3.0 Project Description

During the period 2007 to 2011, Husky plans to develop up to four new drill centres in three areas adjacent to the three drill centres currently active in the White Rose Field (the Southern Glory Hole, the Central Glory Hole and the Northern Glory Hole) (Figures 1.1 and 1.2). Production operations associated with these four new drill centres would occur between 2009 and 2020.

3.1 Name and Location of Proposed Project

The official name of the Project is the Husky White Rose Development Project: New Drill Centre Construction & Operations Program. It is located on the northeastern Grand Banks (Figure 1.1). All proposed activities will occur within the White Rose Operating Area (Figure 1.2), otherwise known as the Project Area.

3.2 Alternative Means within Project

Currently all floating production systems on the Grand Banks are designed similarly to the Terra Nova and White Rose systems (i.e., construction of glory holes and installation of drill centres). While individual field analysis of iceberg risk is performed, the results, to date have supported placement of the trees, manifold, and subsea controls equipment in recessed areas (glory holes) on the seabed. This approach provides protection against icebergs large enough to be a danger to the seabed equipment. There are no alternative means to glory hole construction to produce the oil out of the ancillary pools.

Alternatives to dredge a new glory hole included the use of a suction hopper versus a clamshell dredging system. For technical reasons, the suction hopper dredge technique for excavating the new glory holes was selected. Husky has also considered long range directional drilling but this method was determined to be inappropriate.

3.3 Canada-Newfoundland and Labrador Benefits

Consistent with the legislative requirements of the *Canada Newfoundland Atlantic Accord Implementation* acts, Husky Oil Operations Limited is committed to enhancing the business opportunities for Canada and Newfoundland and Labrador as outlined in the Company's Canada-Newfoundland and Labrador Benefits G/L outlined in the Benefits Plan. Consequently, Husky will utilize the services of Newfoundland and Labrador and other Canadian companies and personnel wherever possible.

3.4 Personnel

The work associated with this Project Description will be managed by Husky's East Coast Operations Development Manager located in St. John's. The onshore management team that supports the Development Manager includes the Drilling and Completions Manager, Sub-Surface Manager, Production Operations Manager, Logistics Manager, Administration Manager, HSEQ Manager and the Regulatory Affairs and Administration Manager.

Offshore, the Management teams will vary by project phase and requirements but will generally consist of the following:

- **Drilling Operations Team** led by the Drill Rig (s) Offshore Installation Manager (s) (OIM) and Offshore Senior Drilling Supervisor reporting to Drilling Superintendent and the Drilling and Completions Manager onshore.

- **Subsea Construction and Installation Team** led by the Subsea Manager and the Subsea Installation Manager onshore will manage the design and construction of the glory holes and the design construction and installation of the subsea drilling templates, well head appurtenances and flow lines connecting the new drill centres to the existing White Rose Development subsea and production infrastructure. The work involved in the construction of the glory holes and the installation of the incremental subsea infrastructure will be carried out by sub-contractors managed by Husky.

- **Production Operations Team** led by the Production Operations Manager will manage production operations once the Project described herein is completed and the operation is fully integrated with the White Rose Production Operation's organization.

Logistical support will be managed through Husky's Logistics Team, made up of a Logistics Lead and supporting Coordinators. The Logistics Coordinator manages supply vessels, helicopters, and materials movement activities for Husky's East Coast operations. The transport of personnel to and from St. John's and the Operating Area will be conducted mainly by helicopter but, in isolated situations, supply vessels may be used.

3.5 Offshore Equipment

3.5.1 Glory Hole Construction/TGB Installation

Dredging, as described in the White Rose Oilfield Comprehensive Study (Husky 2000), is seafloor excavation work generally to lower the "profile of subsea production equipment relative to the surrounding seafloor." A dredge is a vessel equipped with a device for cutting, scraping and/or suctioning the seafloor material and displacing it to another location.

Glory holes in this Project will be dredged using a trailing suction hopper dredging (TSHD) vessel. This type of dredge is a self-propelled ship which fills its hold or hopper during dredging while following a pre-set track. They are equipped with either single or twin (one on each side) trailing suction pipes. Material is lifted through the trailing pipes by one or more pumps and discharged into a hopper contained within the hull of the dredge. When the hoppers are full the TSHD sails to a disposal area and either dumps the material through doors in the hull or pumps the material out of the hoppers. The largest hopper dredges in the world (subject to revision) are Jan De Nul's Vasco Da Gama (33,000 m^3 hopper, 37,060 kW total installed power) and Boskalis WD FAIRWAY 35,000 m^3 hopper.

The Temporary Guide Base (TGB) is, in principle, a standard drilling technology used for individual wells and in multi-well template configurations for the purpose of providing a precise location to begin a well and re-enter a well. TGBs are generally utilized only for the spudding and surface casing portion of the well. As the wellhead system is "built up", a permanent guide base (PGB) is located above the TGB and becomes the new well entry point.

3.5.2 Drilling

Drilling will be conducted by a mobile offshore drilling unit (MODU). The *GSF Grand Banks*, is an example of a typical MODU that has been used on the East Coast. The *GSF Grand Banks* is a rectangular, twin hull, column stabilized, MODU, constructed to an Aker #3.2 design. There are two 29.5 ft. (9.0 m) diameter corner stability columns plus two 24.3 ft. (7.4 m) diameter intermediate stability columns rising from each hull to support the main deck. The deck is arranged with the drilling mast in the centre and modules on the perimeters, housing the living quarters, equipment, storage area and workshops. The *GSF Grand Banks* or a comparable MODU will be used to execute the proposed Project.

3.5.3 Production Subsea Equipment Installation

Subsea facilities to support the new drill centres will include all equipment necessary for the safe and efficient operation and control of the subsea wells and transportation of production and injection fluids. Procedures for installation of subsea facilities and subsequent operations are anticipated to be the same as those currently employed for the existing White Rose Development. The following equipment will be installed in the new drill centres:

- Wellheads and xmas trees (production and water injection);
- Production and water injection manifolds;
- Subsea distribution units;
- Subsea umbilical termination unit;
- Flowlines (gas lift, production, water injection);

- Jumpers (control, gas lift); and
- Rigid spools (to production and water injection xmas trees.

Iceberg protection measures applied to the current White Rose project will also be applied to the SWRX, and other drill centers, including placement of wellheads, xmas trees and manifolds in glory holes, with the top of the equipment a minimum of two to three metres below the seabed level and use of flowline weak link technology.

Subsea equipment for the White Rose project, while standard in design, must be installed quite accurately relative to the seabed and other equipment components. Two types of specialty vessels are required for installation of the subesea equipment; a subsea construction vessel (SCV) and a subsea diving support vessel (DSV).

The SCV work will generally consist of large equipment lifts that require precise placement on the seabed. This work is generally supported by ROV rather than diving operations and may involve several structures such as foundations, piles, manifolds. The flowlines and umbilicals are planned to be installed by a DSV. The lines will be transported on large reels on a heavy lift vessel (HLV) and handled onto the DSV or in a carousel (on the DSV while at the factory). The lines are precisely laid on the seabed, inspected and mapped by ROV. The lines are then connected by divers, displaced to water, pigged and tested.

3.5.4 Production Operations

3.5.4.1 Floating Production, Storage and Offloading Vessel (FPSO)

The FPSO proposed for use at White Rose was described in detail in Section 2.4.1 of the Project Description of the White Rose Oilfield Comprehensive Study (Husky 2000). It is a floating system that contains the necessary equipment to retrieve, produce and store crude petroleum and to moor and transfer oil product to shuttle tankers. The SeaRose FPSO has been operational on the Grand Banks since November 2005. All production from the new drill centres will be processed through the SeaRose FPSO currently operating at White Rose.

3.5.5 Abandonment

The decommissioning and abandonment of all Project facilities will be in accordance with C-NLOPB requirements and *Newfoundland Offshore Petroleum Production and Conservation Regulations* and any other applicable laws (see section 3.8.6 for further detail).

3.6 Logistic Support

3.6.1 Marine Support Vessels

Husky's existing fleet of Anchor Handling Tug Supply (AHTS) and Supply/Standby vessels will be used to support the offshore construction and installation operations associated with the Project. These vessels are and will be Canadian-flagged and crewed and will be managed from the Contractor's office in St. John's, Newfoundland and Labrador.

3.6.2 Helicopter Support

Cougar Helicopters Inc. (CHI) have been contracted to provide helicopter support for the Project and will have access to a Sikorsky S61, AS-332L Super Puma or other equivalent rated aircraft, pooled with all operators in St. John's to service the Company's requirements. Cougar Helicopter Inc. will also provide all auxiliary flight services including First Response Equipment and technicians, alternate landing site at Long Pond complete with weather station, aviation fuel, and helicopter passenger transportation suits and an aircraft maintenance and passenger handling facility located at the St. John's Airport. Cougar Helicopters Inc. will utilise their internal flight following service using the Blue Sky tracking system.

3.6.3 Shorebase Facilities

The Project will be managed and operational decisions will continue to be made from Husky Oil Operations Limited's existing Regional Office in St. John's at Suite 901, 235 Water Street.

A. Harvey and Company Ltd. will continue to provide marine base facilities to support Project activity and, to the extent necessary, it is anticipated that Pier 17 will provide the appropriate wharfage for the dredge vessel. Existing port facilities are capable of servicing multiple operations with the existing infrastructure including office space, crane support, bulk storage and consumable (fuel, water) storage and delivery capability. The existing infrastructure and activity at the Harvey's facility enables the industry to optimise the utilisation of supply vessels and other logistic assets.

Warehouse facilities will continue to be provided by Husky's contracted warehouse provider (ASCO) and Project contractors as required and will consist primarily of storage for tubular goods, and the equipment belonging to the rig contractor which can be stored onshore.

Operation and co-ordination service of voice and data communication services from offshore installations and vessels will continue to be provided from the central facility Stratos Wireless Communications in St. John's. The primary communications link between the offshore installation(s) and the Project Operations office in St. John's will be via a dedicated C-Band satellite service. Details on communications systems are outlined in the Husky East Coast Emergency Response Plan currently on file with the C-NLOPB.

3.7 Information on Consultations

As part of the White Rose Development Plan Application, that included an assessment of development activities such as glory hole construction and well drilling, Husky conducted extensive consultations with numerous organizations. These included federal agencies, particularly Fisheries and Oceans and Environment Canada; provincial departments such as Environment and Labour and Fisheries, Food and Aquaculture; municipal governments in St. John's, Clarenville and Marystown; special interest groups including the Natural History Society; and the general public at various locations. A detailed list of over 100 meetings is contained in the report entitled "White Rose Oilfield Development Public Consultation Report" and summarized in the Comprehensive Study Report. The White Rose Development Plan Application also went through a series of Commission hearings that were open to the public.

In addition, Husky briefed the following parties on the nature of the Jeanne d'Arc Basin exploratory drilling project, including a description of proposed activities, locations and timing.

- Transport Canada (23 April 2002)
- C-NOPB (12 April 2002)
- Transport Canada, C-NOPB, Det Norse Veritas (7 May 2002)
- Environment Canada (May 2002)
- Fisheries & Oceans Canada (May 2002)

For the proposed new drill centre development program, the following organizations have been consulted by Husky during the preparation of the environmental assessment:

- Department of Fisheries and Oceans
- Environment Canada
- Natural History Society
- One Ocean
- Fish, Food and Allied Workers Union
- Association of Seafood Producers
- Fishery Products International
- Independent Crab Fishers
- Groundfish Enterprise Allocation Council
- Clearwater Seafoods Limited Partnership
- Icewater Harvesting

Environmental concerns expressed during some of the meetings on the White Rose Project that could be of relevance to the development of new drill centres included those associated with the discharge of waste including drilling muds and cuttings (more so synthetic based muds as opposed to water based muds), produced water, any oily discharges (particularly accidental oil spills), fishery exclusions, and attraction of several species of seabirds to the rig. The general

consensus of the meetings was that offshore oil could be developed on the Grand Banks in an environmentally responsible manner and in coexistence with the fishing industry. These issues were also addressed during the White Rose Development Application review process and will be considered in the environmental assessment together with issues that arose from the specific consultations conducted for the new drill centre development program. Husky will maintain ongoing consultations with the above groups and is available to discuss issues at all times.

3.8 Project Components/Structures/Activities

Four new drill centres are being proposed at the following locations:

- **South White Rose Extension (SWRX)** (one glory hole with drill centre) approximately five kilometres due south of the current Southern Drill Centre in approximately 120 m of water.

- **West White Rose Extension (WWRX)** (one or two glory holes with one or two drill centres) approximately 1.5 to 3.0 km northwest of the current Central Drill Centre in approximately 120 m of water.

- **North White Rose Extension (NWRX)** (one glory hole with drill centre) approximately 3.0 km northeast of the current Northern Drill Centre in approximately 125 m of water.

Figure 1.1 depicts the general locations of the new drill centres within the Project Area (i.e., White Rose Operational Area).

The number of wells that will be drilled in each glory hole has yet to be determined and will depend on the results of delineation drilling. However, for planning purposes it will be assumed that each of the four drill centres could potentially support the following distribution of wells if all the drill centres are constructed over the next five years:

- South White Rose Extension: maximum 8 wells.
- West White Rose Extension: maximum 18 wells.
- North White Rose Extension: maximum 4 wells.

It is proposed that initial construction operations will start with glory hole excavation at SWRX during the 2007 construction season with drilling and subsea construction operations and tie-ins to the SeaRose FPSO occurring over the 2007-2009 period. The SWRX drill centre will be comprised of three production wells and two water injection wells with expansion capacity to eight wells.

3.8.1 Schedule of Activities

The time table for the remainder of the construction, installation and tie back operations is provided in Table 3.1.

As previously noted, the construction of the West White Rose Extension and North White Rose Extension drill centres is subject to successful delineation drilling results and full economic assessment.

Table 3.1. Project Phases and Scheduling.

Project Phases	Timing
Glory Hole Excavation & TGB Installation	
South White Rose Extension Glory Hole	Summer 2007
West White Rose Extension Glory Holes (up to 2)	Summer 2008/2009
North White Rose Extension Glory Hole	Summer 2010
Drilling	
South White Rose Extension	Fall 2007 – Spring 2009
West White Rose Extension	Fall 2008 – Summer 2009
North White Rose Extension	Fall 2010- Summer 2011
Subsea Production Equipment Installation	
South White Rose Extension	Spring – Summer 2009
West White Rose Extension	Spring - Summer 2009
North White Rose Extension	Summer 2011
Subsea Flowline Installation and Tie-ins	
South White Rose Extension	Spring – Summer 2009
West White Rose	Spring - Summer 2009
North White Rose	Summer 2011
Production Operations	2009 – 2020
Abandonment	After 2020

3.8.2 Glory Hole Construction & TGB Installation

Glory hole construction methods will be the same as those typically employed for development of the South Avalon Pool. However, the glory hole(s) will be larger and deeper than those constructed for the South Avalon Pool. The glory hole(s) needed to support establishment of the drill centre will be excavated to a maximum of minus 11 m below existing seabed level in order to protect the subsea wellheads and templates from iceberg scour. Each glory hole will have a maximum "floor" dimension of 70 m by 70 m with graded sloped sides (each of four sides 70 m x 35 m) as required for stability and the flowline ramps. The greater dimensions result from lessons learned during the original White Rose Development. Specifically:

- Increased depth will allow equipment to be installed on purpose-made blocks to decrease exposure of wellheads and associated equipment to irregularities in excavation and sedimentation in the bottom of the glory hole;

- A larger size will facilitate unimpeded movement of ROVs, easier equipment installation, and to allow for possible installation of a universal subsea tree structure currently being assessed; and

- Graded slope ramps will facilitate placement of flow lines and may enhance removal or movement of sediment out of the glory hole through less obstructed current flow.

Glory hole construction will be accomplished by use of a trailing suction hopper dredge operation.

Approximately 155,540 m^3 of seabed sediment per glory hole will be moved and dumped at a previously used dumpsite located approximately three kilometres south-southeast of the current southern glory hole. Husky will submit an application for an Ocean Dumping Permit for the South White Rose Extension Glory Hole early in 2007.

Concrete mattresses or impact resistant plastic sleeves at flow exits from the glory holes will protect the flow lines from drill rig anchor chains. It is not planned to bury flow lines in the seabed.

Construction of glory holes will engender a HADD, pursuant to the federal *Fisheries Act*. To compensate for the loss of fish habitat and its attendant fish productivity, Husky will be required to construct marine fish habitat in inshore areas of Newfoundland. This compensation plan proposes the construction of an area of scallop shell habitat.

3.8.3 Drilling

Husky's current drill rig contractor or a separate contractor will operate a MODU to drill the wells associated with this project.

The drill rig employed will have been constructed to an appropriate design for the operating area and physical environment. The drilling unit will have the necessary capability for drilling in the water depths required and the functional specifications of the well design. The rig will have a valid Certificate of Fitness for Canadian waters issued by the rig contractor's Certifying Authority; a Transport Canada Marine Safety Inspection will be conducted as part of the requirements for a Letter of Compliance issued by that agency.

The rig contractor(s) will have an operations office located in St. John's, Newfoundland. The strategy concerning drilling unit crewing plans will be presented in the associated Canada-Newfoundland Benefits Plan and/or components of the Safety Program update documentation. Any foreign Worker's Permits will be sought as the overall project crew complement is finalized.

3.8.4 Production Subsea Equipment Installation

The production subsea equipment installation will be done in a similar fashion to the same work previously carried out for the other White Rose drill centers in recent years (i.e., flowlines, umbilicals, and subsea manifolds with control system components).

Development of the new SWRX will entail tying back the new drill centre to the existing White Rose Southern Drill Centre (SDC) via two additional production flowlines. [This procedure may also apply to the WWRX and NWRX drill centres, which would be tied back to existing Central and Northern drill centres, respectively. Alternatively, the WWRX and NWRX drill centres may be tied back directly to the SeaRose FPSO.] In order to facilitate this tieback, it will be necessary to disconnect valves and sections of pipework from the existing subsurface manifolds in the SDC. Prior to disconnection of the existing manifold pipework, the complete SDC production flowline system will be depressurized and all production fluids (i.e., oil and gas) will be flushed from the manifold and flowline system using a pig train driven by water from the FPSO. To assist in the removal of oil emulsions from the surface of the flowline and manifold pipework, a mild detergent may be added to the water during the flushing operation. Any chemicals used during the process will be screened through the Offshore Chemical Screening System.

Despite the flushing operations, small amounts of oil may remain trapped in the flowline carcass and manifold piping cavities due to the nature of the flexible flowlines and the intricacies of the manifold pipework. As a result, once the pipework section is removed by divers, a small amount of oily residue may be released to the environment. The pipework will be open for approximately 2 to 4 hours until the replacement pipe spools are connected to the exposed manifold flanges. The amount of oily residue released is not anticipated to exceed 0.327317 m^3.

Once tie-in is complete, the system will be brought back into service through the existing infrastructure at the FPSO.

As already noted, lessons learned will be incorporated into glory hole design for the new glory holes. Specifically, glory holes will be larger and deeper to reduce the interface of equipment with the seabed.

The umbilical and flowlines utilized for the new drill centres will be of the same design and specifications as those currently used by White Rose. Subsea tie-in work in the new drill centres and the existing drill centres (if new drill centres are tied back to existing ones) will be accomplished using ROV technology as well as divers, when required.

3.8.5 Production Operations

3.8.5.1 Organization

Husky Oil manages the production and maintenance operations of the White Rose oilfield on behalf of itself and Petro-Canada from the Husky Oil office in St. John's, where the management team is located. The day-to-day management and control of all offshore operations is the responsibility of the Offshore Installation Manager (OIM) who is located on the FPSO. Each MODU operating in the field will also be managed and controlled by an Installation Manager. The OIM on the FPSO will, however, take responsibility for routine coordination of all concurrent offshore operations.

3.8.5.2 FPSO

The crew complement for the FPSO is approximately between 80-90 personnel on board (POB). The maximum allowed POB offshore during production is 90. The crew complement on the FPSO is not anticipated to change as result of the development of the new drill centres. Major maintenance will be conducted during production shutdowns.

The offshore operation will be provided with engineering support by the Technical Services Group. This support will be for specific tasks, or investigation and solution of process problems, and will be on an ad hoc basis.

3.8.5.3 MODU

Each drilling vessel will require approximately 85-110 support staff during drilling operations. To provide for rotation, this means a requirement of some 170 to 210 personnel per drilling unit.

3.8.5.4 Operations and Maintenance Procedures

Operations and maintenance procedures and manuals have been prepared specifically for the White Rose development. They make provision for compliance with all regulatory requirements, and personnel are trained to operate in accordance with the manuals and procedures.

3.8.5.4.1 Systems

Systems manuals provide descriptions and drawings of the primary process, ancillary systems, and associated equipment and subsystems. The rationale behind the design is presented. Operating parameters are set out. Operator training manuals are based upon these documents.

3.8.5.4.2 Equipment

Detailed information on each individual piece of equipment and each system and subsystem are assembled and incorporated into data books. Such information is drawn from vendor sources, design specifications and operational record. It includes drawings, specifications, descriptions, materials, installation guidelines, operation and maintenance guidelines, and recommendations on spare parts inventory.

3.8.5.4.3 Reporting Relationships and Procedures

Roles, limits of authority, lines of reporting and accountabilities in production operations are set out in reporting procedures and where applicable bridging manuals. For the current White Rose operations, these clearly identify reporting relationships throughout the organization as well as with external agencies. The reporting procedures will be applied to activities related to the development of the new drill centres.

Similarly, the procedures for record-keeping are set out in the manuals, together with requirements for report generation and distribution and data acquisition. Operating and maintenance records are documented as required by Husky Oil and governing regulations. Requisite reports are produced routinely. The same record-keeping procedures will be applied to activities related to the development of the new drill centres.

Production operating procedures and drilling and production operations environmental protection plans that govern day to day work define the necessary environmental protection, compliance monitoring and internal/external reporting processes required to ensure environmental protection. These procedures will also apply to the activities related to the construction and operation of the new drill centres.

3.8.5.4.4 Maintenance Procedures

Maintenance procedures manuals will be prepared for all equipment installed for the new drill centres . These procedures will be based on design data, recommendations by vendors, operating conditions, and the importance of the equipment to operation of the facility. This latter aspect will be based on the effect of failure of the item of equipment on personnel safety, environmental consequences, operational efficiency, and revenues.

As with existing White Rose operations, the maintenance program for new equipment will be extensively supported by computerized systems, providing detailed information on each item of equipment, including its criticality, maintenance history, and spares to be kept in inventory. The system will also be linked to an inventory control system.

The basic significant features of monitoring, inspection, and maintenance and repair, will be recognized in the program.

3.8.5.4.5 Production and Marine Procedures

The production and marine procedures manual deals with the safe and efficient operation of the FPSO for all facets of production and marine-related activities. It describes in detail how the following activities are carried out or managed:

- process start-up and shutdown;
- routine production;
- operations limits;
- adverse weather conditions;
- crude storage and shipment; and
- marine activities.

The procedures manual will apply to all activities related to the construction and operation of the new drill centres.

3.8.5.4.6 Ice Management Procedures

Husky Oil already has an Ice Management Plan in place for its operations on the Grand Banks. Husky Oil will review and update, or modify, this plan as appropriate for application to the proposed development of additional drill centres at the White Rose field.

Ice management procedures currently set out clearly the steps and responsibilities for ice surveillance, monitoring and reporting. The procedures are structured to include cooperation with other operators and government agencies in their concurrent ice surveillance and management operations on the Grand Banks. All available ice intelligence information sources are used to ensure the well-being of the facilities offshore. The ice management procedures in place for the current White Rose development will be employed for construction and operation of the new drill centres.

3.8.5.4.7 Health, Safety and Environment (HSE) Management System

Husky Oil has a health, safety and environment management system for the White Rose development that meets or exceeds all statutory requirements, and facilitates continued employee safety and health as well as environmental protection. Environmental protection and compliance monitoring plans and the environmental effects monitoring program also comprise part of the HSE Management System. The HSE Management System will apply to all activities related to construction and operation of the new drill centres.

3.8.5.4.8 Emergency Procedures

Documented procedures are available to address the various tiers of emergencies that might arise on the FPSO or other offshore facilities. As well, there are contingency documents that address specific risks that have been identified as potential emergencies

3.8.5.5 Operational Limits

Environmental factors impose limitations on the following operations:

- station-keeping ability;
- deck loading;
- bulk storage;
- crane operation;
- helicopter movement;
- ice management; and
- crude storage and tanker loading.

The new facilities are expected to have a system efficiency comparable to that of the existing White Rose operation. Similar to White Rose, operating efficiency will be subject to equipment, reservoir and well performance as well as environmental factors.

3.8.5.6 Logistics

3.8.5.6.1 Marine Base, Warehousing, and Storage Yard

The marine base will be located in St. John's and will utilize the same facilities as the current White Rose project. The current marine base is anticipated to be able to accommodate the additional equipment required for construction of the new drill centres. During operations, no additional warehousing and storage yard space will be required above that used for the current White Rose development.

3.8.5.6.2 Support Vessels

Support vessel requirements for the operation of the new drill centres will not change from the current requirements for the White Rose project. During construction of the new drill centres, additional support vessels will be required to service drilling rigs and installation vessels.

Vessels will be continuously available in the field for standby duty in accordance with regulatory requirements. Supply vessels will convey materials, consumables and equipment to and from the offshore facilities.

All personnel staffing the support vessels will be fully trained in emergency duties. There will be routinely scheduled emergency drills and exercises.

3.8.5.6.3 Personnel Movements

As with the current White Rose project, personnel movements between St. John's and the field will normally be carried out by helicopter. During construction of the new drill centres, some additional helicopter flights may be required to transfer personnel from drilling rigs. During operations, the current helicopter requirements will remain the same since it is anticipated that no additional personnel will be required on the FPSO.

3.8.5.7 Communications

Communication requirements related to the construction and operation of the new drill centres will be integrated into the system currently used for the White Rose project. This system includes communications linkages between all of Husky's facilities both onshore and offshore.

Primary and back-up systems will continue to be used to ensure continuous communications capability amongst all facilities in all environmental conditions. The system comprises the following elements:

- FPSO and MODU/Shore Link;
- Telephone System;
- Local Area Network (LAN);
- Ship Radio System;
- Air/Ground/Air VHF Base Station;
- Air/Ground/Air VHF Hand-held Radios;
- Non-directional Beacon for Aircraft Approach;
- VHF Radio System; and
- Shore Base Radio Station Services (including marine vessel tracking and flight following).

3.8.6 Abandonment

At the end of the production life of the White Rose oilfield, Husky Oil will decommission and abandon the site according to C-NLOPB requirements and Newfoundland Offshore Petroleum Production and Conservation Regulations and any other applicable laws. Floating production facilities will be removed from the field. Subsea infrastructure will be removed or abandoned as outlined in the Whiterose Comprehensive Study and the Decision report 2001.01. The site will be restored to a condition that minimizes environmental impact.

3.8.6.1 Approval Process

At the completion of oil production from the White Rose field, Husky Oil will seek approval to decommission the facilities and abandon the field in accordance with the requirements of the *Newfoundland Offshore Petroleum Production and Conservation Regulations*.

The approval request will include all relevant data required to demonstrate that all practical and economic extraction of oil from the field has been achieved.

3.8.6.2 Abandonment Methods

3.8.6.2.1 Production and Injection Wells

Husky Oil intends to follow the following procedure for abandonment of wells:

- install cement plugs and mechanical bridge plugs as follows:
  - at the bottom of the deepest casing string;
  - above the uppermost perforations;
  - at depths not exceeding 150 m below the mudline;
  - to seal off porous, permeable formations; and
  - to seal off formations with abnormal pressures;
- remove wellheads and cut casings; and,
- displace hydrocarbons in production wells with a kill fluid and abandon.

3.8.6.2.2 FPSO

At abandonment, the FPSO will be disconnected from the risers. The topsides equipment will be decommissioned offshore, and any residual hazardous waste arising from this will be taken to shore and treated at appropriate approved waste treatment facilities. All anchors, lines and chains will be recovered.

The ultimate disposition of the FPSO will depend upon its condition at of the end of the production life of the White Rose field, and upon the options available for further use.

3.8.6.2.3 Subsea Facilities

All equipment located in glory holes will be removed and the glory holes will be left as they are. Christmas trees and manifolds will be purged, rendered safe, and recovered.

All other subsea facilities above the seafloor, including production manifolds, riser base manifolds, loading riser manifolds, flowlines, and export lines, will be purged and

decommissioned in accordance with regulations prevailing at the time. Risers and umbilicals will be decommissioned, rendered safe, and recovered.

The final abandonment and decommissioning plan has to meet C-NLOPB requirements and *Newfoundland Offshore Petroleum Production and Conservation Regulations* and any other applicable laws or regulations and will be subject to final approval by the C-NLOPB.

3.9 Description of Waste Discharges and Treatments

Waste discharges during the development will include drill muds and cuttings, produced water, grey and black water, ballast water, bilge water, deck drainage, discharges from machinery spaces, cement, blowout preventer (BOP) fluid, and air emissions. All discharges will be in compliance with the Offshore Waste Treatment Guidelines (*OWTG*). Details are provided in the following sections.

All wastes discharges associated with the FPSO and drill rigs are itemized in the respective EPPs. Waste discharges of the dredger and supply vessels would include air emissions, grey and black water, and bilge water.

3.9.1 Drilling Muds

Water-based muds (WBM) will be used where possible, usually during the first sections of each well. Synthetic-based muds (SBM) will be used to drill the majority of each well.

Components and additives typically differ somewhat by well, the specific conditions encountered in drilling, and by the depth and purpose for drilling. Typical formulations for water based drilling mud and the quantities likely to be used when drilling a vertical well hole for the surface and the conductor are provided in Section 7.0.

The first part of the hole (i.e., the surface casing and conductor) is drilled without the riser in place and thus the water based drilling mud and associated cuttings are discharged directly to the marine environment. Approximately 230 m^3 of water based cuttings will be discharged per well during this stage of the drilling.

During the drilling of the hole for the intermediate casing, the riser and associated BOP are in place and mud is transported back to the rig. Cuttings are then removed from the drilling mud in successive separation stages through shakers, hydrocyclones, and centrifuges. After passing through the solids control system, the cleaned cuttings are then discharged overboard through a cuttings chute. Recoverable mud is then reconditioned and reused. Up to 175 m^3 of cleaned cuttings could be discharged during the installation of the intermediate casing. SBM will be recycled and reused where possible, or brought to shore for disposal when spent.

All drilling cuttings and fluid discharges will be in accordance with the C-NOPB *OWTG* – August 2002 Revision and subject to approval by C-NLOPB.

3.9.2 Produced Water

3.9.2.1 Well Testing

If hydrocarbons are present and testing is conducted then small amounts of produced water may be discharged by atomizing with hydrocarbons and flared. If the flare capacity is exceeded, then small amounts of treated produced water will be brought ashore for disposal.

3.9.2.2 Production

Total amounts of produced water from the new drill centres will be within those specified in the White Rose Comprehensive Study (Husky 2000).

The composition of typical produced water is provided in Table 3.2.

Table 3.2. Typical Produced Water Composition.

Ion	Concentration (mg/L)
Na	15,860
K	250
Ca	757
Mg	102
Ba	3.01
Sr	122
Fe	2.63
B	56.4
Mn	0.25
Cl	25,550
Br	53
I	58.2
HCO_3	1068
SO_4	390

3.9.2.2.1 Produced Water Treatment

As per the White Rose Oilfield Comprehensive Study (Husky 2000), produced water separated from the gas, oil and condensate will be treated on site to meet the current OWTG (NEB, C-NOPB and C-NSOPB 1996). Produced water will be treated to reduce the oil content to 30 mg/L or less averaged over a 30-d period and subsequently discharged. Minimal, if any, produced water will be discharged during development drilling.

Compliance monitoring of produced water will be conducted as per the FPSO Environmental Protection Compliance Monitoring Plan (EPCMP). A water quality specific component of the

overall Environmental Effects Monitoring (EEM) program that will primarily address produced water is under development and will be implemented with C-NLOPB approval

3.9.3 Air Emissions

The SeaRose FPSO was designed to minimize greenhouse gas emissions (GHG) and volatile organic compounds (VOC's). These design modifications are addressed in the document referencing Condition 35 of Approval for the White Rose project. Drilling operations by comparison to production operations emit small amount of greenhouse gas emissions. The quantity of emissions from the Whiterose project is calculated and sent to the C-NLOPB annually as per the OWTG 2002 and also reported to the National Pollutant Release Inventory.

3.9.4 Grey and Black Water

Grey and black water produced on the drilling rig and FPSO is treated as per the relevant Environmental Protection Compliance Monitoring Plan (EPCMP). Black water or sewage will be macerated to 6 mm particle size or less and discharged as per the *OWTG*. Estimated amounts of black water are up to 19 m^3 per day.

3.9.5 Bilge Water

Bilge water for both the drill rig and FPSO will be treated to *OWTG* standards (15 mg/L or less).

3.9.6 Deck Drainage

Any deck drainage for both the drill rig and FPSO for both the drill rig and FPSO will be through a closed system and treated to 15 mg/L of oil or less.

3.9.7 Ballast Water

Water used for stability purposes in both supply boats, FPSO's and drilling rigs is stored in dedicated closed system tanks and does not contain any oil under normal circumstances. If oil is suspected in the ballast water it will be tested and if necessary treated to *OWTG* standards.

3.9.8 Cooling Water

3.9.8.1 FPSO

As per the FPSO EPCMP, cooling water (i.e., seawater) return is treated with chlorine as a biocide and is monitored pursuant to the OWTG. Husky's target discharge concentration is 0.5 ppm. Water from closed systems will be tested prior to discharge and will comply with the *OWTG*. Any proposals for alternate biocides will be submitted to C-NLOPB for consideration prior to use.

3.9.9 Garbage

All trash and garbage, including organic waste from galleys, will be containerized and transported to shore for disposal in approved landfills. Combustible waste such as oil rags and paint cans will be placed in hazardous materials containers for transport to shore.

3.9.10 Glycol and Other Chemicals

When drilling with semi-submersibles, BOP test fluid (glycol/water) is released at intervals (typically three pressure and three function tests per 40-day drilling). About 1.0 m^3 is released per test (Husky 2000). No other substances not discussed above or covered in the *OWTG* will be discharged without prior notification and approval of the C-NLOPB. Additional information on discharges and treatment is contained in the environmental assessment sections of this document.

3.10 Seismic Survey Equipment (Geohazard and VSP Surveys)

Geohazard/well site surveys and vertical seismic profiling (VSP) using an airgun array may be conducted as part of the drilling activities. The VSP is used to assist in further defining a petroleum resource. The array is similar to that employed by 2-D or 3-D seismic surveys but is typically smaller and deployed in a smaller area over a shorter time period (12 to 36 hours). Well site or geohazard surveys may also deploy a small array and sonar. They are used to identify and avoid geotechnically unstable areas (e.g., shallow gas deposits) or hazards (e.g., shipwrecks) prior to drilling. The proposed geohazard surveys associated with the drilling program have been assessed under separate cover (LGL and Canning & Pitt 2005).

3.11 Waste Management Plan

The waste streams related to development of the new drill centres will be managed according to the Husky Waste Management Plan currently implemented for the White Rose project. The purpose of the Husky Waste Management Plan is to provide guidance on effectively dealing with waste from the facility and avoiding environmental pollution. As with current operations, wherever possible, waste streams will be segregated so as not to create the additional problem of expensive decontamination or separation onshore.

3.12 Onsite Environmental/Ice Observers

Environmental/Ice-Observers are present on the FPSO at all times. An onsite Environmental Observer will also be on board the MODU to record and report 24-hour weather, oceanographic and ice parameters. During the period when there is a potential for icebergs, two Environmental/Ice Observers will be stationed on the MODU to assist the Drilling Operations personnel in strategic and tactical planning along with the recording and reporting the weather and oceanographic duties. As part of these duties these personnel will also assist in vessel

monitoring under the Project Collision Avoidance Procedures outlined in the East Coast Incident Coordination Plan.

The environmental observers will also conduct seabird and marine mammal observations on a daily basis in accordance with established protocols.

In addition, an Oceanographic Monitoring Program will again be conducted in accordance with the C-NLOPB *Guidelines Respecting Physical Environment Programs*. The program will be the same as previous ones and include the installation of current meters and a wave-sensing device.

3.13 Project Site Information

3.13.1 Environmental Features

The Project has the potential to affect air, water, plankton, fish and fish habitat, fisheries, marine birds, marine mammals, and sea turtles through emissions and discharges, both routine and accidental. There are no known special or unique areas in the Project Area. A description of the physical and biological environment of the northeastern Grand Banks and potential Project interactions and effects are included in this EA. A valued ecosystem component (VEC) approach is used in the EA. VECs in the area include fish, fish habitat, commercial fisheries, seabirds, marine mammals, sea turtles, and *SARA* species (including COSEWIC-listed species). Effects on VECs including cumulative effects (within the Project and with existing and planned projects) are assessed in the EA to follow. Focus is on sensitive species, areas and times, including *Species at Risk Act* (*SARA*) species.

3.13.2 Other Users

Current and past uses of the area include marine shipping, oil and gas exploration, defence-related ship traffic, and commercial fisheries. Hunting of murres, waterfowl, and seals has occurred for many years farther inshore from the Project Area.

There is a continuing problem on the Grand Banks and the approaches to the Gulf of St. Lawrence with oily discharges (i.e., mystery spills) from marine vessels in international shipping lanes. Previous disturbance of the seabed may have occurred from bottom trawling activity associated with commercial fisheries.

The closest protected bird areas are Cape St. Mary's and Witless Bay which are located about 350 and 310 km, respectively, to the west of the Study Area. In addition, the offshore region of the Grand Bank is heavily used by migratory seabirds. The "Bonavista Cod Box," a fisheries protected area, is located approximately 200 km northwest of the Study Area. The closest urban centre is St. John's, located about 300 km to the west of the Study Area.

The physical presence of the rig and supply boats affects navigable waters on the Grand Banks to a small degree. The Study Area is close to major North Atlantic shipping lanes and may receive ship traffic from fishing vessels, tankers, freighters, naval vessels, private yachts and others. The detailed physical characteristics of the waterway are provided in Section 4.0.