). Benthic animals form an important food resource for many species of fish.

A wide variety of fish species occur in the White Rose area. However, these species are not unique, as they also occur in other parts of the Grand Banks and elsewhere. Species that are or have been important commercial species in the project area and adjacent region include: snow crab (*Chionoecetes opilio*), porbeagle shark (*Lamna nasus*), Atlantic cod (*Gadus morhua*), Iceland scallop (*Chlamys islandica*), northern shrimp (*Pandalus borealis*), Stimpton's surf clam (*Mactromeris polynyma*), yellowtail flounder (*Pleuronectes ferruginea*), shortfin mako shark (*lsurus oxyrinchus*), Greenland halibut (*Rheinhardtius hippoglossoides*), American plaice (*Hippoglossoides platessoides*), Atlantic halibut (*Hippoglossus hippoglossus*), various redfish species (*Sebastes* spp.), capelin (*Mallotus villosus*), swordfish (*Xiphias gladius*), bluefin tuna (*Thunnus thynnus*) and bigeye tuna (*Thunnus obesus*), American lobster (*Homerus americanus*), Atlantic salmon (*Salmo salar*), witch flounder (*Glyptocephalus cynoglossus*), short-finned squid (*Illex illecebrosus*), haddock (*Melanogrammus aeglefinus*), grenadier (*Macrourus* spp.) and Atlantic herring (*Clupea harengus harengus*).

A number of other species have been identified as potential commercial fish species in the area. They include: Atlantic (or striped) wolffish (*Anarhichas lupus*), spotted wolffish (*Anarhichas minor*), various skate species (*Raja* spp.), monkfish (or goosefish) (*Lophius americanus*), white hake (*Urophycis tenuis*) and winter flounder (*Pleuronectes americanus*).

Fish are not only an important food source for humans, but are also important ecologically as predators and food for other species. For example, sand lance (*Ammodytes* spp.) is an ecologically important species found in abundance at the White Rose site.

Further information on fish and fish habitat in the area is provided in the Comprehensive Study (Part One, Chapter 3 and the Supplemental Report).

4.1.2 Effects Assessment

4.1.2.1 Routine Development Operations (Drilling and Construction)

Project-related structures will be protected by a safety zone and a no-fishing zone (Figure 3.1). The no-fishing zone will be approximately 15.4 km^2 in size, and could constitute a refuge where fish, including commercially important species, would be attracted to the subsea structures and become concentrated, and will allow the recovery of the benthos in the area. This enhancement of local populations may somewhat offset any adverse effect of the no-fishing zone on fishing activity (see Section 5.4).

The drilling rig and supply and standby ships will carry navigation and warning lights, working areas will be illuminated with floodlights, helicopter pads will be lit, and there may be flaring conducted on the drill rigs. Fish may be attracted to illuminated surface waters near vessels (Hurley 1980), although only low numbers and localized areas will be affected, and mortality will not increase to any noticeable degree.

Benthic habitat will be disturbed during construction of the glory holes and trenching of flowlines. However, recolonization occurs rapidly once the disturbance ends. Quantification of altered, disturbed or destroyed habitat is required by DFO as per its Policy for the Management of Fish Habitat, as is development of a fish habitat compensation plan. No underwater blasting is anticipated. Underwater construction may temporarily displace fish in the immediate area, but these effects would be negligible.

Drilling muds are needed to convey the drill cuttings out of the hole and to keep formation fluids from entering the well. All development drilling within the White Rose area will be conducted using either water-based muds (WBMs) or synthetic-based muds (SBMs). The proponents plan to drill primarily with WBMs, however, SBMs would be used in difficult or highly deviated situations and may also be needed in the reservoir section to avoid formation damage. The main component of WBM is either freshwater or seawater; the components of WBMs are relatively non-toxic (see GESAMP, 1997). The primary component of SBM is a non-toxic synthetic fluid.

At several stages during drilling and at the end of the drilling process, WBM is discharged over the side. In the case of SBM, all the mud is shipped back to the shorebase for recycling or disposal. Drill cuttings are removed from the muds in successive separation stages and discharged at-sea. Some of the mud remains with the discharged cuttings. The SBM associated with the drill cuttings will be handled and treated in accordance with C-NOPB and the current Offshore Waste Treatment Guidelines (NEB, C-NOPB and C-NSOPB)

A report entitled "*White Rose Oilfield Comparison of Drill Cuttings Disposal Options*" (Husky Oil 2001c) has been prepared by Husky Oil to provide details on an analysis of the technical and economic feasibility of cuttings reinjection. The analysis addresses three drill cuttings management options: cuttings reinjection (CRI), onshore disposal and on-site discharges of treated cuttings to the ocean. A detailed technical analysis was undertaken of the options. An economic model was run on all three options to assess the overall cost of each option, and the financial impact to both project value and reduced royalty payments to the Provincial Treasury. A qualitative analysis of environmental effects to the marine and terrestrial environments is also included. A quantitative analysis was undertaken of air emissions for each option based on work by Petro-Canada for Terra Nova. Finally, an integrated risk analysis was done of technical, economic and environmental aspects of cuttings disposal options. The results of this analysis are outlined in detail in the above noted report, and summarized here. The analysis found that CRI is technically feasible, but economically unfeasible. The on-shore disposal option is also technically feasible, but economically unfeasible.

The analysis indicates that the on-site disposal of treated cuttings is both financially and technically feasible. The integrated risk analysis indicates that the technical, potential financial and environmental risks associated with this option are low, while expected financial risk is medium. The technical risks related to onsite disposal of treated cuttings are considered to be minimal as the operation is straightforward and compatible with normal operations. Similarly, there are limited environmental risks associated with this disposal option due to the use of low toxicity synthetic-based drilling fluids and use of best available technology to reduce residual oil content on cuttings.

Based on the detailed analysis undertaken by Husky Oil, and in comparison to the numerous technical issues and economic constraints associated with other disposal options, ocean disposal of cuttings is considered straightforward from an operational point of view and is by far the best option economically for both the proponent and the Province of Newfoundland and Labrador. The integrated risk and decision analysis support these conclusions. Consequently, Husky Oil's recommended method of drill cuttings disposal is on-site treatment and ocean disposal.

The proponents have modelled the potential effect of the discharge to determine the nature and extent of the ZOI, based upon the completion of the maximum number of 25 wells forecast for White Rose (see Part One of the Comprehensive Study, Section 4.3.1.4). The biological ZOI for drill cuttings is predicted to be confined to within approximately 500 m of the drilling area. In the case of SBMs, cuttings will be treated to meet the current Offshore Waste Treatment Guidelines (NEB, C-NOPB and C-NSOPB). Also, because only a low number of wells will be drilled per year in the development area, the concentrations of hydrocarbons in sediments will remain low and will affect benthos in only a very limited area. In the unlikely event that fish are tainted, they are likely to be those that are attracted to the subsea structures and reside in the no fishing zone. Highly mobile fish are unlikely to remain near cuttings with residual SBM long enough to become tainted.

Other fluids and solids associated with the development phase of the project include: completion, packer and workover fluids, cement slurry, blow-out prevention (BOP) fluid, deck drainage, hydrostatic testing fluids, cooling water, sanitary and domestic waste, garbage and other waste, small spills, ballast water, bilge water, and possibly, a limited amount of untreated produced water. Most fluids and solids will be treated and tested prior to discharge, or will be recovered and recycled or transferred to shore. All fluids and solids will be handled in a manner that minimizes accidental spillage, and measures for responding to spills will be in place (see Part One of the Comprehensive Study, Chapters 6 and 8). Fluids and solids associated with the development phase will have negligible to low effects on fish and fish habitat. Atmospheric emissions of potentially harmful materials during development drilling will be low, and they will be rapidly dispersed in the atmosphere resulting in negligible effects. Flaring will occur only during short-term well testing operations during drilling.

Disturbance related to underwater noise could be caused by the drilling platforms and by mobile sources such as supply boats and helicopters. Effects of a passing supply vessel will be transitory and no greater than that of a passing fishing boat. As noise does not transmit well from air to water, there will be negligible effects on fish as a result of aircraft overflights. Noises emitted by a drilling rig are much lower in magnitude, but more continuous, than those discussed above. As fish are often attracted to offshore drilling platforms (Stanley and Wilson 1990; Black et al. 1999), it appears they can adapt well to noises associated with offshore oil exploration (Chapman and Hawkins 1969). The potential effects of noise during the project's development phase is also assessed as negligible.

4.1.2.2 Normal Production and Maintenance Operations

The FPSO and supply vessels will be on site over the life of the project, and a drill rig will be present in the vicinity for various periods. During this time, subsea structures will be present on the sea floor. The effects of subsea structures and the safety zone during production will be similar to those discussed above for the development phase, as would the effects of lights and flares. The subsea structures will require periodic inspection, cleaning and maintenance, which will disturb a limited area of the sea bottom and may disturb some resident fish. These effects are, however, predicted to be negligible. Periodic releases of small amounts of non-toxic control fluid during operation of the subsea control valves would also have negligible effects to marine life.

Water will be injected into the reservoir to enhance oil recovery by maintaining reservoir pressure. Extracting this amount of seawater will have a negligible effect, as would any effects on populations of zooplankton and fish larvae as a result of entrainment. Some of the injected water may eventually be released as a component of produced water.

Produced water is water from the producing formation that comes to surface with the oil and gas. Water treatment facilities on the FPSO will treat produced water to reduce its oil content to compliance with the current Offshore Waste Treatment Guidelines. The FPSO will be capable of treating at least 30 x $10^3 m^3$/d of produced water. Once cleaned to specifications, the produced water will be discharged overboard, approximately three to five m below the waterline. The White Rose ZOI model indicates an irregular ZOI ranging from a low of 1.8 km for produced water in winter to an extreme of 3.6 km in the fall, with the axis always trending southeast to southwest (Comprehensive Study (Part One) Section 4.3.2). The produced water will be warmer and less dense than the receiving water. The ZOI of elevated temperatures will be 50 m or less around the production site. Some zooplankton and fish larvae may experience thermal shock in the immediate vicinity of the outfall, although this effect will be negligible in terms of local populations. Produced water could affect water quality slightly downstream of the release point and affect plankton, although these effects would be of low magnitude. Because it will rise to the surface, produced water will have little potential to interact with the benthos. Any direct effects to fish and fish habitat as a result of produced water will be negligible.

In addition to produced water, other operational discharges include cooling water, deck drainage, sanitary and domestic waste and potential small spills. The FPSO will have segregated ballast tanks to prevent contamination of ballast water with oil. Cooling water may be discharged at temperatures of approximately 30^{o}C above ambient, with potential negligible effects to marine life. Drainage from the decks of drill rigs and the FPSO and wastewater will be treated prior to discharge. Garbage and other waste will be transferred to shore for disposal, and will therefore not interact with the marine biota. Spill prevention has been incorporated into the design and planning of the project, and appropriate spill response capability will be in place (Comprehensive Study (Part One) Chapters 6 and 8).

Flaring will likely occur only during operational upsets on the production facility. The FPSO will use natural gas (associated gas) as its primary fuel source, and equipment will be carefully selected and maintained to minimize the amount of noxious gas in emissions. All additional produced gas will be reinjected into the reservoir. In general, emissions of harmful substances are likely to be low and not detectable outside the immediate vicinity of the FPSO. Overall, the effects of atmospheric emissions on fish and fish habitat from all sources are deemed negligible.

As discussed above, the effects of vessel discharges would be negligible. The effects of helicopters on the marine environment are mainly related to noise. The principal underwater noise sources during production will be similar to those during development, although the FPSO will be an additional source of noise. Overall, the potential effect of this noise during this phase of the project on fish and fish habitat would be negligible, as evidenced by the well-known attraction of fish to offshore production facilities. The transportation of the oil to the nearest shipping lanes is also expected to have a negligible effect on fish and fish habitat.

4.1.2.3 Decommissioning

The White Rose site will be abandoned at the end of the production life and will be restored to minimize residual effects on the environment. During this phase, there will be some disturbance to infaunal communities. Decommissioning will, however, also result in a cessation of any disturbance associated with the project. The most important effect on fish will be the termination of the no-fishery safety zone if, in fact, this constituted a refuge. Assuming a diverse commercial fishery operates in the area, conditions should revert to those before development and overall there will be no adverse effect. If some structures remain projecting above the seabed, there will be a positive, very localized effect on fish populations due to the reef effect, provided these structures are protected from trawlers.

4.1.2.4 Accidental Events

Two types of environmentally-threatening accidents that could occur during the White Rose oilfield development project are oil-well blowouts and “batch” spills. Blowouts are continuous spills lasting hours, days or weeks that could involve the discharge of large volumes of petroleum gas into the atmosphere and large amounts of crude oil into surrounding waters. Blowouts could occur from accidents during development drilling, well-completion activities, workovers, and various production activities. Batch spills are instantaneous or short-duration discharges of oil that could occur from accidents on the FPSO where oil is stored and handled, or accidents associated with the loading of oil onto the shuttle tankers that will move oil from the FPSO. The environmental assessment includes consideration of the likelihood, control and potential environmental effects of such accidental events.

The probabilities of spills of various types and sizes were calculated for White Rose based on world-wide historical statistics. Clearly, the probability of smaller spills, especially those involving fuel or crude transfers, is much higher than for large and very large spills. Small spills less than 50 barrels in size might occur about once every five years, although their average size can be expected to be less than 10 barrels. Spills less than one barrel (159 L) are likely to occur with greater frequency than those in the size range of one to 49 barrels (159 to 7,790 L). These spills are usually fairly inconsequential. Husky Oil will make every effort to ensure that operations are spill-free and as clean as possible and has a zero tolerance policy to all spills. Husky Oil's first response is prevention, but if a small spill occurs, the personnel and equipment will be on site to respond. Additional information relating to spill response is located in Part One of the Comprehensive Study (Chapter 6).

The probability of a major spill is expected to be very low. Large, platform-based spills (greater than 1,000 barrels) have an approximately 0.5 percent chance of occurring over the course of the project (annual probability of 1 in 2,600), while very large platform spills (greater than 10,000 barrels) have a 0.2 percent probability of occurring (annual probability of 1 in 7,100). For the three years of development drilling, the chances of an extremely large (greater than 150,000 barrels) and very large (greater than 10,000 barrels) oil well blowout are about 0.08 (annual probability of 1 in 3,800) and 0.16 percent (annual probability of 1 in 1,900), respectively, while the probabilities of similar blowouts during production activities and workovers are 0.14 (annual probability of 1 in 9,300) and 0.35 percent (annual probability of 1 in 3,700), respectively. The probability of a tanker loading spill over the course of the entire project is historically approximately 30 percent (annual probability of 1 in 43). The size of any such spill would likely be relatively small and restricted to fluids in the offloading system. It is reasonable to expect much lower frequencies for the White Rose project than those presented above, given substantial improvements in technology and/or practice in recent years, and the fact that regulatory requirements relating to oil spill prevention in the Canadian offshore are among the most stringent in the world. Additional details on the historical data used, and the predicted number of blowouts and spills for the project, are provided in the Comprehensive Study (Part One, Chapter 5).

The proponents plan to incorporate oil spill prevention into the design and operations of the White Rose project. All offshore systems and structures, procedures and programs will be designed with consideration of preventing the loss of any hydrocarbons. Examples of measures to reduce the likelihood of oil spills include equipment and facility design (e.g., the use of BOPs, double-hulled vessels), routine maintenance and testing for all aspects of the production program, the use of good communications and sound marine practices, regular inspections and audits of the offshore platform, and employee awareness training. The proponents will also undertake all of the necessary planning, training, and exercising to ensure that the appropriate spill response capability is in place for all phases of the project in the unlikely event of such a spill. Oil spill response will be included as part of the contingency planning undertaken for the White Rose project (see Section 4.4.2 of this report). Additional information regarding the proponents' oil spill prevention measures and response capability is provided in the Comprehensive Study (Part One, Chapters 5 and 6).

Although such an event is unlikely, the fate and behaviour of large accidental oil spills that might occur during the White Rose project were also assessed as part of the environmental assessment. This analysis entailed consideration of the properties of the oil (as determined through laboratory analysis), computer/mathematical modelling for six selected large-spill scenarios, and trajectory modelling of these events to assess the chances of spilled oil reaching shore from the White Rose development area (Comprehensive Study (Part One) Section 5.8).

Certain Grand Banks crude oils, including White Rose oil, do not behave like conventional oils because of their waxy nature. White Rose oil spills would tend to be highly persistent, but will tend to form particles, "wax" balls and mats throughout areas of open water, rather than a continuous slick. The actual behaviour of spilled oil would vary based on the type, size and timing of the spill. Any spilled oil will be moved by currents and wind until it very slowly disperses in the water and diffuses on the surface to low concentrations, or contacts land. Of the 14,600 trajectories modelled using wind and water current information, none predicted that oil spilled at the White Rose site would reach shore. The trajectory data were also used to identify the likelihood of a slick reaching any given area on the Grand Banks (on a monthly basis). Information regarding the predicted spatial and temporal distribution of spilled oil is provided throughout this report in relation to specific VECs (where applicable), and in detail in the Comprehensive Study (Part One, Section 5.8). Effects are assessed for each of the selected large-spill scenarios.

In the unlikely event of a major oil spill or blowout, juvenile and adult fish can and probably will avoid any oil by swimming from the blowout/spill region (Irwin 1997). Should an accidental event occur, the effects of oil spills on fish are therefore predicted to be negligible to low because fish will generally avoid any interaction with the spill. Some eggs and larvae could, however, be affected if they come in contact with a high enough concentration of dissolved oil. This conclusion is consistent with the findings of both the Hibernia (Mobil 1985) and Terra Nova (Petro-Canada 1995) environmental assessments, which concluded that neither surface spills nor subsea blowouts posed significant risks to either pelagic or demersal fish stocks.

A more detailed assessment of the potential environmental effects of the project on fish and fish habitat is provided in the Comprehensive Study (Part One, Chapters 4 and 5). The potential implications of any effects to fish and fish habitat for fishing activities is discussed in Section 5.4 of this report. The potential environmental effects of the development, production and decommissioning phases of the project on fish and fish habitat, and in the case of an accidental event, are summarized in Table 4.1.

Table 4.1 Effects Assessment Summary – Fish and Fish Habitat

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects					
			Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Ecological/Socio-Cultural and Economic Context
DEVELOPMENT								
Presence of Structures								
No Fishing Zone	Safe Refuge From Fishing (P)		1	3	6	3	R	1
Artificial Reef Effect	Increased Food and Shelter (P)		1	2	6	3	R	1
Subsea Structures	NA	NA	NA	NA	NA	NA	NA	NA
Lights and Flares	Attraction (A)		0	1	6	3	R	1
Underwater Construction	Benthic Food Supply (A)	No Blasting	0	1	1	3	R	1

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects					
			Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Ecological/Socio-Cultural and Economic Context
Drilling Mud/Cuttings								
Water-Based Mud	Contamination (A); Habitat Alteration	Recycle Muds; Treat and Discharge Cuttings	0	1	2	3	R	1
Synthetic-Based Mud	Contamination (A); Habitat Alteration	Recycle Muds; Treat and Discharge Cuttings	0	1	2	3	R	1
Other Fluids and Solids								
Completion, Packer and Workover	Contamination (A)	Recycle	0	1	2	3	R	1
Cement	Negligible		0	1	1	3	R	1
BOP Fluid	Contamination (A)	Recycle	0	1	2	3	R	1
Hydrostatic Testing Fluid	Contamination (A)		0	1	1	1	R	1
Cooling Water	Growth (P); Shock (A)		0	1	6	3	R	1
Deck Drainage	Contamination (A)	Treatment	1	1	2	3	R	1
Bilge Water	Contamination (A)	Treatment	0	1	2	3	R	1
Sanitary and Domestic Wastes	Nutrients (P); Contamination (A)	Treatment	0	1	6	3	R	1
Garbage	No interaction	NA						
Atmospheric Emissions	Water Quality (A)	Equipment Design	0	2	6	3	R	1
Ships and Boats	Disturbance (A)		0	1	4	3	R	1
Helicopters	Disturbance (A)		0	1	5	3	R	1
Noise								
Drilling Rigs	Disturbance (A)		0	2	6	3	R	1
Support Vessels	Disturbance (A)		0	2	6	3	R	1
Helicopters	Disturbance (A)		0	1	5	3	R	1
Shore Facilities [a]	NA	NA						
PRODUCTION								
Presence of Structures								
No Fishing Zone	Safe Refuge (P)		1	3	6	5	R	1
Artificial Reef Effect	Food and Shelter (P)		1	2	6	5	R	1
Subsea Structures	NA	NA	NA	NA	NA	NA	NA	NA
Surface Structures	Shelter (P)		0	1	6	5	R	1
Lights and Flares	Attraction (A)		0	1	6	5	R	1
Underwater Maintenance	Food Supply (A)	Material/ Method Selection	0	1	1	5	R	1
Injection Water	Contamination (A)	Safety Plan	0	1	1	5	R	1
Produced Water	Contamination (A)	Treatment	1	2	6	5	R	1
Storage Displacement Water	NA	NA	NA	NA	NA	NA	NA	NA
Cooling Water	Growth (P); Shock (A)		0	1	6	5	R	1
Deck Drainage	Contamination (A)	Treatment	0	1	6	5	R	1

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects: Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Ecological/Socio-Cultural and Economic Context
Sanitary and Domestic Waste	Nutrients (P); Contamination (A)	Primary Treatment	0	1	6	5	R	1
Atmospheric Emissions	Water Quality (A)	Equipment Design	0	2	6	5	R	1
Ships and Boats	Disturbance (A)		0	1	4	5	R	1
Helicopters	Disturbance (A)		0	1	4	5	R	1
Noise								
FPSO	Disturbance (A)		0	2	6	5	R	1
Support Vessels	Disturbance (A)		0	2	6	5	R	1
Helicopters	Disturbance (A)		0	1	4	5	R	1
Shore Facilities [a]	NA	NA						
DECOMMISSIONING								
Offshore Decommissioning	Loss of Refuge and Reef (A);		1	1	6	5	R	2
	Stop Disturbance (P);		1	1	6	5	R	2
	Stop Contamination (P)		1	1	6	5	R	2
Abandonment	No Effect	Removal of subsea material	NA	NA	NA	NA	R	2
ACCIDENTAL EVENTS								
Offshore Oil Spill or Blowout	Effects on Health (A)	Contingency Plan; Training; Preparation; Equipment Inventory; Prevention	0-1	5-6	<1	2	R	1

KEY

Magnitude:
0 = Negligible, essentially no effect.
1 = Low
2 = Medium
3 = High

Frequency:
1 = < 11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = > 200 events/year
6 = Continuous

Reversibility:
R = Reversible
I = Irreversible
(Refers to Population)

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity
2 = Evidence of existing adverse effects

Geographic Extent:
1 = < 1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = > 10,000 km²

Duration:
1 = < 1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = > 72 months

NA = Not Applicable

[a] There will not be any new onshore facilities required. Existing infrastructure will be used.

With the exception of the potential positive effects of the presence of project structures, the residual effects of the various project activities associated with the development and production phases on fish and fish habitat are assessed as adverse, but not significant. The residual effect on fish and fish habitat in the unlikely event of an accidental offshore oil spill or blowout would also be adverse but not significant. The residual environmental effects of project decommissioning are predicted to be positive.

4.1.2.5 Cumulative Effects

The environmental assessment also considers potential cumulative effects resulting from the accumulation of the project’s own effects, as well as in combination with other oil development projects (Hibernia, Terra Nova), present and future exploration activities, marine transportation, and fisheries. As outlined above, the proposed project is predicted to have not significant effects on fish and fish habitat. The cumulative effects of the activities within each of the phases of the White Rose project are also expected to be not significant for this VEC, as is the overall effect of the project as a whole.

In general, the various activities associated with all three oil development projects on the Grand Banks (e.g., the discharge of drill cuttings, produced water, noise) and expected exploration activity will have similar effects on the biophysical environment, with differences in magnitude and duration. The effects of each of these developments and activities have, however, been predicted to be not significant. Oil exploration and development activity is not expected to have significant cumulative effects on this VEC, and fish and fish habitat will likely recover within a few years from any disturbance caused by oil development activity on the Grand Banks as it is presently envisaged. The no fishing zones associated with offshore oil developments will positively affect fish, but negatively affect the fishery in that there will be some exclusion areas. In the long term these effects may cancel each other out, or may even have a positive effect.

The commercial fisheries of the Grand Banks are diverse and extensive, and have contributed to effects to fish populations in the area. Assuming that the commercial fishery resource is managed in a sustainable manner by the resource agencies, the cumulative effect of the fishery and offshore development on fish and fish habitat will not be significant.

Oil development projects will all have associated vessel traffic, as will exploration activity on the Grand Banks. Offshore oil activity will add an incremental amount of tanker traffic. Overall, the cumulative vessel activity of Grand Banks oil developers, including White Rose, Hibernia, Terra Nova, and expected exploration activity, will probably comprise less than 25 percent of total international traffic on the Grand Banks and less than three percent when domestic vessels and fishing vessels are considered (Comprehensive Study (Part One) Section 4.3.4.3). Overall, cumulative vessel activity of Grand Banks oil developers on fish and fish habitat will be negligible and not significant.

4.2 MARINE BIRDS

4.2.1 Existing Conditions

The Grand Banks and the southeastern coast of Newfoundland are very important areas for over 60 species of marine birds (Table 4.2). Of these 60 species, approximately 18 are pelagic (that is, living or feeding on the water), nine of which nest in the area. There are several million of these nesting birds, and there are millions of annual visitors that forage on the Grand Banks. In addition, a wide variety of coastal species, including gulls, terns, cormorants, waterfowl and shorebirds frequent shoreline areas in the area. Marine birds in the area eat a variety of prey, including capelin, copepods, amphipods and short-finned squid; different species forage at different water depths.

Several endangered or threatened bird species also occur in or near the area, including harlequin ducks (*Histrionicus histrionicus*), piping plovers (*Charadrius melodus*), ivory gulls (*Pagophila eburnea*), manx shearwaters (*Puffinus puffinus*) and common black-headed gulls (*Larus ridibundus*).

Further information on marine birds is provided in the Comprehensive Study (Part One, Chapter 3).

4.2.2 Effects Assessment

4.2.2.1 Routine Development Operations (Drilling and Construction)

The presence of ships (including the semi-submersible drill rig) and boats involved in the development phase of the project could potentially disturb marine birds. Birds that are active at night (e.g., storm-petrels) may be attracted to light sources on offshore facilities and/or could possibly be incinerated by gas flaring (Avery et al. 1978; Bourne 1979; Sage 1979). Although there may be some flaring during development, this would be limited to short periods and the heat and noise generated by the flare may deter marine birds from the immediate area. Reasonable efforts will be made to allow seabirds found stranded on boats and other offshore structures to recover, and to release them at night near minimal lighting. The presence of lights on drill rigs and supply boats and any flaring would have low magnitude effects during this phase of the project.

Table 4.2 Marine Birds Recorded in the Study Area

Common Name	Scientific Name	Distribution in Study Area	Common Name	Scientific Name	Distribution in Study Area
Red-throated loon [?]	*Gavia stellata*	coastal	American golden-plover	*Pluvialis dominica*	littoral
Common loon [?]	*Gavia immer*	coastal	Semipalmated plover	*Charadrius semipalmatus*	littoral
Pied-billed grebe	*Podilymbus podiceps*	coastal	Greater yellowlegs	*Tringa melanoleuca*	littoral
Red-necked grebe	*Podiceps grisegena*	coastal	Spotted sandpiper [1]	*Actitis macularia*	littoral
Northern fulmar [1]	*Fulmarus glacialis*	offshore, coastal	Semipalmated sandpiper	*Calidris pusilla*	littoral
Cory's shearwater	*Colonectris diomedea*	offshore	White-rumped sandpiper	*Calidris fuscicollis*	littoral
Greater shearwater	*Puffinus gravis*	offshore, nearshore	Purple sandpiper	*Calidris maritima*	littoral
Sooty shearwater	*Puffinus griseus*	offshore, nearshore	Red-necked phalarope	*Phalaropus lobatus*	offshore
Manx shearwater [1]	*Puffinus puffinus*	offshore, nearshore	Red phalarope	*Phalaropus fulicaria*	offshore
Little shearwater	*Puffinus assimilis*	offshore	Pomarine jaeger	*Stercorarius pomarinus*	offshore
Wilson's storm-petrel	*Oceanites oceanicus*	offshore	Parasitic jaeger	*Stercorarius parasiticus*	offshore
Leach's storm-petrel [1]	*Oceanodroma leucorhoa*	offshore	Long-tailed jaeger	*Stercorarius longicaudus*	offshore
Northern gannet [1]	*Sula bassanus*	offshore, coastal	Great skua	*Catharacta skua*	offshore
Great cormorant [?]	*Phalacrocorax carbo*	coastal	Common black-headed gull	*Larus ridibundus*	coastal
Double-crested cormorant [1]	*Phalacrocorax auritus*	coastal	Ring-billed gull	*Larus delawarensis*	coastal
Canada goose [?]	*Branta canadensis*	coastal	Herring gull [1]	*Larus argentatus*	coastal, offshore
American black duck [?]	*Anas rubripes*	coastal	Iceland gull	*Larus glaucoides*	coastal, offshore
Ring-necked duck	*Aythya collaris*	coastal	Lesser black-backed gull	*Larus fuscus*	coastal, offshore
Greater scaup	*Aythya marila*	coastal	Glaucous gull	*Larus hyperboreus*	coastal, offshore
Common eider [?]	*Somateria mollissima*	coastal	Great black-backed gull [1]	*Larus marinus*	coastal, offshore
King eider	*Somateria spectabilis*	coastal	Black-legged kittiwake [1]	*Rissa tridactyla*	coastal, offshore
Harlequin duck	*Histrionicus histrionicus*	coastal	Sabine's gull	*Xema sabini*	offshore
Oldsquaw	*Clangula hyemalis*	coastal	Ivory gull	*Pagophila eburnea*	offshore
Black scoter	*Melanitta nigra*	coastal	Common tern [1]	*Sterna hirundo*	coastal, offshore
Surf scoter	*Melanitta perspicillata*	coastal	Arctic tern [1]	*Sterna paradisaea*	coastal, offshore
White-winged scoter	*Melanitta fusca*	coastal	Dovekie	*Alle alle*	offshore, coastal
Common goldeneye	*Bucephala clangula*	coastal	Common murre [1]	*Uria aalge*	coastal, offshore
Bufflehead	*Bucephala albeola*	coastal	Thick-billed murre [1]	*Uria lomvia*	coastal, offshore
Common merganser	*Mergus merganser*	coastal	Razorbill [1]	*Alca torda*	coastal, offshore
Red-breasted merganser	*Mergus serrator*	coastal	Black guillemot [1]	*Cepphus grylle*	coastal
Black-bellied plover	*Pluvialis squatarola*	littoral	Atlantic puffin [1]	*Fratercula arctica*	coastal, offshore

[1] Indicates species that nest along the coast of the study area.

[?] Indicates species that may nest along the coast of the study area.

(Source: Mobil 1985)

The discharge of drilling cuttings will have negligible effects on birds. Cuttings fall to the seafloor, and therefore, there is little chance of interaction with birds on the surface. SBMs will be recycled/reused and ultimately disposed of on-shore. The discharge of treated completion, packer and workover fluids would have negligible effects on birds as hydrocarbon levels are reduced to very low levels, acids are neutralized, and limited volumes of these fluids are released. Similarly, BOP fluid will have negligible effects on seabirds because these (glycol-water mixes) will have a low-toxicity. Hydrostatic testing fluid will be immediately diluted upon release, and the effects of cooling water will be negligible because the volume released will be low and any thermal effect will be localized. There will be no interaction between discharged cement piles and marine birds.

Other fluids, such as deck drainage and bilge water, will be treated (or diluted), recycled or discharged below the water surface. Although sanitary and domestic wastes will be treated before discharge, seabirds (most notably gulls) may be attracted to these potential food sources, with a subsequent increase in predation on smaller seabirds that associate with offshore structures. Any such effects would be of low magnitude. Atmospheric emissions could, in theory, affect the health of some marine birds, but this effect is also expected to be negligible because only low volumes of potentially harmful materials will be emitted and they will be rapidly dispersed in the atmosphere to undetectable levels.

Vessel and air traffic near seabird colonies could cause disturbance and affect productivity at these sites. However, any such effects would be negligible to low. Vessels will maintain a distance of 2 km from any seabird colonies. Aircraft will fly at minimum altitudes of 600 m whenever possible, avoid colonies of birds, and will avoid repeated overflights of concentrations of birds and/or important habitats. Seabirds are often attracted to offshore structures and vessels, and are usually not disturbed by industrial noise in the air. Birds spend relatively short amounts of time underwater and are therefore not expected to be affected by underwater noise.

4.2.2.2 Normal Production and Maintenance Operations

Seabirds are known to be attracted to offshore platforms, such as the FPSO that will be used during the operation phase, due to, for example, the increased availability of food due to artificial reef and fishing zone effects, the presence of a roosting area at sea, and the discharge of human wastes. Overall, however, the effects on marine birds caused by the physical presence of vessels and structures during project operations are expected to be of low magnitude. As for the development phase, the presence of project-related lights would also have low magnitude effects. Underwater maintenance activities will not interact with marine birds.

Treated oily water contained in produced water will have negligible effects on birds. The plume will be narrow and snake like, and although birds may come into contact with the surficial sheen, it will be dilute. Other operational discharges such as cooling water, treated deck drainage and bilge water and atmospheric emissions will, as for the development phase, also have negligible effects on birds. As in the development phase, the discharge of sanitary and domestic wastes may attract some birds and lead to increased predation, but again, these effects will be low. The principal sources, and potential effects, of underwater noise during production will be essentially the same as those during project development. The noise produced from the FPSO will have negligible effects on seabirds; some species will be attracted to the light and some will avoid the noise from the structure. Direct effects on other species are unlikely because seabirds are highly mobile and can easily avoid the stationary FPSO.

4.2.2.3 Decommissioning

The White Rose site will be abandoned and restored to near pre-development conditions at the end of its production life to minimize potential residual effects on the environment. Increased vessel activity during periods when facilities are being removed may cause some disturbance to seabirds, but this will occur over short periods of time and have a negligible effect. An overall positive effect on marine birds may be realized due to the cessation of activity in the project area.

4.2.2.4 Accidental Events

Accidental events resulting in a substantial release of oil would have serious effects on seabirds. Therefore, it is mandatory to have stringent preventative procedures, practices and technologies in place designed to prevent such occurrences. While the probability of a large spill or blowout is, as discussed previously (Section 4.1.2.4), very low, birds would be at significant risk should one occur. Birds are seriously affected by direct contact with oil, and most birds that come in contact with an oil spill subsequently die (Frink and White 1990; Fry 1990). As significant numbers and concentrations of birds occur on the Grand Banks, any oil spill or blowout could cause at least some and, at worst, extensive bird mortality. There is no clear correlation between the size of an oil spill and numbers of seabirds killed (Burger 1993). The density of birds in a spill area, wind velocity and direction, wave action, and distance to shore may have a greater bearing on mortality than size of the spill (Burger 1993).

As discussed previously, the probability of a large spill is very low and of the numerous spill modelling scenarios created, none predicted oil onshore (Comprehensive Study (Part One) Section 5.8). Therefore, it is extremely unlikely that crude oil accidentally spilled at the White Rose site will reach any seabird colonies in the study area. Due to the makeup of the White Rose crude and its waxy nature, the crude oil will be persistent, but will tend to take the form particles and “wax” balls and mats throughout areas of open water rather than creating a continuous slick.

Seabirds are known to associate with offshore structures and are at risk of exposure in the unlikely event of an accidental release of oil at the White Rose site. During summer, shearwaters, gulls (including kittiwakes), storm-petrels, and fulmars would be the species most likely exposed to oil near the release point. The oil spill trajectory models predict that oil would likely move east and southeast of the White Rose release point (Comprehensive Study (Part One) Section 5.8). It is unlikely that oil would move into the central and western portions of the Grand Banks. However, during May and June, there is an increased likelihood (still relatively low) that oil would be found along the southwestern depth contours of the Grand Banks. Oil would probably not extend into the southeast shoal, so the large numbers of greater shearwaters and Wilson’s storm-petrels and smaller numbers of sooty shearwaters, that moult and forage there during the summer, would probably not be exposed to oil. During winter, large numbers of alcids, most notably thick-billed murres and dovekies, could die from exposure to oil from a major accidental spill or blowout at the White Rose site. The exact location of their wintering areas is unknown and likely varies from year to year. It is possible that oil could pass through a substantial portion of those wintering areas, having an effect on large numbers of alcids.

Depending on the time of year, the location of seabirds within the area, and the type of oil spill or blow-out, the effects of an offshore oil release could range from low to high magnitude, with a geographic extent of up to greater than 10,000 km^2 for both above-surface and subsea blowouts, and a duration of 1 to 12 months. There could therefore be significant adverse effects on marine birds from any major spill or blowout at the White Rose site, although such an event is unlikely.

A more detailed assessment of the potential environmental effects of the project on this VEC is provided in Part One of the Comprehensive Study (Chapters 4 and 5). The potential effects of the various phases of the project and accidental events on marine birds are summarized in Table 4.3.

Table 4.3 Effects Assessment Summary– Marine Birds

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects					
			Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Ecological/Socio-Cultural and Economic Context
DEVELOPMENT								
Presence of Structures								
No Fishing Zone	No Interaction	NA						
Subsea Structures	No Interaction	NA						
Lights	Attraction (A)	Release Stranded Birds	1	2	6	3	R	1
Flares	Mortality (A)		1	2	1	3	I [a]	1
Underwater Construction	No Interaction	NA						
Drilling Mud/Cuttings								
Water-Based Mud	Effects on Health (A)	Recycle Muds; Treat and Discharge Cuttings	0	1	2	3	R	1
Synthetic-Based Mud	Effects on Health (A)	Recycle Muds; Treat and Discharge Cuttings	0	1	2	3	R	1
Other Fluids and Solids								
Completion, Packer and Workover	Effects on Health (A)	Recycle	0	1	2	3	R	1
Cement	No Interaction	NA						
BOP Fluid	Effects on Health (A)	Recycle	0	1	2	3	R	1
Hydrostatic Testing Fluid	Effects on Health (A)	Treatment	0	1	1	3	R	1
Cooling Water	Effects on Health (A)	Treatment	0	1	6	3	R	1
Deck Drainage	Effects on Health (A)	Treatment	0	1	2	3	R	1
Bilge Water	Effects on Health (A)	Treatment	0	1	2	3	R	1
Sanitary and Domestic Wastes	Nutrients (P); Increased Predation (A)	Primary Treatment	1	2	6	3	R	1
Garbage	No Interaction	NA						
Atmospheric Emissions	Effects on Health (A)	Equipment Design	0	1	6	3	R	1
Ships and Boats [b]	Disturbance (A)	Avoid Colonies	0	4	6	3	R	1

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects					
			Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Ecological/Socio-Cultural and Economic Context
Helicopters [b]	Disturbance (A); Mortality (A)	Avoid Colonies & Repeated Overflights of Bird Concentrations	1	4	4	3	R	1
Noise								
Drilling Rigs	Disturbance (A)		0	2	6	3	R	1
Support Vessels	Disturbance (A)	Avoid Colonies	0	4	6	3	R	1
Helicopters	Disturbance (A); Mortality (A)	Avoid Colonies & Repeated Overflights of Bird Concentrations	1	4	4	3	R	1
Shore Facilities								
PRODUCTION								
Presence of Structures								
No Fishing Zone	Increased Food (P)		1	3	6	5	R	1
Artificial Reef Effect	Increased Food (P)		1	2	6	5	R	1
Subsea Structures	No Interaction	NA						
Surface Structures	Attraction (A); Mortality (A)	Release Stranded Birds	0-1	2	6	5	R	1
Lights	Attraction (A)	Release Stranded Birds	1	2	6	5	R	1
Flares	Mortality (A)		1	2	1	5	I [a]	1
Underwater Maintenance	No Interaction	NA						
Injection Water	Effects on Health (A)	Treatment	0	1	6	5	R	1
Produced Water	Effects on Health (A)	Treatment	0	1	6	5	R	1
Storage Displacement Water	No Interaction	NA						
Cooling Water	Effects on Health (A)	Treatment	0	1	6	5	R	1
Deck Drainage	Effects on Health (A)	Treatment	0	1	2	5	R	1
Bilge Water	Effects on Health (A)	Treatment	0	1	2	5	R	1
Sanitary & Domestic Waste	Nutrients (P); Increased Predation (A)	Primary Treatment	1	2	6	5	R	1
Garbage	No Interaction	NA						
Atmospheric Emissions	Effects on Health (A)	Equipment Design	0	1	6	5	R	1
Ships and Boats [b]	Disturbance (A)	Avoid Colonies	0	4	6	5	R	1
Helicopters [b]	Disturbance (A); Mortality (A)	Avoid Colonies & Repeated Overflights of Bird Concentrations	1	4	4	5	R	1
Noise								
FPSO	Disturbance (A)		0	2	6	5	R	1
Support Vessels	Disturbance (A)	Avoid Colonies	0	4	6	5	R	1
Helicopters	Disturbance (A); Mortality (A)	Avoid Colonies & Repeated Overflights of Bird Concentrations	1	4	4	5	R	1
Shore Facilities [c]								

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects					
			Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Ecological/Socio-Cultural and Economic Context
DECOMMISSIONING								
Offshore	Stop Disturbance (P); Reduce Mortality and Health Risks (P)		1	1	3	2	R	2
Onshore [c]								
ACCIDENTAL EVENTS								
Offshore Oil Spill or Blowout	Mortality (A)	Contingency Plan; Training; Preparedness; Prevention; Cleanup Inventory	1-3	5-6	<1	2	I[a]	1

KEY

Magnitude:
0 = Negligible, essentially no effect
1 = Low
2 = Medium
3 = High

Frequency:
1 = < 11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = > 200 events/year
6 = Continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity
2 = Evidence of existing adverse effects

Geographic Extent:
1 = < 1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = > 10,000 km²

Duration:
1 = < 1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = > 72 months

NA = Not Applicable
[a]Effects on individuals irreversible, but any population effects are likely reversible.
[b]Effects of noise considered here.
[c]There will not be any new onshore facilities required. Existing infrastructure will be used.

Residual environmental effects on marine birds as a result of the activities associated with project development and production will be adverse but not significant, while the effects of project decommissioning will be positive. Although unlikely, the residual effect of a major offshore oil spill or blowout on this VEC would be adverse and significant. Preventive measures and contingency planning identified by the proponents will further reduce the likelihood and minimize the effects of any oil spill.

4.2.2.5 Cumulative Effects

The cumulative effects of the various activities within each of the development, production and decommissioning phases of the White Rose project are expected to be not significant for marine birds, as is the overall effect of the project as a whole. Each of the three oil development projects (Hibernia, Terra Nova and White Rose) will have similar effects on marine birds, and some types of disturbance, such as the presence of lights and noise, will also occur as a result of exploration activity, marine transportation and fishing vessels on the Grand Banks. The cumulative effects of these projects on this VEC are, however, predicted to be not significant as well. One of the pressures on populations of marine birds in the area is legal and illegal hunting activity. Most of the Newfoundland saltwater hunt is directed towards thick-billed murres (also known as turres locally). However, only a portion of the population that is offshore, and will interact with ongoing projects and exploratory activity, will be subject to inshore hunting pressures. The cumulative effects of the White Rose development in combination with hunting activity and other development activity on the Grand Banks are expected to be not significant.

4.3 MARINE MAMMALS AND SEA TURTLES

4.3.1 Existing Conditions

Eighteen species of marine mammals are known to occur in the area, including 14 species of whales and dolphins (cetaceans) and four species of seals (phocids). A few additional species may also visit, but these are not considered important components of the ecosystem because of their infrequent presence. Although most species are seasonal inhabitants, the waters of the Grand Banks and surrounding areas are important feeding grounds for some.

Six species of baleen whales (mysticetes) occur in the area: humpback (*Magaptera novaeangliae*), blue (*Balaenoptera musculus*), fin (*Balaenoptera physalus*), sei (*Balaenoptera borealis*), minke (*Balaenoptera acutorostrata*) and, possibly, North Atlantic right (*Eubalaena glacialis*) whales. Although nearly all of these species experienced a decline in numbers due to whaling, it is likely that some are recovering. However, the humpback, blue and fin whales are still listed as vulnerable, and the North Atlantic right whale is listed as endangered. In addition, eight species of toothed whales (odontocetes) are found in the region: sperm whales (*Physeter macrocephalus*), northern bottlenose whales (*Hyperoodon ampullatus*), killer whales (*Orcinus orca*) and long-finned pilot whales (*Globicephala melas*); common dolphins (*Delphinus delphis*), Atlantic white-sided dolphins (*Lagenorhynchus acutus*), white-beaked dolphins (*Lagenorhynchus albirostris*), and the harbour porpoise (*Phocoena phocoena*). Most of these marine mammals occur seasonally in the study area and little is known regarding their distribution and population size in these waters. Of the toothed whales found in the study area, the harbour porpoise is listed as threatened and a population of the northern bottlenose whale is considered vulnerable. In addition, a number of seal species (phocids) occur in the area at various times of the year: grey (*Halichoerus grypus*), harp (*Phoca groenlandica*), hooded (*Cystophora cristata*) and harbour (*Phoca vitulina*) seals. The main diet of seals consists of fish, and invertebrates such as squid and shrimp.

Sea turtles are rare on the Grand Banks, particularly in the cold water of the White Rose area. Three species of sea turtle (leatherback (*Dermochelys coriacea*), loggerhead (*Caretta caretta*), and Kemp's ridley (*Lepidochelys kempii*)) are known to occur in the area. The leatherback turtle is listed as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The United States National Marine Fisheries Service and Fish and Wildlife Service list both the leatherback turtle and the Kemp's ridley turtle as endangered, and the loggerhead turtle as threatened.

Further information on marine mammals and sea turtles in the area is provided in the Comprehensive Study (Part One, Chapter 3).

4.3.2 Effects Assessment

4.3.2.1 Routine Development Operations (Drilling and Construction)

Potential effects on marine mammals are mainly related to the noise produced by offshore structures and activities. Marine mammals depend on the underwater acoustic environment. They are typically more tolerant of fixed location noise sources, such as a semi-submersible drill rig and FPSO facility, than moving sources. Effects of drilling operations on whales and seals may be negligible to low, and will continue throughout the drilling phase of the project. Because drilling activities will continue for several years, habituation may occur. The reactions of marine mammals to marine vessels and aircraft varies between species, and according to the type, level and distribution of activity. Some species of marine mammals will avoid boats and supply vessels, whereas others, such as dolphins and seals, are quite tolerant and may even approach passing vessels (Shane et al. 1986; Richardson et al. 1995; Moulton and Lawson 2000). Overall, the effect of boats and aircraft on marine mammals is predicted to be low. Effects will be reduced if boats maintain a steady course and speed whenever possible, and areas with large numbers of individuals are avoided. Helicopters will also fly at a minimum altitude of 600 m whenever possible.

Drilling activities are unlikely to produce concentrations of heavy metals in muds and cuttings that are harmful to marine mammals (Neff et al., 1980 in Hinwood et al. 1994), and any effects would be negligible. As discussed for birds, the discharge of treated completion, packer and workover fluids would also have negligible effects on marine mammals, as would BOP fluid, hydrostatic testing fluid, and cooling water, as well as cement. Treated oily-water discharge from other drilling fluids, deck drainage and bilge water could potentially affect marine mammals. However, the marine mammals of Newfoundland rely on blubber rather than fur for insulation, and are therefore less likely to be affected by exposure to oily water. Releases of treated oily water will have negligible effects on marine mammals. Organic matter from sanitary and domestic waste will be quickly dispersed and degraded by bacteria, and the effects on marine mammals swimming in the receiving waters will therefore also be negligible.

4.3.2.2 Normal Production and Maintenance Operations

The potential effects of structures (stationary platforms) on marine mammals are primarily related to the effects of noise. Potential effects due to the physical presence of the structures, the increased availability of food due to artificial reef effects, bottom disturbance and noise due to the periodic maintenance of subsea structures, and injection and produced water are predicted to be negligible. As discussed above, releases of treated oily-water discharge (e.g., deck drainage and bilge water) and organic matter from sanitary and domestic waste will have negligible effects on marine mammals during the production phase. All discharges from vessels will be treated as described above, and will therefore have a negligible overall effect on marine mammals. Lights and flares will not interact with marine mammals.

The principal underwater noise sources during production will be similar to those during project development, particularly for ships (supply vessels, tankers, and other marine traffic) and aircraft. Noise levels for the FPSO are similar to a semi-submersible drill rig. At White Rose, the FPSO will be in the same area throughout the production phase. The effects on marine mammals will be minimized because it is a stationary source and because habitation is likely. Overall, the effects of noise will be of low magnitude, and will last for the entire duration of the operations phase.

4.3.2.3 Decommissioning

The White Rose site will be abandoned and restored at the end of production to minimize permanent effects on the environment. Although decommissioning activities may create some short term disturbance and negligible effects within relatively short time periods, overall a positive effect on marine mammals will probably occur as a result of stopping project activity.

4.3.2.4 Sea Turtles

The major threats to sea turtle survival include disturbance and destruction of sensitive reproductive habitat on subtropical and tropical sandy beaches, ingestion of floating plastic debris, and commercial fisheries. On the Grand Banks, sea turtles are caught incidental to the pelagic longline fishery directed at tunas, swordfish and sharks (NOAA 2000). In most situations, the effects of the development, production and decommissioning phases of the project on sea turtles are assumed to be the same as those predicted for marine mammals. The project will have a not significant adverse effect on sea turtles during development, operations and decommissioning.

4.3.2.5 Accidental Events

Whales are not considered at high risk to the effects of oil exposure. However, whales present in the area could suffer sublethal effects through oiling of mucous membranes or the eyes if they swim through a slick (Geraci 1990). These effects are reversible and would not cause permanent damage to the animals. There is a possibility that the baleen of whales could be contaminated with oil, thereby reducing filtration efficiency (Geraci 1990). However, effects would also be minimal and reversible. Also, there is little chance that oil will reach the southeast shoal of the Grand Banks, where baleen whales like humpbacks are known to concentrate to feed on capelin (Comprehensive Study (Part One) Section 5.8). Whales are present on the offshore portions of the Grand Banks in low numbers at certain times of the year. Therefore, only small proportions of populations are at risk at any time.

Likewise, seals are not considered to be at high risk to the effects of oil exposure, but some evidence implicates oil spills with seal, particularly young seal, mortality (St. Aubin 1990). The majority of seals present in the area are associated with the edge of the pack ice. In average years, the ice edge extends no closer than several hundred kilometres north of the White Rose area and then only for several months of the year. The oil spill trajectory models indicate that after the oil moves away from a release point, it will likely be found east and southeast of White Rose (Comprehensive Study (Part One) Section 5.8). Therefore, it is highly unlikely that oil accidentally released at the White Rose site will reach the ice edge during years with average ice conditions. Few seals are therefore expected to be exposed to oil from an accidental release at the White Rose site and most seals do not exhibit large behavioural or physiological reactions to limited surface oiling, incidental exposure to contaminated food or ingestion of oil (St. Aubin 1990; Williams et al. 1994).

Because sea turtles breathe at the surface and are visual predators that feed near the surface, they may be vulnerable to a surface oil slick. In general, there is a very low likelihood that sea turtles will be exposed to oil from an accidental release at White Rose, however, because they are rarely present.

Depending on the time of year, the location of marine mammals and turtles within the study area, and type of oil spill or blowout, the effects of an offshore oil release could range from negligible to low magnitude.

A more detailed assessment of the potential environmental effects of the project on this VEC is provided in the Comprehensive Study (Part One, Chapters 4 and 5). The potential effects of the various project phases and activities/components on marine mammals are summarized in Table 4.4.

Table 4.4 Effects Assessment Summary – Marine Mammals

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects					
			Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Ecological/Socio-Cultural and Economic Context
DEVELOPMENT								
Presence of Structures								
No Fishing Zone	No Interaction	NA						
Subsea Structures	Disturbance (A)		0	1	6	3	R	1
Lights	No Interaction	NA						
Flares	No Interaction	NA						
Underwater Construction	Disturbance (A)		0-1	1-2	2	2	R	1
Drilling Mud/Cuttings								
Water-Based Mud	Effects on Health (A)	Recycle Muds; Treat and Discharge Cuttings	0	1	2	3	R	1
Synthetic-Based Mud	Effects on Health (A)	Recycle Muds; Treat and Discharge Cuttings	0	1	2	3	R	1
Other Fluids and Solids								
Completion, Packer and Workover	Effects on Health (A)	Recycle	0	1	2	3	R	1
Cement	Increased Food (P)		0					
BOP Fluid	Effects on Health (A)	Recycle	0	1	2	3	R	1
Hydrostatic Testing Fluid	Effects on Health (A)	Treatment	0	1	1	3	R	1
Cooling Water	Effects on Health (A)	Treatment	0	1	6	3	R	1
Deck Drainage	Effects on Health (A)	Treatment	0	1	2	3	R	1
Bilge Water	Effects on Health (A)	Treatment	0	1	2	3	R	1
Sanitary and Domestic Wastes	Effects on Health (A)	Primary Treatment	0	1-2	6	3	R	1
Garbage	No Interaction	Transport to Shore						
Atmospheric Emissions	No Interaction	NA						
Ships and Boats [a]	Disturbance (A)	Avoid Concentrations of Marine Mammals; Maintain Steady Course & Speed when Possible	1	3-4	6	3	R	1
Helicopters [a]	Disturbance (A)	Fly at Minimum Altitude of 600 m whenever Possible	1	1-3	4	3	R	1

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects					
			Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Ecological/Socio-Cultural and Economic Context
Noise								
Drilling Rigs	Disturbance (A)		0-1	1-2	6	3	R	1
Support Vessels	Disturbance (A)	Avoid Concentrations of Marine Mammals; Maintain Steady Course & Speed when Possible	1	3-4	6	3	R	1
Helicopters	Disturbance (A)	Fly at Minimum Altitude of 600 m whenever Possible	1	1-2	6	3	R	1
Shore Facilities [b]								
PRODUCTION								
Presence of Structures								
No Fishing Zone	No Interaction	NA						
Artificial Reef Effect	Increased Food (P)		1	1	6	5	R	1
Subsea Structures	Disturbance (A)		0	1	6	5	R	1
Surface Structures	Disturbance (A)		0	1	6	5	R	1
Lights	No Interaction	NA						
Flares	No Interaction	NA						
Underwater Maintenance	Disturbance (A)		0	1	1	1	R	1
Injection Water	Effects on Health (A)	Treatment	0	1	6	5	R	1
Produced Water	Effects on Health (A)	Treatment	0	1	6	5	R	1
Storage Displacement Water	No Interaction	NA						
Cooling Water	Effects on Health (A)	Treatment	0	1	6	5	R	1
Deck Drainage	Effects on Health (A)	Treatment	0	1	6	5	R	1
Bilge Water	Effects on Health (A)	Treatment	0	1	6	5	R	1
Sanitary and Domestic Wastewater	Effects on Health (A)	Primary Treatment	0	1-2	6	5	R	1
Garbage	No Interaction	NA						
Atmospheric Emissions	No Interaction	NA						
Ships and Boats [a]	Disturbance (A)	Avoid Concentrations of Marine Mammals; Maintain Steady Course & Speed when Possible	1	3-4	6	5	R	1
Helicopters [a]	Disturbance (A)	Fly at Minimum Altitude of 600 m whenever Possible	1	1-3	4	5	R	1
Noise								
FPSO	Disturbance (A)	NA	1	1-2	6	5	R	1

Project Activity	Potential Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects					
			Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Ecological/Socio-Cultural and Economic Context
Support Vessels	Disturbance (A)	Avoid Concentrations of Marine Mammals; Maintain Steady Course & Speed when Possible	1	3-4	6	5	R	1
Helicopters	Disturbance (A)	Fly at Minimum Altitude of 600 m whenever Possible	1	1-3	4	5	R	1
Shore Facilities [b]								
DECOMMISSIONING								
Offshore	Stop Disturbance (P); Reduce Mortality and Health Risks (P)		1	1	3	3	R	2
Onshore [b]								
ACCIDENTAL EVENTS								
Offshore Oil Spill or Blowout	Effects on Health (A)	Contingency Plan; Training; Preparedness; Prevention; Cleanup Inventory	0-1	5-6	<1	2	R	1

KEY

Magnitude:
0 = Negligible, essentially no effect
1 = Low
2 = Medium
3 = High

Frequency:
1 = < 11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = > 200 events/year
6 = Continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity
2 = Evidence of existing adverse effects

Geographic Extent:
1 = < 1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = > 10,000 km²

Duration:
1 = < 1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = > 72 months

NA = Not Applicable
[a]Effects of noise considered here.
[b]There will not be any new onshore facilities required. Existing infrastructure will be used.

The residual environmental effects of project activities on this VEC during the development and operations phases, and in the unlikely event an offshore oil spill or blowout, will be adverse, but not significant, while the decommissioning phase will have a positive residual effect.

4.3.2.6 Cumulative Effects

The cumulative effects of the various activities within each of the development, production and decommissioning phases of White Rose, and in relation to the project as a whole, on marine mammals and sea turtles are predicted to be not significant. The cumulative effects of the project in combination with other oil development and exploration activity on the Grand Banks are also expected to be not significant.

As discussed previously, potential effects on marine mammals are mainly related to the effects of noise produced by offshore structures and activities. Given the amount of marine transportation and fishing activity that presently occurs on the Grand Banks, it is safe to conclude that the underwater environment is already noisy. The noise made by the oil and gas industry (FPSOs, supply boats, drilling rigs, and seismic exploration) will add to the underwater ambient noise levels on the Grand Banks. However, the incremental noise created as a result of the White Rose project will have little effect on overall noise levels. The cumulative increased levels of low frequency ambient noise associated with oil and gas exploration and development on the Grand Banks will not be appreciable, and in many cases will be masked by natural events. In the absence of masking, it is possible that animals will be disturbed by the anthropogenic noise sources from industry. However, there is no evidence of disturbance effects from distant ambient noise (Richardson et al. 1995). Based on studies in other areas, marine mammals would have to be close (within a few kilometres) to the actual sources of noise from oil and gas activities to be affected by them. Thus, the disturbance effects on marine mammals would be additive from a few isolated sources of noise, and will be not significant on a project basis or cumulatively.

4.4 MITIGATION MEASURES AND CONTINGENCY PLANNING

4.4.1 Mitigation Measures

Mitigation measures planned for the development, operation and decommissioning phases of the White Rose development to minimize the environmental effects of the project are summarized below:

- use of WBMs where practical;
- recycling SBMs and other drilling-related fluids/solids;
- treating cuttings;
- treating drilling-related fluids, deck drainage, bilge water, sanitary and domestic wastes, cooling water and produced water;
- transporting solid waste to shore;

- developing a waste management plan to provide guidance for addressing all offshore wastes;
- designing equipment to reduce atmospheric emissions; and
- preparing a contingency plan to mitigate and remediate effects of offshore oil spills.

VEC-specific mitigative measures are summarized in the following sections.

4.4.1.1 Fish and Fish Habitat

Additional mitigation measures for fish and fish habitat include:

- no blasting activity during underwater construction activities;
- selecting materials/methods to reduce effects during underwater maintenance; and
- removing subsea equipment at abandonment to minimize residual effects.

4.4.1.2 Marine Birds

Additional mitigation measures for marine birds include:

- releasing stranded birds that are attracted to surface structures and lights;
- establishing a 2 km avoidance zone around bird colonies for ships and boats; and
- requiring helicopters to avoid colonies and repeated overflights of bird concentrations and/or important bird habitat.

4.4.1.3 Marine Mammals and Sea Turtles

Additional mitigation measures for marine mammals and sea turtles include:

- requiring ships and boats to avoid concentrations of marine mammals;
- requiring ships and boats to maintain a steady course and speed, when possible; and
- requiring helicopters to fly at a minimum altitude of 600 m whenever possible.

4.4.2 Contingency Planning

Prior to commencement of production, the proponents will develop contingency plans that will serve as guides for responding to any emergency encountered during the White Rose production. The plans will outline the necessary personnel, equipment and logistics support along with procedures to implement initial actions to respond to an emergency incident in a safe, prompt and coordinated manner.

The preventive and contingency plans which will be developed are:

- Health, Safety and Environment Loss Control Management System;
- Offshore Emergency Response Procedures;
- Alert and Emergency Response Plan;
- Collision Avoidance Plan;
- Ice Management Plan;
- Oil Spill Response Plan;
- Ship's Oil Pollution Emergency Plans;
- Family Support Plan;
- Emergency Communications Plan;
- Action Plans and Standard Operating Procedures; and
- Corporate Emergency Notification Procedures.

The emergency response management structure will be based on the organization of action-oriented teams structured for rapid and efficient response to emergencies (see Part One of the Comprehensive Study, Chapter 6). Plans will be dynamic documents and will be updated as needed to reflect changes in project operations. All regular East Coast production personnel, including contractors, will receive directed emergency training and a regular program of exercises will be instituted to ensure the readiness of all personnel.

4.5 RESIDUAL ENVIRONMENTAL EFFECTS SUMMARY

The predicted residual environmental effects of project development, production and possible accidental events on fish and fish habitat are assessed as adverse, but not significant. The residual environmental effects of project decommissioning on fish and fish habitat are predicted to be positive. The overall residual effect of the project on fish and fish habitat is assessed as not significant (Table 4.5).

The residual environmental effects of project development and production on marine birds are assessed to be adverse, but not significant, while effects during decommissioning will be positive. The environmental effect of an accidental event such as a significant oil spill on marine birds, although unlikely, is assessed to be adverse and significant. The overall residual effect of the project on marine birds is assessed as not significant (Table 4.5).

The residual effects of project development and production and in the case of an accidental event on marine mammals and sea turtles are assessed to be adverse, but not significant. Predicted effects to this VEC as a result of project decommissioning are predicted to be positive. The overall residual effect of the project on marine mammals and sea turtles is assessed to be not significant (Table 4.5).

In summary, after mitigation measures have been implemented, the overall predicted environmental effects of the project on each of these VECs are assessed as not significant. The only exceptions are the potential effects of a major offshore oil spill on marine birds. However, the probability of such an event is, as discussed previously, very low. Preventive measures and contingency actions outlined by the proponents will further reduce the likelihood of, and minimize the effects of, any oil spill.

Table 4.5 Residual Effects Summary - Biophysical

Phase	Residual Environmental Effects Rating, including Cumulative Effects	Level of Confidence	Likelihood	
			Probability of Occurrence	Scientific Certainty
Fish and Fish Habitat				
Development	NS	3	3	3
Production	NS	3	3	3
Decommissioning	P	3	3	3
Accidental Events	NS	3	1	3
Project Overall	NS	3	3	3
Marine Birds				
Development	NS	3	3	3
Production	NS	3	3	3
Decommissioning	P	3	3	3
Accidental Events	S	3	1	3
Project Overall	NS	3	3	3
Marine Mammals and Sea Turtles				
Development	NS	3	3	3
Production	NS	3	3	3
Decommissioning	P	3	3	3
Accidental Events	NS	2	1	2
Project Overall	NS	3	3	3

Key:

Residual Environmental Effects Rating:

S = Significant Adverse Environmental Effect
NS = Not-significant Adverse Environmental Effect
P = Positive Environmental Effect

Level of Confidence:

1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

Probability of Occurrence:

1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence

Scientific Certainty:
(based on scientific information, statistical analysis or professional judgement)
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

4.6 FOLLOW-UP

EEM programs are designed to verify effects predictions made during the environmental assessment, assess the effectiveness of the implemented mitigation measures, provide an early warning of changes in the environment, facilitate project planning and continuous improvement, and, ultimately, to improve the understanding of environmental cause and effect relationships. An EEM program is an integral part of the follow-up program required by CEAA.

The proponents plan to undertake a comprehensive EEM program for the White Rose oilfield development (see Part One of the Comprehensive Study, Chapter 7). The development of an appropriate EEM program will include review by relevant government departments through the C-NOPB's approval process. Husky Oil is supportive of, and will cooperate in, any appropriate regional monitoring initiatives.

Proposed components of the EEM program include:

- sediment quality (toxicity, chemistry and benthic community analysis);
- water quality and primary productivity;
- fish body burden (American plaice and snow crab);
- fish taint (American plaice and snow crab); and
- fish health histopathology and multi-function oxidase (MFO) (American plaice).

A supply vessel based seabird monitoring program was conducted in conjunction with the drilling platform in 1999, and is continuing in 2000. This program will continue to be reviewed throughout the development phase of the project. In addition, any incidental bird mortalities associated with the project will be recorded.

A dedicated EEM will also be implemented to determine the effects of any major spills, focusing primarily on marine birds, but also including fish and marine mammals. The structure of the monitoring program will follow the structure of the EEM program established for routine production activities at White Rose. The decision to implement such a program will be made after consultation between the proponents and the C-NOPB, and will be based on the circumstances of the spill. In addition, as per DFO's Policy for the Management of Fish Habitat, any habitat compensation measures will be monitored and addressed.

Compliance monitoring will be conducted to verify adherence with applicable legislation and conditions of regulatory approvals. Compliance monitoring will primarily involve monitoring for conformance with the discharge limits identified in the Offshore Waste Treatment Guidelines. Monitoring programs will be developed to measure and report on waste discharges that are treated according to the guidelines.

Additional information on proposed monitoring initiatives is included in the Comprehensive Study.

5 SOCIO-ECONOMIC EFFECTS ASSESSMENT

The following sections provide an overview of the existing socio-economic conditions in the various study areas, as well the potential effects of the White Rose project on each of the socio-economic VECs under consideration, including mitigation measures, cumulative effects, residual effects, and follow-up. An extensive overview of the existing socio-economic environment, and a detailed effects analysis, is provided in Part Two of the Comprehensive Study. As noted in Section 1.3 of this report, a number of the socio-economic VECs (i.e., business and employment, community social infrastructure and services and community physical infrastructure) will be addressed primarily through the Development Application review process pursuant to the *Atlantic Accord Acts.* As part of this process, the Commissioner appointed by the C-NOPB will be empowered to receive comments from the public concerning any matters associated with the Development Application, including these socio-economic issues.

5.1 BUSINESS AND EMPLOYMENT

5.1.1 Existing Conditions

The 1990s were something of a “roller coaster” for the provincial economy. Positive developments in the offshore oil industry (Hibernia) were offset by the declaration of moratoria on fishing for northern cod and other groundfish species. A major consequence of the fishery closure has been a declining population, particularly in rural Newfoundland and Labrador (Statistics Canada 2000). In 1999, however, Newfoundland posted the strongest economic growth of any province for the second year running. Economic gains included increases in offshore oil activity, crab and shrimp landings, construction activity, tourism and manufacturing (Department of Finance 2000a). The oil industry was the leading contributor to this growth in the provincial economy.

The St. John’s area has shared the economic success enjoyed by the province, and is currently enjoying a boom in economic growth and activity. Recent years have seen increasing employment in the region, due, in part, to the important contribution the offshore oil industry is making to the St. John’s area’s economy. St. John’s has been the primary location for administrative, engineering, regulatory, training, supply base, air transportation and service activities for the east coast oil industry. Economic conditions in the Isthmus of Avalon area have fluctuated over the years, reflecting changes in the provincial economy, fishery and major industrial projects within and close by the region. The Isthmus area has been involved with the offshore oil industry over the past decade (through, for example, the Bull Arm construction and fabrication facility and the Newfoundland Transshipment Terminal). The economy of the Marystown area has also fluctuated over the years, depending on fishing, fish processing and the shipyard. The Marystown shipyard is the largest shipbuilding and repair facility in the province, and has resulted in Marystown being involved in the Newfoundland oil industry since its early years.

Further information on business and employment activity in these regions is provided in the Comprehensive Study (Part Two, Chapter 3 and Section 4.2).

5.1.2 Effects Assessment

White Rose will have a range of economic effects throughout the construction/installation and operations phases in particular, but also in terms of its cumulative effects in conjunction with other offshore and industrial projects. These potential benefits include direct, indirect and induced employment activity. The positive effects anticipated reflect, in part, the proponents' commitment to Canada-Newfoundland benefits, which will ensure that a broad range of business, employment and industrial benefits result from the project during both the development and operations phases. A full discussion of project approach and the benefits associated with the project is included in the Development Plan and Canada-Newfoundland Benefits Plan was provided to C-NOPB as part of the Development Application process (Husky Oil 2001b).

The potential for Canadian and Newfoundland involvement in project construction and operations activity could potentially be constrained by industrial and labour capability and capacity, and will be directly reflective of the competitiveness of the local environment. The business and employment effects of the project will depend not only on the existing business capabilities and labour force and how they might be increased or enhanced, but also on other cumulative demands on them. However, given the current project schedule, it is anticipated that there will be only limited conflicts between industrial and labour requirements of White Rose and those of other major projects.

There will be similar demands on infrastructure and labour required for operations. However, this is not viewed as problematic, given that such demand provides long-term opportunities, justifying investments in infrastructure and training. There is a high level of awareness, within the federal and provincial government, industry and training institutions of the need to plan and prepare for future labour requirements.

In addition to these potential direct effects, there will also be important secondary or multiplier effects that can be wide-ranging and long-term. The oil industry as a whole is having a transformative effect on companies and workers as they develop new skills and capabilities that make them highly competitive in Newfoundland's oil industry and elsewhere. Similarly, oil industry-related industrial infrastructure, research and education are increasing the likelihood of and potential for Newfoundland benefits from further offshore petroleum projects. Overall, the project will further contribute to this growing industry and, hence, to the further development and diversification of the Newfoundland economy.

During the development phase of the project, the St. John's area will see administrative, engineering, training, regulatory, and supply and service activity. In addition, during the operational life of the field, the St. John's area will be the administrative, engineering, training, regulatory and supply and service centre for the project. This activity, and associated indirect and induced business and employment effects, will have an important beneficial effect on the St. John's area economy.

The Bull Arm site in Trinity Bay was originally developed as the construction and fabrication facility for the Hibernia project, and has been used for the Terra Nova Development. Depending on final decisions resulting from the competitive bid process, the site could also be used for similar White Rose FPSO activity. The main local business and employment effects of any project activity at Bull Arm would fall within the daily commuting range of the site. The White Rose schedule would see development activity following after construction, fabrication and hook-up/commissioning activity associated with the Terra Nova project. This is potentially advantageous to the proponents if current schedules are maintained since it means that equipment and skills could potentially be available at Bull Arm. This will also be beneficial to the Isthmus area, in that it could result in some continuity in direct and spin-off employment and business activity related to the Bull Arm facility. There may also be local business and employment benefits as a result of project operations. It appears unlikely that there would be any significant adverse cumulative effects at Bull Arm resulting from concurrent construction/fabrication of White Rose and other project components.

The Marystown area could also be positively affected by this project through involvement in project-related work, if success is achieved through the competitive bidding process. Any such work will both provide direct and spin-off benefits to the local economy and reinforce the shipyard's position as an important oil industry facility. Any cumulative effects will depend on other work that may be ongoing at the same time, although from the perspective of the yard's owner and operator, any likely cumulative effects would be beneficial rather than adverse.

The predicted effects (including project-specific and cumulative effects) of the project on business and employment are summarized in Table 5.1. For each project phase, the potential effects on business and employment are seen as positive, and no adverse effects are anticipated or mitigative measures suggested.

Table 5.1 Effects Assessment Summary - Business and Employment

Project Activity	Positive (P) or Adverse (A) Environmental Effect	Mitigation	Environmental Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Socio-Economic Context
Construction							
Fabrication of offshore components	Increased business and employment (P)	Implementation of C-N Benefits Plan	1	2-3	1/1	R	2
Installation of offshore components	Increased business and employment (P)	Implementation of C-N Benefits Plan	1	2-3	1/1	R	2
Operations							
Offshore production/ support/ service	Increased business and employment (P)	Implementation of C-N Benefits Plan	1	2	3/ 3	R	2
Decommissioning							
Offshore decommissioning/ support	NA	NA	NA	NA	NA	NA	NA
Malfunctions/Accidents							
Emergency response/support	Increased business and employment (P)	Implementation of C-N Benefits Plan	1	2-3	3/2	R	2
Past/Present/Future Projects							
Construction	Increased business and employment (P)	Implementation of C-N Benefits Plan	1	2-3	1/ 2	R	2
Operations	Increased business and employment (P)	Implementation of C-N Benefits Plan	1	2-3	3/ 2	R	2

KEY

Magnitude
1 = Low: within current capacity, standard or threshold
2 = Medium: approaches current capacity, standard or threshold
3 = High: exceeds current capacity, standard or threshold

Geographic Extent:
1 = Individual Community
2 = Regional Study Area
3 = Province

Duration:
1 = Construction only
2 = Operations only
3 = Life of Project
4 = Decommissioning only

Frequency:
1 = single occurrence
2 = occasional occurrence
3 = continuous

Reversibility:
R = Reversible
I = Irreversible

Socio-economic Context:
1 = Area has no previous experience with offshore development
2 = Area has previous experience with offshore development

NA = Not Applicable

The project is expected to add further business and employment benefits to all regions and the province as a whole. No significant adverse residual effects are anticipated. Monitoring and reporting of Canada-Newfoundland benefits commitments will be undertaken as required by the C-NOPB.

5.2 COMMUNITY SOCIAL INFRASTRUCTURE AND SERVICES

Local residents value community infrastructure and services insofar as the quantity and quality of those services in a community contribute to the overall standard and quality of life. These include education, health, security (policing and fire protection) and recreation infrastructure and services.

5.2.1 Existing Conditions

Education

In recent years, the province has seen a decline in the number of schools, students, teachers and the student-teacher ratio. During the 1999-2000 school year there were 343 schools in Newfoundland and Labrador, with 93,957 full-time students. The student-teacher ratio as of 1998-1999 was 1:15 (Newfoundland and Labrador 1999). Post-secondary education in the province is provided through Memorial University of Newfoundland, the College of the North Atlantic and 54 registered private training institutions.

Primary and secondary education in the St. John’s area is administered by the Avalon East School Board. In 1998-1999 there were 74 schools in the St. John’s study area (Newfoundland and Labrador 1999). The number of schools in the area has decreased in recent years, due to changing demographics and consolidation. In 1998-99 there were 31,745 primary and elementary students in the area (Newfoundland and Labrador 1999), with recent years seeing steadily decreasing enrollments in area schools. Statistics on school capacity are not available, although in general, supply continues to exceed demand. The Isthmus of Avalon and Marystown areas have also seen a decrease in primary and secondary schools and in student enrollment. There were 12 primary and secondary schools in the Isthmus of Avalon area, with 2,719 students in 1998-99. During the same year, there were six primary and secondary schools in the Marystown area, with a total student enrolment of 2,423 (Newfoundland and Labrador 1999). The College of the North Atlantic has a campus in Burin.

Health and Community Services and Infrastructure

Health and community services in Newfoundland and Labrador are administered by the provincial Department of Health and Community Services. There are currently 36 hospitals and 19 nursing homes in the province (Department of Health and Community Services 2000). The level of service, as defined by the number of nurses and doctors per capita, is comparable to other Canadian provinces. In 1998, the overall physician-to-population ratio was 1.7 physicians per 1,000 persons and the registered nurse-to-population ratio was 9.8 per 1,000 persons (Department of Finance 2000b). The St. John’s area has a number of acute and long-term health care facilities and one health care centre. The Dr. G.B. Cross Memorial Hospital in Clarenville serves the Isthmus area. The Marystown area has one acute-care facility, the Burin Peninsula Health Care Centre.

Social Assistance and Employment Services

The Department of Human Resources and Employment is the provincial agency responsible for income support through social assistance and employment-related services. In the St. John's area, there is a St. John's Region office, three district offices within the City and others on Bell Island and in Conception Bay South. The District Office for the Isthmus of Avalon area is located in Clarenville, while the office for the Marystown area is located in Marystown. The demand for social assistance in the St. John's, Marystown and Isthmus of Avalon areas has fluctuated over the past decade (Department of Health and Community Services 2000b).

Security and Safety: Policing and Fire Protection

Policing in the St. John's area is provided by the Royal Newfoundland Constabulary (RNC), while the Isthmus of Avalon and the Marystown areas fall under the jurisdiction of the Royal Canadian Mounted Police (RCMP). In the St. John's area, fire protection services are provided by the St. John's Regional Fire Department and volunteer fire departments in various communities. The Isthmus is served by fire departments in five local communities, while fire protection in the Marystown area is provided by volunteer departments in five local communities and a composite fire department in Marystown.

Recreation Services and Facilities

The St. John's area contains numerous recreation and leisure facilities capable of accommodating a wide range of activities. Some of the existing facilities are used to full capacity, and there is a demand for some new types of facilities. The Isthmus of Avalon area also has a range of recreational facilities, many of which are found in the Clarenville-Shoal Harbour area. Likewise, there are a number of recreational facilities in the Marystown area, with Marystown and Burin having the widest range of facilities and serving a number of the smaller communities. The facilities and programs appear to satisfy the needs of local residents.

5.2.2 Effects Assessment

Education

Direct project effects on education at the provincial level will be limited to post-secondary training. There is already a substantial supply of trained and experienced labour; however, ongoing training of new entrants to the industry and upgrading of those already in it will continue. It is expected that local institutions will be able to provide much of the required training. At this time, no problems are anticipated to arise from the project itself, or from cumulative activity, to which provincial post-secondary institutions could not respond.

The Hibernia and Terra Nova projects have not resulted in significant effects on schools in the St. John's area. When all three projects are in operation, there will be a large workforce located in the St. John's area, but any increased cumulative demand on the education system is unlikely to be problematic as the changing demographics of the area continue to lead to a reduced or, at best, stable (in most cases, at lower levels than the past), demands for services. In addition, White Rose is not expected to generate any substantial demands on education in the Isthmus of Avalon or Marystown areas that the existing systems cannot accommodate.

The predicted effects (including project-specific and cumulative effects) of the project on education are summarized in Table 5.2. Through a Canada-Newfoundland Benefits Plan, the proponents will actively promote the employment and training of Newfoundland residents. Insofar as such training will affect the post-secondary components of the provincial system, the outcomes should be beneficial or positive for those trained and for those individuals and institutions providing the training. No significant adverse effects on the primary and secondary elements of the education system are expected either from the White Rose project itself or cumulatively with other offshore projects or other activity. No formal monitoring or follow-up is anticipated, beyond the normal processes that post-secondary institutions follow in tracking and anticipating demand for existing and potential courses and programs.

Health and Community Services and Infrastructure

The White Rose oilfield development will result in some in-migration of onshore and offshore personnel and their families, which will have a small incremental effect on the overall demand for medical services over the life of the project. There is no evidence that the Hibernia or Terra Nova projects resulted in substantial new demands for health care services. Incoming workers and their families generally tend to be relatively young and healthy, and therefore place relatively low demands on medical services. These workers are very likely net contributors to the system in terms of taxes paid relative to services used. Any increased demands for medical services are therefore expected to be minimal given the typical age of the workforce and the fact that operators have medical programs in place (Table 5.2). The residual effects of the project on medical services and infrastructure are predicted to be adverse, but not significant. There will be some cumulative effects during the operations phase in particular, but demands from the off-shore related workforce overall are expected to be small and within the capabilities of the current system. Monitoring demand at the institutional level is a provincial responsibility. The proponents will monitor workforce health issues on a periodic basis.

Social Assistance and Employment Services

Potential effects to these types of community services are expected to be of both a direct and indirect nature, primarily experienced in the operations phase and as a result of cumulative effects, and particularly in the St. John's area. The effects may be both positive and negative. The project will generate employment, thereby reducing the need for financial support. However, there may also be negative effects as the benefits of economic growth will not be shared by all and any associated inflationary effects will particularly affect those with low incomes. This would potentially increase demands for income support services. Overall, however, the effects of the project on social assistance and employment services is expected to be small, but primarily positive (Table 5.2). No adverse significant residual effects are anticipated, and no formal project monitoring is recommended. The provincial department responsible for social assistance and employment support programs have in place mechanisms to assess and address program needs.

Policing and Fire Protection

As with any other industrial or business activity, there is a potential for project-related activities to require policing or fire protection services. There has been no suggestion or evidence that Hibernia or Terra Nova have affected the nature or level of crime, or the demands for policing services or fire protection, in the St. John's, Isthmus of Avalon or Marystown areas. White Rose, even when the cumulative effects of multiple project operations are considered, is not expected to change this should any project related activity occur there (Table 5.2). The residual effects of the project on this VEC are predicted to be not significant. Data on events and needs are collected on a regular basis by the relevant policing and fire-protection authorities as part of their normal mandate and planning activities. No additional monitoring or follow-up is anticipated or proposed.

Recreation Services and Facilities

Effects on recreation systems may be both adverse and positive. While additional demand may reduce access and enjoyment, newcomers may make activities more viable. The potential effects of the project on recreation services and facilities are summarized in Table 5.2. The project will result in some in-migration and increased demand for access to recreation facilities and programs, primarily during the operations phase. These effects will mainly be experienced in the St. John's area. However, the magnitude of these effects will be low and existing facilities and programs are expected to be able to cope with any increases. Even with the cumulative effects of population growth associated with direct and indirect employment for the three major oil developments, the effects on recreation are not expected to be significant. No formal project monitoring is recommended. The authorities responsible for recreation facilities and programs have in place mechanisms to assess and project demand, and can be expected to respond accordingly.

Table 5.2 Effects Assessment Summary - Community Social Infrastructure and Services

Project Activity	Positive (P) or Adverse (A) Environmental Effect	Mitigation	Environmental Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Socio-Economic Context
EDUCATION							
Construction							
Fabrication of offshore components	Training of provincial workforce (P)	Post-secondary institutions plan to meet industry needs	1	2-3	1/1	R	2
Installation of offshore components	Training of provincial workforce (P)	Post-secondary institutions plan to meet industry needs	1	2-3	1/1	R	2
Operations							
Offshore production/support/ service	Training of provincial workforce (P)	Post-secondary institutions plan to meet industry needs	1	2-3	3/3	R	2
Decommissioning							
Offshore decommissioning/ support	NA	NA	NA	NA	NA	NA	NA
Malfunctions/Accidents/Unplanned Events							
Emergency response/support	Training of provincial workforce (P)	Post-secondary institutions plan to meet industry needs	1	2-3	3/3	R	2
Past/Present/Future Projects							
Construction	NA	NA	NA	NA	NA	NA	NA
Operations	Training of provincial workforce (P)	Post-secondary institutions plan to meet industry needs	1	2-3	3/2	R	2
MEDICAL SERVICES AND INFRASTRUCTURE							
Construction							
Fabrication of offshore components	Increased demand for medical services (A)	Institutions respond as appropriate/ feasible	1	2	1/ 3	R	2
Installation of offshore components	Increased demand for medical services (A)	Institutions respond as appropriate/ feasible	1	2	1/ 3	R	2
Operations							
Offshore production/ support/ service	Increased demand for medical services (A)	Institutions respond as appropriate/ feasible Proponent monitors and responds to work and family life issues	1 1	2 3	3/ 3 3/ 3	R R	2 2
Decommissioning							
Offshore decommission/ support	NA	NA	NA	NA	NA	NA	NA

Project Activity	Positive (P) or Adverse (A) Environmental Effect	Mitigation	Environmental Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Socio-Economic Context
Malfunctions/Accidents/Unplanned Events							
Emergency response/ support	Increased demand for medical services (A)	Institutions respond as appropriate/ feasible Proponent medical and EAP programs	1	2	3/ 3	R	2
Past/Present/Future Projects							
Construction	NA	NA	NA	NA	NA	NA	NA
Operations	Increased demand for medical services (A)	Institutions respond as appropriate/ feasible	1	2	3/ 3	R	2
SOCIAL ASSISTANCE AND EMPLOYMENT SERVICES							
Construction							
Fabrication of offshore components	Decreased demands for services (P)	Monitoring/ action by responsible authorities	1	2	1/3	R	2
Installation of offshore components			NA	NA	NA	NA	NA
Operations							
Offshore production/ support/service	Increased demands for services (A) Decreased demands for services (P)	Monitoring/ action by responsible authorities	1	2	3/ 3	R	2
Decommissioning							
Offshore decommissioning/ support	NA	NA	NA	NA	NA	NA	NA
Malfunctions/Accidents/Unplanned Events							
Emergency response/support			NA	NA	NA	NA	NA
Past/Present/Future Projects							
Construction	NA	NA	NA	NA	NA	NA	NA
Operations	Increased demands for services (A) Decreased Demands for services (P)	Monitoring/ action by responsible authorities	1	2	3/ 3	R	2
POLICING AND FIRE PROTECTION							
Construction							
Fabrication of offshore components	Increased demands for services (A)	Monitoring/ action by responsible authorities	1	2	1/ 3	R	2
Installation of offshore components	Increased demands for services (A)	Monitoring/ action by responsible authorities	1	2	1/ 3	R	2
Operations							
Offshore production/support/ service	Increased demands for services (A)	Monitoring/ action by responsible authorities	1	2	3/ 3	R	2

Project Activity	Positive (P) or Adverse (A) Environmental Effect	Mitigation	Environmental Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Socio-Economic Context
Decommissioning							
Offshore decommissioning/ support	NA	NA	NA	NA	NA	NA	NA
Malfunctions/Accidents/Unplanned Events							
Emergency response/support	Increased demands for services (A)	Monitoring/ action by responsible authorities	1	2	3/ 3	R	2
Past/Present/Future Projects							
Construction	NA	NA	NA	NA	NA	NA	NA
Operations	Increased demands for services (A)	Monitoring/ action by responsible authorities	1	2	3/ 3	R	2
RECREATION SERVICES AND FACILITIES							
Construction							
Fabrication of offshore components	Increased use of facilities/demand for services (P/A)	Monitoring/ action by service providers	1	2	1/3	R	2
Installation of offshore components	NA	NA	NA	NA	NA	NA	NA
Operations							
Offshore production/ support/service	Increased use of facilities/demand for services (P/A)	Monitoring/ action by service providers	1	2	3/ 3	R	2
Decommissioning							
Offshore decommissioning/ support	NA	NA	NA	NA	NA	NA	NA
Malfunctions/Accidents/Unplanned Events							
Emergency response/support	NA	NA	NA	NA	NA	NA	NA
Past/Present/Future Projects							
Construction							
Operations	Increased use of facilities/demand for services (P/A)	Monitoring/ action by service providers	1	2	3/ 3	R	2

KEY

Magnitude
1 = Low: within current capacity, standard or threshold
2 = Medium: approaches current capacity, standard or threshold
3 = High: exceeds current capacity, standard or threshold

Geographic Extent:
1 = Individual Community
2 = Regional Study Area
3 = Province

Duration:
1 = Construction only
2 = Operations only
3 = Life of Project
4 = Decommissioning only

Frequency:
1 = single occurrence
2 = occasional occurrence
3 = continuous

Reversibility:
R = Reversible
I = Irreversible

Socio-economic Context:
1 = Area has no previous experience with offshore development
2 = Area has previous experience with offshore development

NA = Not Applicable

5.3 COMMUNITY PHYSICAL INFRASTRUCTURE

5.3.1 Existing Conditions

Housing

The number of dwellings in the province has grown considerably over the past 20 years. However, the number of annual housing starts has declined. In 1996, there were 185,500 occupied private dwellings in Newfoundland with most being owner-occupied, single-detached homes. During that same year there were 60,295 occupied private dwellings in the St. John's area, of which 61 percent were located within the City of St. John's itself (Statistics Canada 1996). Much of the growth in the region continues to occur in Conception Bay South and Mount Pearl. Annual housing starts in the area have fluctuated over the last decade, with the general trend being one of decline (CMHC 2000). In recent years, the housing market, as reflected in number and value of sales, has generally improved, and vacancy rates have fluctuated widely. Social housing in the St. John's area is provided by the City of St. John's and the Newfoundland and Labrador Housing Corporation.

The total housing stock in the Isthmus Area increased by 26 percent between 1991 and 1996 (Statistics Canada 1991; 1996), with most growth occurring in the Clarenville-Shoal Harbour area. In 1996, there were 3,895 occupied private dwellings in the Marystown area (Statistics Canada 1996), where the housing market is affected by the seasonal and annual fluctuations in employment by the main employers in the area.

Port and Airport

St. John's Harbour is administered by the St. John's Port Corporation, a federal agency. There is approximately 5 km of available dockface. Currently, the port serves as a container and roll-on/roll-off (RoRo) terminal for vessels carrying freight between Halifax and Montreal. The A.H. Harvey wharf is used by Hibernia and Terra Nova for shore-based marine services. Overall, the port has been considerably underused in recent years with traffic tonnage declining in the early 1990s. Cargo tonnage handled has increased in recent years, with over one million tonnes of cargo being handled in 1999 (St. John's Port Authority 2000).

The St. John's International Airport is the busiest commercial airport in the province. The main terminal serves scheduled national and international passenger air traffic, most charter flights and air cargo traffic. Helicopter, military and private aircraft also use the airport. Over 800,000 commercial passengers used the airport in 1999 (St. John's International Airport 2000). In response to increased passenger demand and anticipated further increases, the St. John's Airport Authority is currently undertaking a $48 million redevelopment program, including runway improvements and terminal building upgrading.

Industrial and Commercial Land, Warehousing and Office Space

The dockyard in St. John's covers approximately 7.5 ha (18.5 acres) at the western end of the Port of St. John's. The dockyard is capable of providing a range of marine and offshore services. Its facilities include a graving dock, marine elevator, transfer and repair berths, mobile cranes, fabrication shops, warehousing and laydown areas (St. John's Dockyard Limited 2000). There are currently eight industrial parks in the St. John's area, with a total area of 464 ha (1,150 acres). Highway access from these industrial lands to other key infrastructure elements such as the Port of St. John's and the St. John's Airport is generally good. St. John's and Mount Pearl are the only communities in the study area with substantial amounts of commercial warehouse space. Office space for administrative and development and operations-phase activities is found mainly in St. John's.

The Bull Arm site represents the most significant industrial lands in the Isthmus area relevant to the offshore industry. While the construction/administration area is closed, the fabrication and assembly yard are currently in operation for the Terra Nova project. There are other industrial and commercial lands in the area with most concentrated in Clarenville and Arnold's Cove. In Marystown, Friede Goldman Newfoundland Limited owns and operates the Marystown Shipyard, which handles boat construction and repair, refitting, conversion and maintenance for fishing fleet and offshore-related vessels, as well as rig component construction and outfitting. The Cow Head facility, completed in the early 1990s, handles a variety of offshore construction contracts.

5.3.2 Effects Assessment

Housing

There is the potential for increased demands for housing during construction activities and during the operations phase. Direct effects during construction activity could occur in any of the study areas, while effects from operations are expected only in the St. John's area. Some cumulative effects may also occur in the St. John's area as a result of multiple field development, growth of the offshore service sector and general economic growth. Any project-specific direct effects on housing in the St. John's area are likely to be small and of short-term duration. Cumulatively, the three offshore projects, a growing offshore supply and service sector, and growth related to other economic activities, will increase the demand for housing. For the most part, however, these effects will be beneficial, especially from the perspective of home-builders and suppliers, home sellers, and municipal tax authorities. However, it could place a burden on those with low or fixed incomes who find higher prices for accommodations problematic.

The White Rose project is also not expected to have any substantive effects on housing in the Isthmus of Avalon area, should it be the site of the project-related activity. The proponents will work with the local community to plan the management of any workforce effects, including decisions regarding the accommodation of workers. In the Marystown area, there is presently a large excess of infrastructure capacity, including housing, and it is therefore not expected that there would be any significant adverse effects on housing should fabrication and construction contracts for White Rose be awarded to the shipyard. Cumulative effects on housing are not anticipated in either of these areas. The potential effects of the White Rose oilfield development on housing are summarized in Table 5.3. Overall, project residual effects are considered to be primarily positive, with any adverse effects being not significant.

Port and Airport

The port would be used if topsides or subsea components are to be fabricated at the St. John's Dockyard. An existing marine supply base will be used to support offshore production. The harbour and airport would also be used as necessary in the event of accidents or other unplanned events. The effects of the project on both the Port of St. John's and St. John's International Airport are expected to be positive (Table 5.3). Their greater use would generate increased revenues for both administrative authorities, but should have no negative effects on other users. No mitigative measures are considered necessary, and the overall predicted residual effects of the project on this VEC are predicted to be positive. The port and airport authorities monitor activities on an ongoing basis and can be expected to respond to any customer needs as they emerge.

Industrial and Commercial Land, Warehousing and Office Space

During the construction/installation phase, depending on where contracts are awarded, there will be a demand for industrial and commercial land, warehousing and office space. During operations there will primarily be a demand for industrial lay-down space, light industry space, and office and warehouse space, particularly in the St. John's area. The potential effects of the project on industrial and commercial lands, warehousing and office space will likely to be positive.

Offshore operators, industry suppliers and contractors have and will continue to use industrial land and warehouse and office space in the St. John's area. These properties contribute to the local economy through their direct and indirect employment and business effects. Terra Nova and White Rose personnel presently occupy office space in downtown St. John's and may require additional industrial and warehouse space when their projects are operational. These will benefit the area and should not exceed the capacity or capability of the area to meet demand. In the Isthmus area, the use of the Bull Arm site by the oil industry has been beneficial to the local and provincial economies. Any use made of it for the White Rose project would continue these benefits. No additional demands are expected to be placed on lands in Clarenville, Arnold's Cove or other Isthmus area communities. Similarly, the Marystown Shipyard and the Cow Head facility are capable of accommodating demands which might be placed upon them by the White Rose project. Additional work on the project would be welcomed and generate positive benefits for the area.

The potential effects of the project on this VEC are summarized in Table 5.3. Municipal authorities and other public and private land developers track industrial and commercial occupancy characteristics and respond accordingly. No specific mitigative measures are considered necessary at this time and no monitoring beyond what is currently undertaken is considered necessary. The residual effects with respect to these infrastructure components are predicted to be positive, with no significant adverse effects.

Table 5.3 Effects Assessment Summary - Community Physical Infrastructure

Project Activity	Positive (P) or Adverse (A) Environmental Effect	Mitigation	Environmental Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Socio-Economic Context
HOUSING							
Construction							
Fabrication of offshore components	Increased demands for housing (P/A)	Monitoring/ action by responsible authorities	1	2	1/ 3	R	2
Installation of offshore components	Increased demands for housing (P/A)	Monitoring/ action by responsible authorities	1	2	1/3	R	2
Operations							
Offshore production/support/ service	Increased demands for housing (P/A)	Monitoring/ action by responsible authorities	1	2	3/ 2	R	2
Decommissioning							
Offshore decommissioning/ support	NA	NA	NA	NA	NA	NA	NA
Malfunctions/Accidents/Unplanned Events							
Emergency response/support			NA	NA	NA	NA	NA
Past/Present/Future Projects							
Construction	NA	NA	NA	NA	NA	NA	NA
Operations	Increased demands for housing (P/A)	Monitoring/ action by responsible authorities	1	2	3/ 3	R	2
PORT AND AIRPORT							
Construction							
Fabrication of offshore components	Increased use of Port and Airport (P)	Monitoring/ action by service providers	1	1	1/ 3	R	2

Project Activity	Positive (P) or Adverse (A) Environmental Effect	Mitigation	Environmental Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Socio-Economic Context
Installation of offshore components	Increased use of Port and Airport (P)	Monitoring/ action by service providers	1	1	1/ 3	R	2
Operations							
Offshore production/ support/service	Increased use of Port and Airport (P)	Monitoring/ action by service providers	1	1	3/3	R	2
Decommissioning							
Offshore decommissioning/ support	NA	NA	NA	NA	NA 3	NA	NA
Malfunctions/Accidents/Unplanned Events							
Emergency response/support	Increased use of Port and Airport (P)	Monitoring/ action by service providers	1	1	3/ 3	R	2
Past/Present/Future Projects							
Construction	NA	NA	NA	NA	NA	NA	NA
Operations	Increased use of Port and Airport (P)	Monitoring/ action by service providers	1	1	3/ 3	R	2
Industrial and Commercial Land, Warehousing and Office Space							
Construction							
Fabrication of offshore components	Increased demands for land, office space, etc. (P/A)	Monitoring/ action by responsible authorities/ private sector	1	1	1/3	R	2
Installation of offshore components	NA	NA	NA	NA	NA	NA	NA
Operations							
Offshore production/support/ service	Increased demands for land, office space, etc. (P/A)	Monitoring/ action by responsible authorities/ private sector	1	1	3/3	R	2
Decommissioning							
Offshore decommissioning/ support	NA	NA	NA	NA	NA	NA	NA
Malfunctions/Accidents/Unplanned Events							
Emergency response/support	NA	NA	NA	NA	NA	NA	NA

Project Activity	Positive (P) or Adverse (A) Environmental Effect	Mitigation	Environmental Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Socio-Economic Context
Past/Present/Future Projects							
Construction	NA	NA	NA	NA	NA	NA	NA
Operations	Increased demands for land, office space, etc. (P/A)	Monitoring/ action by responsible authorities/ private sector	1	1	3/2	I	2

KEY

Magnitude
1 = Low: within current capacity, standard or threshold
2 = Medium: approaches current capacity, standard or threshold
3 = High: exceeds current capacity, standard or threshold

Geographic Extent:
1 = Individual Community
2 = Regional Study Area
3 = Province

Duration:
1 = Construction only
2 = Operations only
3 = Life of Project
4 = Decommissioning only

Frequency:
1 = single occurrence
2 = occasional occurrence
3 = continuous

Reversibility:
R = Reversible
I = Irreversible

Socio-economic Context:
1 = Area has no previous experience with offshore development
2 = Area has previous experience with offshore development

NA = Not Applicable

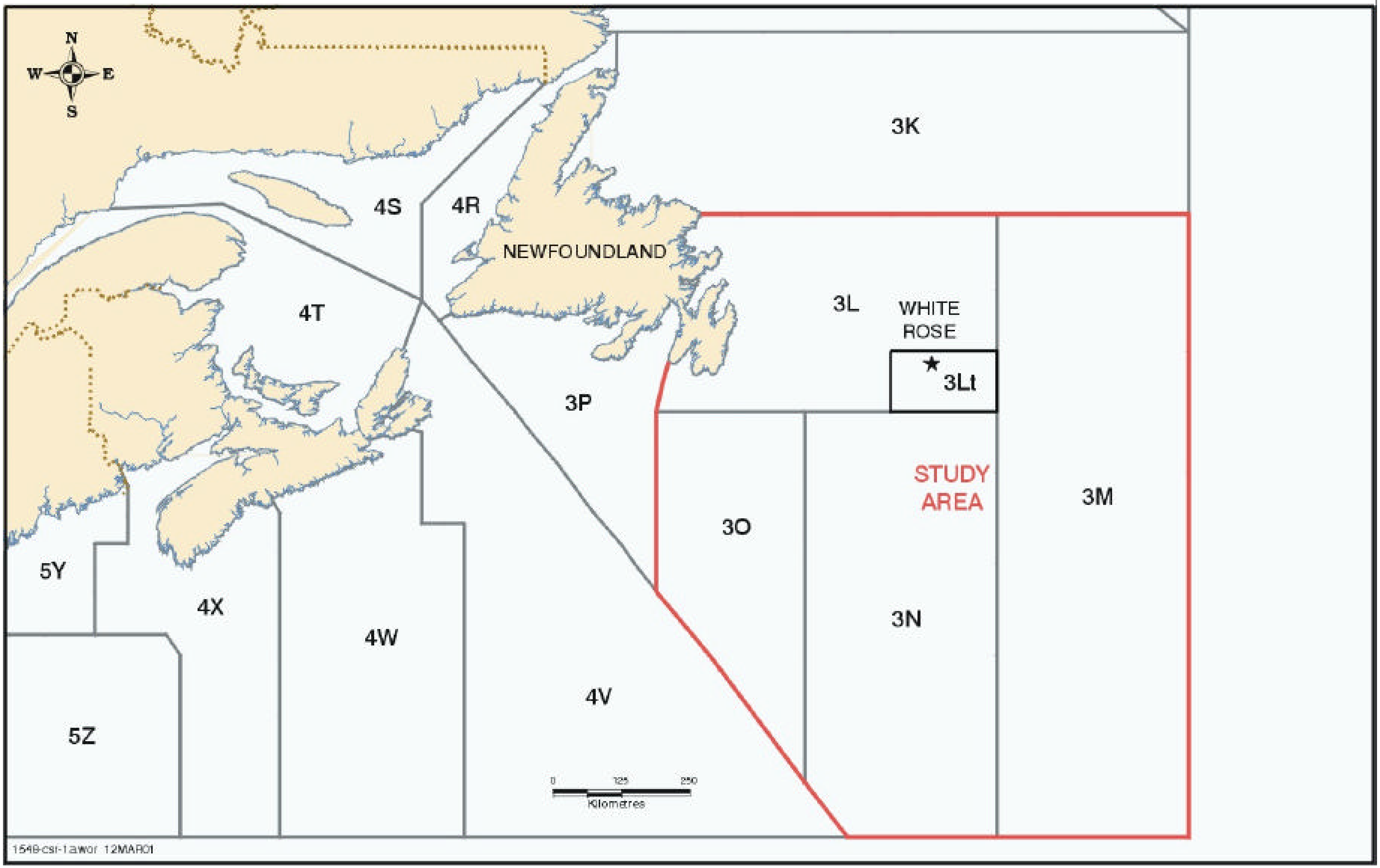
5.4 FISHERIES

5.4.1 Existing Environment

Newfoundland and Labrador’s fishing industry has undergone significant structural changes in the last decade following the closure of traditional groundfish fisheries, and is again highly viable. Among the Goods Industries in Newfoundland and Labrador, fisheries accounted for 35 percent of employment in 1998 and ranked second in terms of contribution to GDP (Government of Newfoundland and Labrador 2000). The number of people employed in fish harvesting in Newfoundland has remained relatively stable since 1995. The annual average for 1999 was 8,700 employed, with peak employment at 10,300. There are over 100 (core and non-core) processing plants in Newfoundland, employing an average of 8,400 people, with peak employment at 16,700 (Department of Fisheries and Aquaculture 1999).

The Grand Banks fisheries have undergone substantial change since the collapse of groundfish stocks. Groundfish (mostly northern cod) accounted for 63 percent of the catch by weight on the Grand Banks in 1987 (Petro-Canada 1995). In 1998, catches of snow crab, capelin, yellowtail flounder and redfish made up the bulk of the catch (81 percent). Overall, the Grand Banks fishery was more lucrative in 1998 ($74 million landed value) than it was 11 years earlier (approximately $62 million). Grand Banks fisheries differ across NAFO Divisions (Figure 5.1) in terms of species harvested and their relative importance, landings, value and industry structure (CHART 2000).

Figure 5.1 NAFO Zones



The proposed White Rose project, along with the Terra Nova and Hibernia developments, is located in NAFO Division 3L, in NAFO unit area 3Lt (Figure 5.1). The fishery in 3L is predominantly a fixed gear (crab pot) fishery and is mostly conducted by Newfoundland vessels under 35 ft (10.6 m). The bulk of the 3L fishery is undertaken close to shore. The most intensive fishing activity typically occurs between June and September.

In 3Lt, the groundfish fishery (northern cod and American plaice) made up 99 percent of the catch by weight in 1987. In 1998, the fishery in this area was dominated by snow crab (98 percent of landed value). Other important fisheries (existing and anticipated) near White Rose are shrimp, Greenland halibut, and perhaps American plaice and northern cod during the later part of the operations and decommissioning phases of the project. Shrimp and Greenland halibut concentrations are not found in the immediate vicinity of White Rose, but rather, further offshore. Catch data from research surveys do not indicate that the fishable area around White Rose will generate new fisheries in the near future. Fishing activity has generally not been predominant in the project area, with catches being lower than elsewhere in 3L. Overall, catches in 3Lt made up only one percent of the total catches (by value) in 3L from 1992 to 1998 (CHART 2000).

The focus of the assessment is on Canadian (commercial) catches. An analysis of foreign catches based on NAFO statistics confirmed the assumption that the distribution of foreign fisheries parallels that of Canadian catches (see the Supplemental Report). At present there are no Aboriginal, recreational or subsistence fisheries in 3Lt.

Further information regarding fishing activity in the area is provided in Part Two of the Comprehensive Study (Section 7.1) and in the Supplemental Report.

5.4.2 Effects Assessment

Given the renewed strength of the fishing industry, issues have been raised regarding potential losses in catch and income as a result of the proposed White Rose project. It was assumed that any effects on Canadian fisheries are representative of effects on international fisheries. The primary issues are those related to loss of access to fishing grounds, damage to fishing gear or vessels, biophysical effects to fish and possible oil spills. Effects on fisheries are predicted to be consistent across the development, production and decommissioning phases of the project.

A no-fishing zone will be in place around the glory holes and will cover an area of approximately 15.4 km^2. This no-fishing zone comprises only a small proportion of the total fishing area available in 3L (152,000 km^2), and a much smaller proportion of the total fishing area on the Grand Banks as a whole. Given the geographic distribution of fisheries in the area, it is very unlikely that catch levels will decline. The no-fishing zone would allow a growth refuge for a proportion of the harvested fish and shellfish populations and/or food species, which may indirectly benefit the fishery.

Two to three supply boats are expected to travel between White Rose and St. John's weekly. Four tanker trips per month are expected to travel between the project area and the nearest shipping lanes. Increased vessel traffic on the Grand Banks as a result of White Rose is not expected to interfere with fisheries. The fishing industry currently operates in proximity to, or encounters, many other vessels during their operations, including increased numbers of vessels engaged in crab fishing on the Grand Banks.

Damage to fishing gear or vessels may result from physical contact with White Rose vessels or installations, and small oil spills and materials lost from vessels, drill rigs or production facilities could damage or foul gear. In addition to fishing vessel damage or loss of gear, further economic loss might result from reduced catch. Overall, however, these types of damages are expected to occur infrequently. To date, there have been no reported damages as a result of the Hibernia and Terra Nova developments.

Potential effects to fish and fish habitat as a result of construction, operation and decommissioning at White Rose are predicted to be not significant (Section 4.1). In addition, any effects to fish will not be directly transferred to fisheries, because additional variability will be introduced by changing fishing practices and management regimes. Therefore, any resulting effects on fisheries are anticipated to be of low magnitude.

Increased and ongoing environmental data collection and monitoring programs for the White Rose project will enhance understanding of the Grand Banks ecosystem, and may lead to the identification of new commercial species. Also, the White Rose production facility and supply vessels will be able to provide emergency services to existing fishing activity on a large portion of the Grand Banks.

Major oil spills are unlikely events (see Section 4.1.2.4), but have the potential to cause serious damage to the fishing industry. The most serious potential effects from major spills are loss of market or market value, loss of access to fishing grounds, damage to fishing gear, and fish tainting (real or perceived). Oil spill trajectory model results for spills greater than 10,000 barrels (Comprehensive Study (Part One) Section 5.8) indicate that an oil spill occurring in the project area would most often disperse offshore and to the south of the Flemish Cap. Given these dispersion patterns, fisheries that would be most disrupted include the Greenland halibut, tuna and swordfish fisheries around the Flemish Pass and the shrimp fishery on the Flemish Cap. Fisheries in the eastern portion of NAFO division 3L and 3N could be affected, but to a much lesser degree. The most serious effect should be loss of market or market value, a disruption of fishing activity, and potential damage to gear rather than any serious effect on fish.

Cumulative effects on fisheries might occur as a result of the Hibernia, Terra Nova and White Rose oilfields, general marine transportation, seismic testing and exploration drilling. Cumulative effects due to loss of access to fishing grounds and/or increased vessel traffic on the Grand Banks will be of low magnitude. The total no-fishing zone for Hibernia (5 km^2), Terra Nova (13.8 km^2) and White Rose (15.4 km^2) is approximately 34.2 km^2, comprising a very small fraction of the total fishing area available in 3L. Further, the bulk of current fish catches are made either well on the landward side of oil development sites or on the shelf margin rather than in 3Lt itself. As discussed above, the presence of no-fishing zones could also indirectly benefit fisheries. With respect to vessel traffic, the total number of trips per week by supply vessels supporting offshore oil operations will remain a very small fraction of total traffic on the Grand Banks.

Although to date there have been no damages reported, damage to fishing gear might nevertheless occur in the future as a result of Hibernia, Terra Nova and White Rose vessels and installations. Although each operator has or will have mitigation measures in place to deal with damage to fishing equipment, there could be delays in compensation for lost or damaged gear and lost revenue if there is disagreement about which project is responsible. In such a case, the industry non-attributable damage compensation policy, currently in development, will provide guidance. Cumulative effects on fish catches as a result of biophysical effects of oil operations on fish are anticipated to be of low magnitude. A positive cumulative effect is expected with respect to information, communication and emergency response as a result of oil development on the Grand Banks.

A more detailed assessment of the potential effects of the proposed project on this VEC is provided in Part Two of the Comprehensive Study (Chapter 7). The potential effects (including cumulative effects) of the various phases and components/activities associated with the proposed project on fisheries are summarized in Table 5.4.

Table 5.4 Effects Assessment Summary – Fisheries

Project Activity	Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Socio-Economic Context
Construction, Operations, Decommissioning							
Loss of Access to Fishing Grounds	A	Discussion with Fishing Industry; Common Traffic Routes	1	3	5/6	R	2
Damage to Fishing Vessels or Gear	A	No-fishing Zone; Notification to Mariners; Reduction or Elimination of Debris; Compensation	1	5	5/1	R	1
Biophysical Impacts on Fisheries	A	See Chapter 4	1	3	5/6	R	1
Information, Communication and Emergency Response	P	NA	1	6	5/6	R	1

Project Activity	Positive (P) or Adverse (A) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects				
			Magnitude	Geographic Extent	Duration/ Frequency	Reversibility	Socio-Economic Context
Malfunctions/Accidents/Unplanned Events							
Major Oil Spills[a]	A	Prevention; Containment; Monitoring; Recovery; Compensation	2-3	4-6	2-5/1	R	1
Past/Present/Future Projects (seismic testing, exploration drilling, marine transportation, Hibernia, Terra Nova, White Rose)							
Loss of Access to Fishing Grounds	A	Discussion with Fishing Industry; Common Traffic Routes;	1	3	5/6	R	2
Damage to Fishing Vessels or Gear	A	No-fishing Zone; Notification to Mariners; Reduction or Elimination of Debris; Compensation	1	5	5/1	R	1
Biophysical Impacts on Fisheries	A	See Chapter 4	1	3	5/6	R	1
Information, Communication and Emergency Response	P	NA	1	6	5/6	R	1

KEY:

Magnitude:
1 = Low
2 = Medium
3 = High

Geographic Extent:
1 = <1 km²
2 = 1-10 km²
3 = 11-100 km²
4 = 101-1000 km²
5 = 1001-10,000 km²
6 = > 10,000 km²

Duration:
1 = < 1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = > 72 months

Frequency:
1 = < 11 events/year
2 = 11-50 events/year
3 = 51-100 events/year
4 = 101-200 events/year
5 = > 200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity
2 = Evidence of adverse effects

NA = Not Applicable

[a] Note: Effects of major oil spills on fishing gear and on loss of access to fishing grounds can be remedied relatively quickly (often within 2 years of a spill). However, loss of market and market value for fisheries species depends on media coverage and public perception of fish taint. Because of this, impacts of major spills can extend over a larger area than the immediate geographic area affected by the spill and can extend long after oil has been removed and/or has dissipated.

For the most part, potential effects on fisheries are small, and can be further decreased by the implementation of various mitigation measures, the majority of which include discussion and collaboration with the fishing industry. Measures to mitigate potential effects on commercial fisheries are summarized below:

- establishing a no-fishing zone at the White Rose development site;
- compensation for damage resulting from project and industry activities either through the proponents program or the overall industry unattributable damage programs (under development);
- all reasonable efforts will be made to accommodate fishing activity over portions of the field not under development;
- a sequential approach to reservoir development will allow for sequential fishing over portions of the White Rose oilfield during pre-drilling, before production or as wells are abandoned;
- using common routes by Hibernia, Terra Nova and White Rose vessels, or collaborating (where appropriate) to minimize the number of trips, to reduce overall interference with the fishing industry;
- beyond the no-fishing zone, the proponents will keep the fishing industry fully informed of the timing and sequence of field development and of the exact location of potential hazards (e.g., through participation in the industry fisheries liaison group); and
- oil spill prevention and response procedures.

The residual environmental effects of the project on fisheries during the development, production and decommissioning phases will be adverse but not significant. Although unlikely, the residual effect of a major oil spill on fisheries is predicted to be adverse and significant.

5.5 RESIDUAL SOCIO-ECONOMIC EFFECTS SUMMARY

The predicted residual socio-economic effects of the proposed White Rose oilfield development are summarized in Table 5.5.

The residual effects of the various project phases, and of the project overall, on business and employment are assessed as positive. The project's decommissioning phase is not expected to have an effect on this VEC (Table 5.5).

The residual effects of project construction and operations on the various aspects of community social infrastructure and services are assessed as positive and/or adverse but not significant. The project's decommissioning phase is not expected to have an effect on this VEC. Malfunctions, accidents or unplanned events are not predicted to result in significant adverse effects. Overall, the proposed project is expected to have positive effects on education, and social assistance and employment services, adverse but not significant effects on medical services and infrastructure and policing and fire protection, and both positive and not significant adverse effects on recreation services and facilities (Table 5.5).

The residual effects of project construction and operations on the various components of community physical infrastructure are predicted to be either positive, or a combination of positive and not significant adverse effects. The project's decommissioning phase is not expected to have an effect on community physical infrastructure, and adverse effects are not expected as a result of any malfunctions, accidents or unplanned events. The overall residual effects of the project on housing and industrial and commercial land, warehousing and office space are assessed as a combination of positive and not significant adverse effects, while the overall residual effect of the project on the port and airport is predicted to be positive (Table 5.5).

The construction, operations and decommissioning phases of the project are predicted to have adverse, but not significant, effects on fisheries. The effect of a major oil spill on fisheries is, although unlikely, assessed to be adverse and significant. The overall residual effect of the project on fisheries is predicted to be not significant (Table 5.5).

In summary, after mitigation measures have been implemented, the overall predicted socio-economic effects of the project are, depending on the specific component, assessed to be either positive, or adverse but not significant. The only exception is the potential effects of a major offshore oil spill on fishing activity. As discussed previously, however, the potential for such an event is very low, and preventive measures and contingency plans proposed by the proponents will further reduce the likelihood of, and minimize the effects of, any spills.

Table 5.5 Residual Effects Summary – Socio-Economic

Phase	Residual Environmental Effects Rating, including Cumulative Socio-economic Effects [1]	Level of Confidence	Likelihood	
			Probability of Occurrence	Scientific Certainty
BUSINESS AND EMPLOYMENT				
Construction	P	3	3	3
Operations	P	3	3	3
Decommissioning	NA	NA	NA	NA
Malfunctions, Accidents, Unplanned Events	P	3	3	3
Project Overall	P	3	3	3
COMMUNITY SOCIAL INFRASTRUCTURE AND SERVICES				
Education				
Construction	P	3	2	3
Operations	P	3	3	3
Decommissioning	NA	NA	NA	NA
Malfunctions, Accidents, Unplanned Events	P	3	3	3
Project Overall	P	3	3	3
Medical Services and Infrastructure				
Construction	NS	3	3	3
Operations	NS	3	3	3
Decommissioning	NA	NA	NA	NA
Malfunctions, Accidents, Unplanned Events	NS	3	3	3

Phase	Residual Environmental Effects Rating, including Cumulative Socio-economic Effects [1]	Level of Confidence	Likelihood	
			Probability of Occurrence	Scientific Certainty
Project Overall	NS	3	3	3
Social Assistance and Employment Services				
Construction	P	3	3	3
Operations	P	3	3	3
Decommissioning	NA	NA	NA	NA
Malfunctions, Accidents, Unplanned Events	P	3	1	3
Project Overall	P	3	3	3
Policing and Fire Protection				
Construction	NS	3	3	3
Operations	NS	3	3	3
Decommissioning	NA	NA	NA	NA
Malfunctions, Accidents, Unplanned Events	NS	3	3	3
Project Overall	NS	3	3	3
Recreation				
Construction	NA	NA	NA	NA
Operations	P/NS	3	3	3
Decommissioning	NA	NA	NA	NA
Malfunctions, Accidents, Unplanned Events	NA	NA	NA	NA
Project Overall	P/NS	3	3	3
COMMUNITY PHYSICAL INFRASTRUCTURE				
Housing				
Construction	P/NS	3	3	3
Operations	P/NS	3	3	3
Decommissioning	NA	NA	NA	NA
Malfunctions, Accidents, Unplanned Events	NA	NA	NA	NA
Project Overall	P/NS	3	3	3
Port and Airport				
Construction	P	3	3	3
Operations	P	3	3	3
Decommissioning	NA	NA	NA	NA
Malfunctions, Accidents, Unplanned Events	P	3	3	3
Project Overall	P	3	3	3
Industrial and Commercial Land, Warehousing and Office Space				
Construction	P/NS	3	3	3
Operations	P/NS	3	3	3
Decommissioning	NA	NA	NA	NA
Malfunctions, Accidents, Unplanned Events	NA	NA	NA	NA
Project Overall	P/NS	3	3	3
FISHERIES				
Seismic Testing / Construction	NS	3	1	2
Operations	NS	3	1	2
Decommissioning	NS	3	1	2
Malfunctions, Accidents, Unplanned Events (Major Oil Spills)	S	3	1	3
Project Overall	NS	3	1	2

Phase	Residual Environmental Effects Rating, including Cumulative Socio-economic Effects [1]	Level of Confidence	Likelihood	
			Probability of Occurrence	Scientific Certainty

Key:

Residual Socio-economic Effects Rating:

S = Significant Adverse Effect
NS = Not-significant Adverse Effect
P = Positive Effect

Level of Confidence:

1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

Probability of Occurrence:
(based on professional judgement)
1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence

Scientific Certainty:
(based on scientific information, statistical analysis or professional judgement)
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

NA = Not Applicable

[1] As determined in consideration of established residual socio-economic effects rating criteria

6 CONCLUSION

This Comprehensive Study Report has been prepared in relation to the proposed White Rose Oilfield Development, in accordance with the requirements of CEAA. The environmental assessment includes consideration of the environmental effects of the project, including those due to malfunctions or accidents that may occur and any likely cumulative environmental effects, as well as the significance of these potential effects. Public input was actively sought as part of the environmental assessment, and the comments received from the public were considered throughout. The proponents have demonstrated the purpose of, and the need for, the proposed project. Alternatives to, and alternatives means of carrying out, the project were also considered.

Mitigation measures which are technically and economically feasible have been incorporated into project design and planning. With the implementation of these measures, the proposed White Rose oilfield development is not likely to cause significant adverse environmental effects. A comprehensive follow-up program will be undertaken to assess the accuracy of the effects predictions made in the assessment, and to determine the effectiveness of mitigation measures.

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