6.0 Effects Assessment Methodology

Two general types of effects are considered in this document:

1. Effects of the environment on the Project; and
2. Effects of the Project on the environment, particularly the biological environment.

Methods of effects assessment used here are comparable to those used in the Hibernia and Terra Nova EISs, White Rose Oilfield Development EA and Comprehensive Study, Husky Jeanne d'Arc Basin Seismic and Drilling EAs, Husky Lewis Hill Drilling EA, Chevron Orphan Basin Seismic and Drilling EA, and other east coast seismic and drilling EAs. These documents conform to the *Canadian Environmental Assessment Act* (CEAA) and it's associated Responsible Authority's Guide and the CEA Agency Operational Policy Statement (OPS-EPO/5-2000) (CEA Agency 2000). Cumulative effects are incorporated within the procedures in accordance with *CEAA* (CEA Agency 1994) as adapted from Barnes and Davey (1999) and used in the White Rose EA.

6.1 Scoping

Scoping of an assessment mainly includes determining the spatial and temporal extent of the assessment, selecting which components (i.e., sensitive and/or representative species or species-groups and associated habitats) of the ecosystem to assess, and which project activities to analyze. Scoping was conducted according to the following steps, not necessarily in chronological order.

- Review of all relevant information on project activities and literature on the effects of offshore oil and gas activities (with emphasis on previous EAs for Newfoundland and Labrador waters),

- Key group consultations at various stages of the assessment, and

- Scoping document prepared by the C-NLOPB with input from relevant government agencies such as the CEA Agency, Fisheries and Oceans, Environment Canada, other government departments, and the interested public.

6.2 Consultations

In preparation for Husky's proposed development of new drill centres, Canning and Pitt Associates, Inc. consulted with relevant government agencies, representatives of the fishing industry and other interest groups. The purpose of these consultations was to describe the Project, identify any issues and concerns, and to gather additional information relevant to the EA.

At each consultation meeting, Husky provided maps showing information available at the time on the proposed development of new drill centres. The information included the potential seafloor disturbance area related to the four proposed drill centres as well as the location of the spoils area where Husky proposes to dump the sediment removed during excavation of the glory holes.

Consultations were undertaken with the following agencies and interest groups:

- Fisheries and Oceans
- Environment Canada
- Natural History Society
- One Ocean
- Fish, Food and Allied Workers Union (FFAWU)
- Association of Seafood Producers
- Fishery Products International
- Groundfish Enterprise Allocation Council (Ottawa)
- Clearwater Seafoods
- Icewater Harvesting

Appendix 2 provides a list of agency and industry officials consulted.

6.2.1 Issues and Concerns

None of the agencies, interest groups or fisheries industry officials contacted raised any major concerns or issues related to the proposed Project. However, various agency managers and industry representatives had a number of questions and comments, as discussed below.

6.2.1.1 Environment Canada

In response to several questions from agency managers concerning the proposed development of new drill centres Project, Husky noted that approximately 100,000 m^3 of material would be excavated at each glory hole site. In response to a question about the application for the disposal permit, it was noted that Husky's application would cover all four glory holes though it expected to apply for just two this year. EC managers suggested that the company should submit two applications with the understanding that, if the second was not activated in 2006, Husky could apply for an extension to that permit in 2007.

6.2.1.2 Fishery Products International/Association of Seafood Producers

FPI representatives noted that none of their 2006 fish harvesting activities would be taking place in the vicinity of the Project Area. Company vessels will be fishing yellowtail in 3Lr and 3Nc, both of which are well to the south of the Project Area. The firm's turbot fishing activities to the

north in the vicinity of Orphan Basin area will be completed by April. Representatives also noted that FPI expects to undertake some industry surveys (northern shrimp, 3PS cod) in 2006, but none of these would be near the proposed Project activities.

A representative of the Association of Seafood Producers was invited to attend the FPI meeting but was unable to do so because of his busy schedule. However, the Association's Executive Director indicated that his organization did not have any concerns or issues with the proposed Project activities.

6.2.1.3 Icewater Seafoods

The fish harvesting consultant for Icewater Seafoods and the captain of the firm's vessel reviewed the information provided by Husky and reported that the firm would not be conducting harvesting operations within the Project Area during 2006.

6.2.1.4 FFAWU and One Ocean

Representatives of the FFAWU and One Ocean did not have any major concerns about the proposed development of new drill centres Project. Both groups suggested that it would be useful if the fisheries maps could indicate the Nova Scotia catch data separately from the Newfoundland data. They also noted that, for future consultations, they would like to receive the fisheries maps as soon as they are prepared. There was also some discussion that these fisheries maps might need to be "ground-truthed" with relevant fishers.

6.2.1.5 Other Fisheries Industry Participants

Fisheries industry managers from GEAC and Clearwater Partnership were contacted for these consultations and both received information about Husky's plans for 2006. However, to date, these groups have not yet responded.

6.3 Valued Ecosystem Components (VECs)

The Valued Ecosystem Component (VEC) approach was used to focus the assessment on those biological resources of most potential concern and value to society.

VECs include the following groups:

- rare or threatened species or habitats (as defined by COSEWIC and *SARA*);
- species or habitats that are unique to an area, or are valued for their aesthetic properties;

- species that are harvested by people (e.g., commercial fish species); and
- species that have at least some potential to be affected by the Project.

VECs were identified based on the Hibernia EIS (Mobil 1985), the Terra Nova EIS (Petro-Canada 1996a,b), the White Rose Oilfield Development EA and Comprehensive Study and associated supplement (Husky 2000, 2001a), Jeanne d'Arc Basin Seismic (LGL 2005a) and Drilling EAs (LGL 2002) and updates (LGL 2005a, 2006a), DFO and EC comments, and consultations with stakeholders and regulators. The results of the White Rose issue scoping sessions, public and agency consultations, and Commission hearings were also considered in identifying the VECs for assessment.

The VECs were selected based upon expressed public comments related to social, cultural, economic, or aesthetic values and scientific community concerns. From a local perspective, most concern for offshore oil and gas activities is related to the fishery and the seabirds. National and international issues may include such groups as deep sea corals and marine mammals. The VECs include:

- Fish Habitat
- Fish
- Commercial Fishery
- Marine Birds
- Marine Mammals
- Sea Turtles
- Species at Risk (SAR)

6.3.1 Fish Habitat VEC

'Fish habitat' is a wide-ranging concept that includes both physical and biological components. It includes coverage of fish habitat components including water quality, plankton and benthos. Both plankton (phytoplankton and zooplankton) and benthos (epifauna and infauna) are integral components of fish habitat, and, hence, of the marine ecosystem. Phytoplankton is mostly responsible for the primary production in the Northwest Atlantic marine ecosystem and essentially all plankton species serve as food sources for a vast array of marine biota. Benthos, which includes macroalgae, also accounts for some primary production and plays a very important role in the cycling of organic material through the marine ecosystem. Benthos also serves as food sources for many marine biota. Plankton and benthos can be considered the basis of the marine ecosystem food web. Certain aspects of this EA, specifically drilling, excavation and subsea construction, will require focus on the benthic aspect of fish habitat considering the nature of the proposed activities (i.e., substantial interaction between the project activities and the ocean bottom). The fish habitat VEC as it relates to key species is of prime concern from both a public and scientific perspective, at local, national and international scales.

6.3.2 Fish VEC

The fish VEC includes both invertebrates and fish. The commercial and *SARA* species previously profiled in this EA (i.e., snow crab, Atlantic halibut, Greenland halibut, Atlantic cod, and wolffishes) are suitable examples to use in the effects assessment. Atlantic cod is an important commercial and cultural species for which most data exist with respect to behaviour, life history, reproduction, etc., and therefore, is a good representative species for the fish VEC. The fish VEC is of prime concern from both a public and scientific perspective, at local, national and international scales.

6.3.3 Commercial Fishery VEC

The commercial fishery is a universally acknowledged important element in society, culture, economic and aesthetic environment of Newfoundland and Labrador. This VEC is of prime concern from both a public and scientific perspective, at local, national and international scales.

6.3.4 Marine Bird VEC

Newfoundland supports some of the largest seabird colonies in the world and the Grand Banks area hosts very large populations during all seasons. They are important socially, culturally, economically, aesthetically, ecologically and scientifically. Seabirds are a key component near the top of the food chain and are an important resource for bird watching (one of the fastest growing outdoor activities in North America), the tourist industry, local hunting, and scientific study. In addition, this VEC is more sensitive to oil on water than other VECs. This VEC is of prime concern from both a public and scientific perspective, at local, national and international scales.

6.3.5 Marine Mammal VEC

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. Public concern about whales is evident in the media on an almost daily basis. Historically, seals have played an important economic and cultural role due to the large annual seal hunt. Newfoundland and Labrador is an internationally recognized location for marine mammal scientific research. This VEC is also of prime concern from both a public and scientific perspective, at local, national and international scales.

6.3.6 Sea Turtle VEC

While sea turtles are typically scarce on the Grand Banks, they attain status of a VEC because of their endangered and threatened status in Canada, the United States and elsewhere. Of the three species known to occur on the Grand Banks, two are considered ‘endangered’ and the other

'threatened'. While they are of little or no economic, social or cultural importance to Newfoundland and Labrador, their status ensures local, national, and international scientific attention beyond their likely ecological importance to the Grand Banks ecosystem.

6.3.7 Species at Risk VEC

"Species at Risk" are those listed as endangered or threatened on Schedule I of *SARA*. All SAR species in Newfoundland and Labrador offshore waters are captured in the VECs listed above. However, due to their special status, they are also discussed separately.

6.4 Other Issues

Offshore air quality also has been given some consideration because it may affect water quality and animal and human health, albeit in very minor ways. Although the seven VECs listed above represent very broad groups of organisms, consideration was given to individual species and life stages when data were sufficient and where warranted. In many cases, during effects analysis, species with similar life histories and sensitivities were grouped together.

6.5 Boundaries

Boundaries have been defined using CEA Agency (2003) as guidance.

6.5.1 Temporal

Effects of the routine activities associated with the development of as many as four new drill centres (i.e., pre-production) have been assessed 'year-round' for the period 2007-2011. Effects of activities associated with production operations using the new drill centres have been assessed 'year-round' for the period 2009-2020. Effects of routine activities related to abandonment have been assessed for after 2020. The potential effects of accidental events (i.e., blowouts and batch spills) have also been considered.

6.5.2 Spatial

The following spatial boundaries were used.

6.5.2.1 Project Area

The Project Area is where project activities will occur in any given year. It has been defined as the White Rose Operational Area (Figure 1.1).

6.5.2.2 Study Area

The Study Area boundary is based on the oil spill trajectory modeling conducted for the White Rose Oilfield Comprehensive Study (Husky 2000). Although the Study Area is very large relative to the Project Area (Figure 1.1), it is substantially smaller than the Regional Study Area of the Comprehensive Study. If not for the consideration of accidental events, the Study Area would be much reduced in size based on routine activities alone.

6.5.2.3 Affected Area

The Affected Area is the geographic extent of a specific potential effect on a species or species group. It varies according to the timing and type of project activity in question and the sensitivities of the species. Thus, there are many affected areas or geographic extents defined in this EA.

6.5.2.4 Regional Area

The Regional Area, based on convention established by numerous previous EAs for Newfoundland and Labrador waters, includes the Study Area and the Grand Banks.

6.6 Effects Assessment Procedures

The systematic assessment of the potential effects of the Project phase involved three major steps:

1. preparation of interaction (between Project activities and the environment) matrices;

2. identification and evaluation of potential effects including description of mitigation measures and residual effects; and

3. preparation of residual effects summary tables, including evaluation of cumulative effects.

6.6.1 Identification and Evaluation of Effects

Interaction matrices identify all possible Project activities that could interact with any of the VECs. The matrices include times and places where interactions could occur. The interaction matrices are used only to identify potential interactions; they make no assumptions about the potential effects of the interactions.

Interactions were then evaluated for their potential to cause effects. In instances where the potential for an effect of an interaction was deemed impossible or extremely remote, these

interactions were not considered further. In this way, the assessment could focus on key issues and the more substantive environmental effects.

An interaction was considered to be a potential effect if it could change the abundance or distribution of VECs, or change the prey species or habitats used by VECs. The potential for effect was assessed by considering:

- location and timing of the interaction;
- modeling exercises;
- literature on similar interactions and associated effects (including the previous oil and gas EAs for Offshore Nova Scotia and Newfoundland);
- consultation with other experts (when necessary); and
- results of similar effects assessments, especially monitoring studies done in other areas.

When data were insufficient to allow certain or precise effects evaluations, predictions were made based on professional judgement. In such cases, the uncertainty is documented in the EA. For the most part, the potential effects of offshore oil and gas activities are reasonably well known.

Effects were evaluated for the proposed development of new drill centres which includes many mitigation measures that are mandatory or have become standard operating procedure in the industry.

6.6.2 Classifying Anticipated Environmental Effects

The concept of classifying environmental effects simply means determining whether they are negative or positive. The following includes some of the key factors that are considered for determining negative environmental effects, as per the CEA Agency guidelines (CEA Agency 1994):

- negative effects on the health of biota;
- loss of rare or endangered species;
- reductions in biological diversity;
- loss or avoidance of critical/productive habitat;
- fragmentation of habitat or interruption of movement corridors and migration routes (It can be argued that while this is relevant for some terrestrial EAs, it is not relevant to the offshore where there are no confined corridors or routes.);
- transformation of natural landscapes;
- discharge of persistent and/or toxic chemicals;
- toxicity effects on human health;

- loss of, or detrimental change in, current use of lands and resources for traditional purposes;
- foreclosure of future resource use or production; and
- negative effects on human health or well-being.

6.6.3 Mitigation

Most effects, including any significant ones, can be mitigated by additions to or changes in equipment, operational procedures, timing of activities, or other measures. Mitigation measures appropriate for each effect predicted in the matrix were identified and the effects of various Project activities were then evaluated assuming that appropriate mitigation measures are applied. Effects predictions were made taking into consideration both standard and project-specific mitigations and can thus be considered "residual effects."

6.6.4 Application of Evaluation Criteria for Assessing Environmental Effects

Several criteria were taken into account when evaluating the nature and extent of environmental effects. These criteria include (CEA Agency 1994):

- magnitude;
- geographic extent;
- duration and frequency;
- reversibility; and
- ecological, socio-cultural and economic context.

Magnitude describes the nature and extent of the environmental effect for each activity. Geographic extent refers to the specific area (km^2) potentially affected by the Project activity, which may vary depending on the activity and the relevant VEC. Duration and frequency describe how long and how often a project activity and/or environmental effect will occur. Reversibility refers to the ability of a VEC to return to an equal, or improved condition, at the end of the Project. The ecological, socio-cultural and economic context describes the current status of the area affected by the Project in terms of existing environmental effects. A table is provided for each VEC, indicating the results of the effects analysis. Effects predictions for accidental events are also provided in Section 8.0 for all VECs.

Magnitude was defined as:

Negligible — An interaction that may create a measureable effect on individuals but would never approach the 10% value of the 'low' rating. Rating = 0.

Low — Affects >0 to 10 percent of individuals in the affected area (i.e., geographic extent). Effects can be outright mortality, sublethal or exclusion due to disturbance. Rating = 1.

Medium — Affects >10 to 25 percent of individuals in the affected area (i.e., geographic extent). Effects can be outright mortality, sublethal or exclusion due to disturbance. Rating = 2.

High — Affects more than 25 percent of individuals in the affected area (i.e., geographic extent). Effects can be outright mortality, sublethal or exclusion due to disturbance. Rating = 3.

Definitions of magnitude used in this EA have been used previously in numerous offshore oil-related environmental assessments under CEAA during the last 15 years. These include assessments of exploratory drilling (Thompson et al. 2000; LGL 2002, 2003, 2005a,b, 2006a,b), development drilling (Petro-Canada 1996a,b; Husky 2000, 2001a), and seismic surveying (LGL 2005c, Moulton et al. 2006a; Buchanan et al. 2004a; Moulton et al. 2005b; Buchanan et al. 2004b; Christian et al. 2005).

Durations are defined as:

1	=	< 1 month
2	=	1 – 12 month
3	=	13 – 36 month
4	=	37 – 72 month
5	=	> 72 month

Short duration can be considered 12 months or less and medium duration can be defined as 13 to 36 months.

6.6.5 Cumulative Effects

Projects and activities considered in the cumulative effects assessment included:

- Within-project cumulative impacts, including other White Rose activities. For the most part, and unless otherwise indicated, within-project cumulative effects are fully integrated within this assessment;
- Hibernia and Terra Nova (other existing offshore oil developments);
- Other offshore oil exploration activity (seismic surveys and exploratory drilling). On the Grand Banks for 2007, activity will likely include multiple seismic surveys and some exploratory drilling. Activity may include two exploratory drilling programs. The estimation of seismic activity in 2007 is not yet available (K. Coady, C-NLOPB,

pers. comm.). The Labrador Shelf may also see some exploration activity because there has been recent seismic survey activity there.
- Commercial fisheries;
- Marine transportation (tankers, cargo ships, supply vessels, naval vessels, fishing vessel transits, etc.); and
- Hunting activities (marine birds and seals).

6.6.6 Integrated Residual Environmental Effects

Upon completion of the evaluation of environmental effects, the residual environmental effects (effects after project-specific mitigation measures are imposed) are assigned a rating of significance for the following:

- each project activity or accident scenario;
- cumulative effects of project activities within the Project; and
- cumulative effects of combined projects on the Grand Banks, in the Orphan Basin, and on the Labrador Shelf.

These ratings are presented in summary tables of residual environmental effects. The last of these points considers all residual environmental effects, including project and other-project cumulative environmental effects. As such, this represents an integrated residual environmental effects evaluation.

The analysis and prediction of the significance of environmental effects, including cumulative environmental effects, encompasses the following:

- determination of the significance of residual environmental effects;
- establishment of the level of confidence for prediction; and
- evaluation of the scientific certainty and probability of occurrence of the residual impact prediction.

Ratings for level of confidence, probability of occurrence, and determination of scientific certainty associated with each prediction are presented in the tables of residual environmental effects. The guidelines used to assess these ratings are discussed in detail in the sections below.

6.6.7 Significance Rating

Significant environmental effects are those that are considered to be of sufficient magnitude, duration, frequency, geographic extent, and/or reversibility to cause a change in the VEC that will alter its status or integrity beyond an acceptable level. Establishment of the criteria is based on professional judgement, but is transparent and repeatable. In this EA, a *significant* effect is defined as:

Having a high or medium magnitude for a duration greater than one year over a geographic extent greater than 100 km^2

An effect can be considered *significant*, *not significant*, or *positive*.

6.6.7.1 Level of Confidence

The significance of the residual environmental effects is based on a review of relevant literature, consultation with experts, and professional judgement. In some instances, making predictions of potential residual environmental effects is difficult due to the limitations of available data (for example, technical boundaries). Ratings are therefore provided to indicate, qualitatively, the level of confidence for each prediction.

6.6.7.2 Determination of Whether Predicted Environmental Effects are Likely to Occur

As per Husky (2000), the following criteria for the evaluation of the likelihood of predicted significant effects are used.

- probability of occurrence; and
- scientific certainty.

6.7 Monitoring/Follow-Up

Pursuant to the *OWTG*, compliance monitoring will be conducted of both the drilling and production effluent discharges. Husky currently has an EEM program in place designed to measure potential project effects. The EEM design will be revised as required to include monitoring of the new drill centres. In addition, in the unlikely event that an accidental release of oil occurs from a spill or blowout, a spill environmental effects monitoring (EEM) program may be instituted.. Refer to the East Coast Incident Coordination Plan for additional detail. Barring accidental events, no other follow-up monitoring is planned. However, environmental observers on Project vessels will continue to collect data on seabirds and marine mammals.

6.8 Effects of the Environment on the Project

Effects of the physical environment on the Project include those caused by wind, ice, waves, and currents, particularly extreme events. These are described in detail in Section 4.

Effects of the biological environment on the Project are primarily those related to biofouling. Biofouling may affect rig stability and corrosion and may also affect the interior of pipes as well as water intakes and outlets.

Effects of the environment will be mitigated by state-of-the-art weather and ice prediction, timing, selection of suitable rigs, vessels, equipment and personnel, and by adherence to Husky's HSE Plan. Effects of the environment on the Project are expected to be *not significant*.