Shelburne Basin Venture Exploration Drilling Project

Environmental Impact Statement

Summary Report

June 2014

Stantec

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Acronyms

ADW ..... Approval to Drill a Well
ASA ..... Applied Science Associates
bbl ..... barrels
BOP ..... blow out preventer
BP ..... British Petroleum Exploration Operating Company
BSF ..... below sea floor
CCG ..... Canadian Coast Guard
CEA Agency ..... Canadian Environmental Assessment Agency
CEAA, 2012 ..... *Canadian Environmental Assessment Act, 2012*
CEPA, 1999 ..... *Canadian Environmental Protection Act, 1999*
C-NLOPB ..... Canada-Newfoundland and Labrador Offshore Petroleum Board
CNSOPB ..... Canada-Nova Scotia Offshore Petroleum Board
COSEWIC ..... Committee on the Status of Endangered Wildlife in Canada
CRA ..... commercial, recreational and Aboriginal
CSAS ..... Canadian Science Advisory Secretariat
CWS ..... Canadian Wildlife Service
DFO ..... Fisheries and Oceans Canada
DP ..... dynamic positioning
EA ..... environmental assessment
EBSA ..... ecologically and biologically significant area
ECA ..... Emission Control Area
EEZ ..... Exclusive Economic Zone
EIS ..... environmental impact statement
EL ..... Exploration Licence
FSC ..... food, social and ceremonial
IBA ..... Important Bird Area
IMO ..... International Maritime Organization
km ..... kilometres
KMKNO ..... Kwilmu'kw Maw-klusuaqn Negotiation Office
LAA ..... Local Assessment Area
LCA ..... *Lophelia* Conservation Area
m ..... metres

MAPC ..... Maritime Aboriginal Peoples Council
MARPOL ..... *International Convention for the Prevention of Pollution from Ships*
MBCA ..... *Migratory Birds Convention Act*
MGS ..... Membertou Geomatics Solutions
MODU ..... mobile offshore drilling unit
MPA ..... marine protected area
NAFO ..... Northwest Atlantic Fisheries Organization
NCNS ..... Native Council of Nova Scotia
NEBA ..... Net Environmental Benefit Analysis
NS ESA ..... Nova Scotia *Endangered Species Act*
OA ..... Operations Authorization
OCSG ..... *Offshore Chemical Selection Guidelines*
OSRL-SWIS ..... Oil Spill Response Limited-Subsea Well Intervention Service
OSRP ..... Oil Spill Response Plans
OSV ..... offshore support vessel
OWTG ..... Offshore Waste Treatment Guidelines
Project ..... Shelburne Basin Venture Exploration Drilling Project
RAA ..... Regional Assessment Area
ROV ..... remotely operated underwater vehicle
SARA ..... *Species at Risk Act*
SBM ..... synthetic-based mud
SDL ..... significant discovery licence
SOCI ..... species of conservation interest
SOCP ..... *Statement of Canadian Practice*
SOEP ..... Sable Offshore Energy Project
TUS ..... Traditional Use Study
TVD ..... total vertical depth
UINR ..... Unama'ki Institute of Natural Resources
VC ..... valued component
VSP ..... vertical seismic profile
WAZ ..... wide azimuth
WBM ..... water-based mud

1.0 Introduction and Environmental Assessment Context

Shell Canada Limited (Shell) is proposing to conduct an exploratory drilling program within the area of its offshore Exploration Licences (EL) 2423, 2424, 2425, 2426, 2429 and 2430 (the Licences) (refer to Figure 1.1). These activities will be conducted according to the six-year exploration periods that commenced on March 1, 2012 for ELs 2423, 2424, 2425 and 2426 and January 15, 2013 for ELs 2429 and 2430. Shell maintains a 50% working interest and is the operator of the ELs, with a 30% non-operating interest held by ConocoPhillips and a 20% non-operating interest held by Suncor.

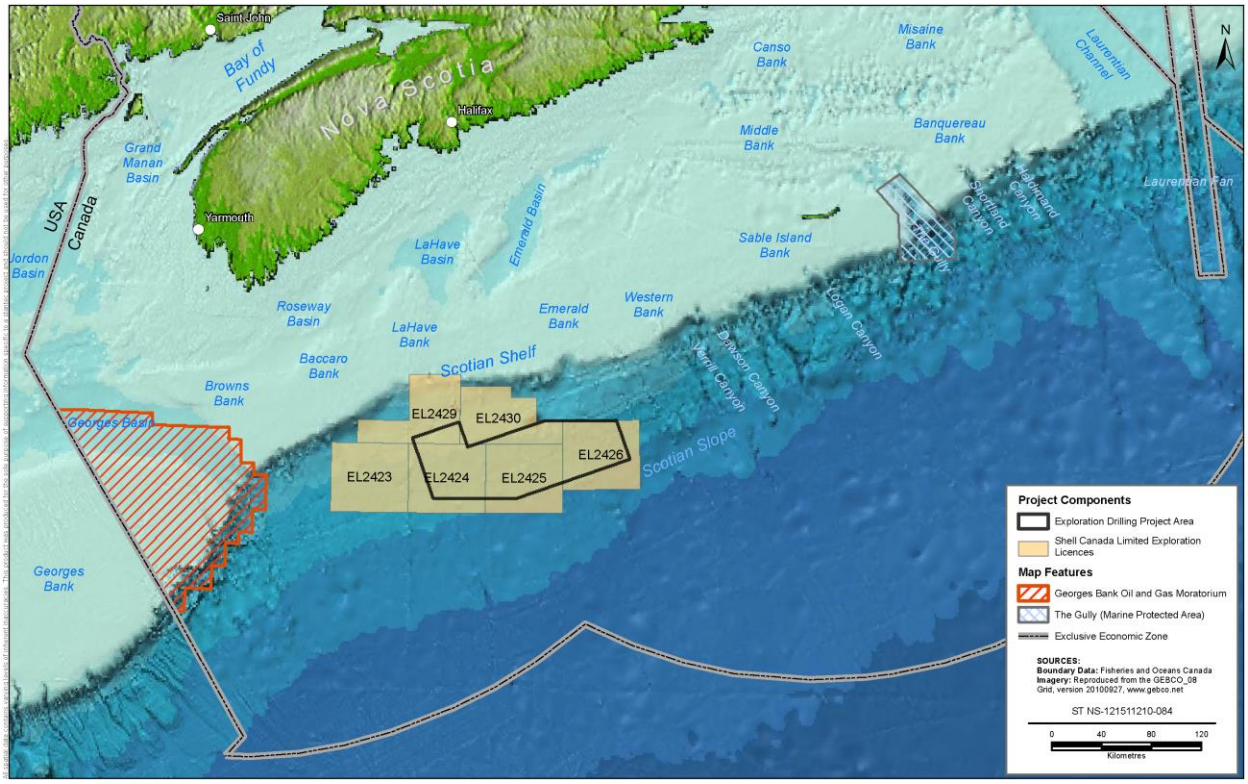

Figure 1.1 Proposed Exploration Drilling Project Area

An environmental impact statement (EIS) has been prepared to fulfill the requirements of to the *Canadian Environmental Assessment Act, 2012* (CEAA, 2012). The EIS will also fulfill environmental assessment (EA) requirements for an Operations Authorization (OA) from the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) according to the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act and the Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation (Nova Scotia) Act* (the Accord Acts). The EIS has been prepared to respond to Project-specific *Guidelines for the Preparation of an Environmental Impact Statement* pursuant to CEAA, 2012 (EIS Guidelines) which were developed for the Project

by the Canadian Environmental Assessment Agency (CEA Agency) with input from other government departments and agencies and the public.

2.0 Project Overview

The Shelburne Basin Venture Exploration Drilling Project (the Project) will consist of up to seven exploration wells drilled over a four-year period from 2015 to 2019. The Project will be divided into two separate drilling campaigns. Each phase of drilling will depend on the results from Shell's Shelburne Basin 3D seismic survey conducted in summer 2013, as well as the results of the previous Project drilling phases. Specific drilling locations have not yet been identified but will be authorized separately by the CNSOPB.

2.1 PROJECT NEED AND JUSTIFICATION

In 2011, Shell participated in a Call for Bids issued by the CNSOPB for deepwater offshore Nova Scotia parcels. In March 2012, Shell was awarded four ELs covering 13 765 km^2 (ELs 2423, 2424, 2425 and 2426) with a Work Expenditure Bid of $970 million (CNSOPB 2012a). Four additional ELs (ELs 2427, 2428, 2429, 2430) were acquired in the 2012 Call for Bids, awarded in January 2013. ELs 2429 and 2430 have a Work Expenditure Bid of almost $28 million (CNSOPB 2012b), and with their addition to the four ELs awarded in 2012 (ELs 2423, 2424, 2425, 2426), Shell now holds six contiguous ELs (ELs 2423, 2424, 2425, 2426, 2429 and 2430) covering an area of 19 845 km^2. ELs 2427 and 2428 are not included as part of the Project. In acquiring the ELs, Shell holds the exclusive right to drill and test for potential hydrocarbons, and to obtain a production licence to develop these areas in order to produce hydrocarbons should the exploratory drilling prove successful.

Exploratory drilling is required to test potential drilling targets that have been identified through the analysis of seismic data. The purpose of exploratory drilling is to determine the presence, nature and quantities of the potential hydrocarbon resource. The Project, as proposed, is also intended to meet the Work Expenditure Bid requirements to be fulfilled within the initial six year exploration period of the nine year EL.

2.2 PROJECT LOCATION

The Project Area is located approximately 250 km offshore from Halifax in a geographical offshore area known as the Southwest Scotian Slope with water depths ranging from 1500 to 3000 m depth. More specifically, the Project Area is located within the Shelburne Basin geological formation located on the Scotian Slope. The basin extends approximately 1200 km from the Yarmouth Arch on the United States and Canadian Border in the southwest to the Avalon Uplift located on the Grand Banks of Newfoundland in the North East with an average width of 250 km, and a total area of approximately 300 000 km^2 (CNSOPB 2013).

The focus of Shell's geologic work in the Shelburne Basin has been to delineate the most favorable parts of the basin for inclusion in the Project. Based on analysis of existing 2-D seismic data and 3D seismic data that was acquired by Shell's Wide Azimuth (WAZ) survey in the summer of 2013, the Project Area (refer to Figure 1.1) has been delineated to include portions of five ELs (EL 2424, 2425, 2426, 2429 and 2430), encompassing approximately 40 % of the original

leasehold. Specific drill sites have not yet been determined and will be identified using the 3D WAZ seismic data collected in 2013 as part of Shell's Shelburne Basin 3D Seismic Survey, as well as a seabed and geotechnical survey to be conducted in the Project Area in 2014.

2.3 PROJECT COMPONENTS

The Project will consist of the following primary components:

- A mobile offshore drilling unit (MODU) (a specialized drilling vessel) designed for year-round operations in deep water to be used for the drilling activities
- Offshore exploration wells (up to seven) to be drilled over a four-year period from 2015 through 2019 in two separate drilling campaigns (up to three wells in first phase and up to four wells in second)

Logistical support will also be required to support the Project, consisting of:

- Offshore support vessels (OSVs) for re-supply and for on-site standby during drilling activities
- Helicopter support for crew transport as well as delivering light supplies and equipment

The only Project component to be newly developed as part of the Project will be the offshore exploration wells. All other primary Project components and logistical support (MODU, OSVs, helicopter support, and onshore supply base) will use existing sites, infrastructure and/or equipment.

2.3.1 Mobile Offshore Drilling Unit

Either a drill ship or a semi-submersible will be used as the MODU for the Project. Both of these MODU options would use a dynamic positioning (DP) system to keep them on location and therefore have no requirement for subsea mooring (*e.g.*, anchors). The selected MODU will be capable of drilling year-round (*i.e.*, winterized) and rated for ultra-deepwater drilling in order to support the potential needs of the Project. A Certificate of Fitness for the MODU will be issued by a recognized certifying authority prior to approval for use. Some of the key components of a MODU include:

- DP system to maintain position under various environmental conditions
- Drilling derrick, which contains and operates the drilling equipment
- Ballast control used to maintain stability during operations
- Diesel-generated power system to operate the ship and the associated drilling equipment
- Helicopter deck and refueling equipment
- Existing storage space to house the associated drilling materials (fuel oil, drilling muds, cement, *etc.*) and equipment (casing) in advance of use for drilling activities

- Subsea equipment inclusive of well control equipment and marine risers to be used for drilling operations
- Cranes for supply and equipment transfer as well as support for drilling activities
- Waste management facilities for offshore treatment or temporary storage prior to shipment to shore
- Emergency and life-saving equipment inclusive of fire-fighting equipment, lifeboats and rafts for emergency evacuation
- Accommodations for up to 200 persons on board

2.3.2 Offshore Exploration Wells

Offshore exploration wells (up to seven) will be drilled over a four-year period (2015 through 2019). Final well design for the initial wells is anticipated to be completed before the end of 2014. These technical details will be provided to the CNSOPB for review and approval as part of the OA and Approval to Drill Well (ADW) applications submitted in association with the Project.

2.4 PROJECT ACTIVITIES

Upon receipt of the necessary regulatory approvals, authorizations and permits, the MODU will mobilize to the drilling site. Once the MODU is in position, pre-drill site surveys will be conducted using a remotely operated underwater vehicle (ROV) deployed to the seabed. These surveys will be conducted to confirm that no potential surface seabed hazards or sensitivities are present at the drilling location. These site surveys will take approximately one day to conduct and will include the video inspection of the seabed. Once the MODU has mobilized and ROV inspection of the seabed has been completed, drilling activities will commence.

2.4.1 Drilling

The drilling of each offshore well can be broken into two components, starting with riserless drilling (*i.e.*, an open system with no direct drill fluid return connection to the MODU) and continuing with riser drilling (*i.e.*, closed loop system with direct drill fluid return connection to the MODU). Each well is anticipated to take approximately 130 days to drill to true vertical depth (TVD).

The following activities will occur during the riserless drilling portion of each exploration well:

- The drilling will commence with jetting the conductor section in place, which will be jetted to approximately 100 m below the sea floor (BSF).
- The drill string is then re-inserted into the conductor pipe and a surface hole section is drilled to approximately 1000 m BSF. The surface casing is then lowered into the wellbore to depth and cemented in place to surface. This process of drilling, casing and cementing is followed for all further drill sections.

- A blowout preventer (BOP) stack is then placed at the end of the drilling riser pipe that is run down from surface to the well. The BOP is a critical piece of safety equipment, which is connected to the well head via the surface casing, creating a connection between vessel and well via the riser system.
- During this phase of drilling, the remaining well sections are drilled to TVD using either a water-based mud (WBM) or synthetic-based mud (SBM). The *Offshore Chemical Selection Guidelines* (OCSG) (NEB *et al.* 2009) will be applied in selecting chemicals for drilling, as well as to the proper treatment and disposal of chemicals s*electe*d.

During riserless drilling, cuttings and mud (WBM) are transported to the seabed and disposed in place. During riser drilling, cuttings and mud (SBM) are transported back to the MODU via the riser pipe. On the MODU, cuttings will be separated from the drilling mud (SBM) for management and disposal through the use of shale shakers, mud recovery units and centrifuges. The recovered drilling mud (SBM) is reconditioned and reused.

In accordance with the *Offshore Waste Treatment Guidelines* (OWTG) (NEB *et al.* 2010), spent WBM and drilling solids (*e.g.*, cuttings) associated with the use of WBM may be discharged at the drill site without treatment. In accordance with the OWTG, drill cuttings associated with the use of SBM must be treated prior to marine disposal such that the synthetic hydrocarbon on cutting does not exceed 6.9 g/100 g oil on wet solids. No whole SBM base fluid or any whole mud containing SBM as a base fluid will be discharged at sea. Spent drilling mud (SBM) that cannot be reused will be transported to shore for disposal.

2.4.2 Vertical Seismic Profiling

Vertical Seismic Profiling (VSP) may be conducted in coordination with exploratory drilling activities. A VSP survey is used to calibrate surface seismic data, giving an accurate depth measure to geological features. By recording and analyzing the reflected seismic waves, the surface seismic data can be directly tied to the well. VSP acquisition employs similar technology to that used during a seismic survey (source and receiver) although the associated size and volume of the array are much smaller than a traditional seismic survey and the activities are conducted over a much smaller spatial and temporal scale. A Zero-offset (MODU source) VSP typically takes approximately one day to acquire and would be conducted at the wellsite.

2.4.3 Well Testing

The testing of a hydrocarbon discovery is a regulatory requirement under the Accord Acts Thus, as part of exploratory drilling activities, wells may be tested to gather further details regarding the potential reservoirs and to assess the associated commerciality of any potential discovery.

As the key objective of well testing is to collect a fluid sample, perforation of the respective reservoir(s) is necessary. Once the well has been perforated, reservoir fluids are allowed to flow up the well to the deck of the MODU. In conjunction with this flow of reservoir fluids, the ship will have a temporary flow testing facility installed to handle the flow of any fluids from the wellbore.

These reservoir fluids may contain hydrocarbons (oil and gas) and/or formation water (produced water).

The hydrocarbons are measured and separated from the produced water. Produced hydrocarbons and small amounts of produced water are flared using high-efficiency igniters for complete combustion and reduction of emissions. If produced water occurs, it will either be flared or treated in accordance with the OWTG prior to ocean discharge.

2.4.4 Abandonment

All wells drilled as part of the Project will be abandoned in accordance with the *Nova Scotia Offshore Petroleum Drilling and Production Regulations*. Abandonment will take place immediately following drilling or well testing, if required.

Abandonment activities will include isolation of the wellbore using cement plugs. These plugs are placed at varying depths in the wellbore to separate and permanently isolate certain subsurface zones to prevent the escape of any subsurface fluids from the well. As part of well abandonment, approval may be sought to leave the wellhead in place. Where removal of the wellhead is required, the wellhead and associated equipment (casing) will be removed up to 1 m BSF through mechanical means (cutters).

2.4.5 Supply and Servicing

OSVs will be used for the transport of supplies from the supply base to the MODU and returning waste material for appropriate disposal onshore, as well as providing standby assistance during drilling activities.

It is anticipated that two to three OSVs will be required for the transport of associated materials and equipment (drilling fluids, casing, water, cement, fuel, *etc.*) to the MODU. During drilling activities, it is anticipated that the OSVs responsible for transporting supplies will make between two to three round trips per week from the supply base to the MODU. Transit to the Project Area by sea takes approximately 12 hours from Halifax travelling at a speed of 22 km/hour (12 knots).

Project activities will also require helicopter support for transfer of crew and light supply. During drilling activities, it is anticipated that an average of one trip per day from onshore Nova Scotia (Halifax Stanfield International Airport) to the MODU will be required. Helicopter support will also be used in the event that emergency medical evacuation from the MODU is necessary during drilling activities. The MODU will be equipped with a helicopter landing pad (including refueling capabilities) to support this service. Transit to the Project Area by helicopter takes approximately 1.5 hours from Halifax.

2.5 PROJECT SCHEDULE

The tentative schedule of Project activities outlined in Table 2.1.

Table 2.1 Proposed Project Schedule

Task	2013				2014				2015				2016				2017				2018				2019			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Project Planning																												
Stakeholder Engagement																												
Regulatory Approvals																												
First Drilling Campaign (2 to 3 wells)																												
Assessment of First Program Results																												
Well Testing *(dependent on assessment results)*																												
Potential Second Drilling Campaign (3 to 4 wells)																												
Abandonment																												

3.0 Scope of the Project and Assessment

3.1 SCOPE OF ASSESSMENT

3.1.1 Scope of the Project to be Assessed

The Project is an offshore exploratory drilling program comprising the drilling, testing and abandonment of up to seven exploration wells within a Project Area encompassing portions of Shell's offshore ELs 2423, 2424, 2425, 2426, 2429 and 2430. The scope of the Project to be assessed under CEAA, 2012 includes the following Project activities and components:

- presence and operation of MODU (including lights, safety zone, and underwater noise)
- discharge of drill muds and cuttings
- other discharges and emissions (including drilling and testing emissions)
- vertical seismic profiling (VSP)
- helicopter traffic
- OSV operations (including loading, transit, and unloading)
- well abandonment

These activities reflect the scope of the Project as outlined in the EIS Guidelines and represent physical activities that would occur on a regular basis throughout the life of the Project.

3.1.2 Factors to be Considered

The EIS gives full consideration to all of the applicable factors outlined in Section 19 of CEAA, 2012. This includes taking into account the environmental effects of the designated project, the significance of the effect, public comments, technically and economically feasible mitigation measures, follow-up and monitoring programs, the purpose of the project, alternative means of carrying out the project, and any change of the project that may be cause by the environment. The EIS must also address any other matter relevant to the environmental assessment that the responsible authority, requires to be taken into account.

3.1.3 Scope of the Factors to be Considered

The scope of the factors to be considered focuses the assessment on the relevant issues and concerns. As per Section 5(1) of CEAA, 2012, the environmental effects that are to be taken into account in relation to an act or thing, a physical activity, a designated project, or a project are:

> *(a) a change that may be caused to the following components of the environment that are within the legislative authority of Parliament:*
>
> *(i) fish as defined in section 2 of the* Fisheries Act *and fish habitat as defined in subsection 34(1) of that Act,*

(ii) aquatic species as defined in subsection 2(1) of the Species at Risk Act*,*

(iii) migratory birds as defined in subsection 2(1) of the Migratory Birds Convention Act, 1994*, and*

(iv) any other component of the environment that is set out in Schedule 2 of [CEAA, 2012];

(b) a change that may be caused to the environment that would occur

(i) on federal lands,

(ii) in a province other than the one in which the act or thing is done or where the physical activity, the designated project or the project is being carried out, or

(iii) outside Canada; and

(c) with respect to Aboriginal peoples, an effect occurring in Canada of any change that may be caused to the environment on

(i) health and socio-economic conditions,

(ii) physical and cultural heritage,

(iii) the current use of lands and resources for traditional purposes, or

(iv) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

Certain additional environmental effects must be considered under Section 5(2) of CEAA, 2012 where the carrying out of the physical activity, the designated project, or the project requires a federal authority to exercise a power or perform a duty or function conferred on it under any Act of Parliament other than CEAA, 2012. This is the case for the Project, as Shell will require authorizations from CNSOPB under the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act* in order for the Project to proceed. Therefore, the following environmental effects have also been considered:

(a) a change, other than those referred to in paragraphs (1)(a) and (b), that may be caused to the environment and that is directly linked or necessarily incidental to a federal authority's exercise of a power or performance of a duty or function that would permit the carrying out, in whole or in part, of the physical activity, the designated project or the project; and

(b) an effect, other than those referred to in paragraph (1)(c), of any change referred to in paragraph (a) on

(i) health and socio-economic conditions,

(ii) physical and cultural heritage, or

(iii) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

These categories of direct and indirect environmental effects have been taken into account in defining the scope of the assessment as well as the scope of factors to be considered in the assessment. These considerations are inclusive of the selection of Valued Components and the identification of spatial and temporal boundaries.

3.2 ENVIRONMENTAL ASSESSMENT METHODS

3.2.1 Overview of Approach

The method used to conduct the EA for the Project is based on a structured approach that is consistent with international best practices for conducting environmental impact assessments, and with the approach used by Stantec for EAs of other major projects assessed by the CEA Agency. The assessment approach is to:

- focus on issues of greatest concern
- consider key issues raised by Aboriginal peoples, stakeholders, and the public
- integrate engineering design and programs for mitigation and follow-up into a comprehensive environmental planning process

This approach includes identification and assessment of potential adverse environmental effects of the Project on Valued Components (VCs). VCs are environmental attributes associated with the Project that are of particular value or interest because they have been identified to be of concern to Aboriginal peoples, regulatory agencies, Shell, resource managers, scientists, key stakeholders, and/or the general public.

It is noted that "environment" is defined to include not only ecological systems but also human, social, cultural, and economic conditions that are affected by changes in the biophysical environment. As a result, VCs relate to ecological, social, and economic systems that comprise the environment.

The potential environmental effects of Project activities and components are assessed using a standard framework to facilitate individual assessment of each VC. Residual Project-related environmental effects (*i.e.*, those environmental effects that remain after the planned mitigation measures have been considered) are characterized for each individual VC using specific analysis criteria (*i.e.*, nature of the effect, magnitude, geographic extent, duration, frequency, reversibility, and environmental context). The significance of residual Project-related environmental effects is then determined based on pre-defined standards or thresholds (*i.e.*, significance rating criteria).

For the purposes of the effects assessment, a **significant adverse residual environmental effect** is defined as a Project-related environmental effect that results in one or more of the following outcomes:

- a decline in abundance or change in distribution of species populations within the LAA, such that natural recruitment may not re-establish the population(s) to its original level within one generation
- jeopardizes the achievement of self-sustaining population objectives or recovery goals for listed species
- permanent and irreversible loss of critical habitat as defined in a recovery plan or an action strategy
- results in serious harm to fish not counterbalanced through offsetting measures in accordance with DFO's Fisheries Protection Policy Statement (2013)
- contravenes applicable legislation (*e.g.*, SARA, MBCA, NS ESA)
- local fishers or Aboriginal fishers being displaced or unable to use substantial portions of the areas currently fished for all or most of a fishing season
- change in the availability of fisheries resources such that resources cannot continue to be used at current levels within the RAA for more than one fishing season
- unmitigated damage to fishing gear

VC-specific significance thresholds are provided in Section 7 of the EIS.

Environmental effects associated with potential accidental events are assessed focusing on plausible accidental events, including those that could result in significant environmental effects in the unlikely event that they do occur (refer to Section 6.7).

The assessment of effects of the environment on the Project considers potential changes to the Project that may result from interactions with the environment or natural events (refer to Section 6.8).

Cumulative environmental effects are those where there is potential for the residual environmental effects of the Project to interact cumulatively with the residual environmental effects of other past, present, or future (*i.e.*, certain or reasonably foreseeable) physical activities in the vicinity of the Project (refer to Section 6.9).

3.2.2 Identification of VCs

The following six VCs were selected to facilitate a focused and effective EA process:

- Fish and Fish Habitat
- Marine Mammals and Sea Turtles
- Marine Birds

- Special Areas
- Commercial Fisheries
- Current Aboriginal Use of Lands and Resources for Traditional Purposes

Table 3.1 presents the VCs assessed in the EIS and the rationale for their selection. The table also provides the rationale for excluding certain environmental components that were identified in the EIS Guidelines as potential VCs for consideration.

Table 3.1 VCs Assessed in the EIS and Rationale for their Selection

Environmental Components Specified in EIS Guidelines	VC Determination	Basis for Inclusion or Exclusion as a VC
Biophysical Environment		
Atmospheric Environment and Climate	In consideration of the environmental context and the mitigation referred to in the next column, it has been determined that environmental effects on atmospheric environment and climate do not warrant focused assessment. Accordingly, this component has not been selected as a VC.	• All nearshore and offshore Project-related vessel operations will take place in Canada's portion of the North American Emission Control Area (ECA), which was implemented under amendments to the Dangerous Chemicals Regulations pursuant to the *Canada Shipping Act* that were adopted in 2013 under Annex VI to MARPOL. • Given the distance offshore, the Project Area does not contain any receptors that would be sensitive to atmospheric emissions from routine Project activities or malfunctions and accidental events.
Fish and Fish Habitat	This VC is included in consideration of its ecological importance, the socio-economic importance of fisheries resources (*i.e.*, target fish species), the legislated protection of fish and fish habitat and applicable SOCI, and the nature of potential Project-VC interactions.	• Several species of fish (including SOCI) are known to occur in the vicinity of the Project Area and have potential to be affected (including habitat effects) by Project activities and components as well as malfunctions and accidental events associated with the Project. • Project effects on fish and fish habitat species have been identified as an issue of concern during Aboriginal engagement. • Fish and fish habitat are protected under the *Fisheries Act*. • Section 5(1)(a) of CEAA, 2012 requires consideration of project-related environmental effects associated with a change to a component of the environment within the legislative authority of Parliament (*e.g.*, fish and fish habitat as defined in the *Fisheries Act*).
Marine Mammals	This VC is included in consideration of its ecological importance, the legislated protection of applicable SOCI, and the nature of potential	• Several species of marine mammals (including SOCI) are known to occur in the vicinity of the Project Area and have potential to be affected by Project activities and components as well as malfunctions and accidental events associated with the Project.

Table 3.1 VCs Assessed in the EIS and Rationale for their Selection

Environmental Components Specified in EIS Guidelines	VC Determination	Basis for Inclusion or Exclusion as a VC
	Project-VC interactions. Marine mammals and sea turtles are considered within the same VC due to the similarities in their potential interactions with the Project.	• Section 5(1)(a) of CEAA, 2012 requires consideration of project-related environmental effects associated with a change to a component of the environment within the legislative authority of Parliament (*e.g.*, aquatic species as defined in SARA).
Marine Turtles	This VC is included in consideration of its ecological importance, the legislated protection of applicable SOCI, and the nature of potential Project-VC interactions. Marine mammals and sea turtles are considered within the same VC due to the similarities in their potential interactions with the Project.	• Several species of marine turtles (including SOCI) are known to occur in the vicinity of the Project Area and have potential to be affected by Project activities and components as well as malfunctions and accidental events associated with the Project. • Section 5(1)(a) of CEAA, 2012 requires consideration of project-related environmental effects associated with a change to a component of the environment within the legislative authority of Parliament (*e.g.*, aquatic species as defined in SARA).
Marine Birds	This VC is included in consideration of its ecological importance, the legislated protection of migratory birds and other applicable SOCI, and the nature of potential Project-VC interactions.	• Several species of marine birds (including SOCI) are known to occur in the vicinity of the Project Area and have potential to be affected by Project activities and components as well as malfunctions and accidental events associated with the Project. • Migratory birds are protected under the *Migratory Birds Convention Act* (MBCA). • Section 5(1)(a) of CEAA, 2012 requires consideration of project-related environmental effects associated with a change to a component of the environment within the legislative authority of Parliament (*e.g.*, migratory birds as defined in the MBCA).
Species at Risk and Species of Conservation Concern	In consideration of the environmental context referred to in the next column, it has been determined that environmental effects on SOCI are more appropriately assessed as part of the Marine Mammals and Sea Turtles VC, the Fish and Fish Habitat VC, and the Marine Birds VC. SOCI will be included as part of these VCs and will not be	• Species at risk and species of conservation concern are collectively referred to in the EIS as SOCI. More specifically, SOCI include the following: o species listed on Schedule 1 of SARA and their critical habitat, which are federally protected o species assessed as endangered, threatened or of special concern by the federal Committee on the Status of Endangered Wildlife of Canada (COSEWIC) o species listed under the Species at Risk Regulations pursuant to the Nova Scotia *Endangered Species Act* (NS ESA), which are provincially protected • Several SOCI are known to occur in the vicinity of

Table 3.1 VCs Assessed in the EIS and Rationale for their Selection

Environmental Components Specified in EIS Guidelines	VC Determination	Basis for Inclusion or Exclusion as a VC
	assessed as a distinct, stand-alone VC.	the Project Area, including fish, other aquatic species (*e.g.*, marine mammals, turtles) and migratory birds, and have potential to be affected by routine Project activities as well as malfunctions and accidental events associated with the Project. • SOCI can be more vulnerable to changes in their habitat or population levels than secure species and therefore require special consideration. However, in general, evaluation of potential environmental effects and mitigation measures taken to protect SOCI are also protective of secure species. • With respect to marine mammals and sea turtles, many of the species found in the area are considered SOCI and therefore separate VCs to assess secure species and SOCI would be highly redundant. This redundancy has have been avoided in the EIS through consideration of SOCI as applicable within the Marine Mammals and Sea Turtles VC.
Special Areas	This VC is included in consideration of its ecological and/or socio-economic importance, the legislated protection of applicable special areas, and the nature of potential Project-VC interactions.	• Several special areas (*i.e.*, areas designated as being of special interest due to their ecological and/or conservation sensitivities, including those protected under federal legislation) are known to occur in the vicinity of the Project Area and have potential to be affected by Project activities and components and/or malfunctions and accidental events associated with the Project. • Special areas provide important habitat for certain SOCI.
Human Environment		
Other Ocean Use (*e.g.*, shipping, research, oil and gas, military activities, ocean infrastructure)	In consideration of the environmental context and the mitigation referred to in the next column, it has been determined that environmental effects on other ocean use do not warrant assessment as a VC. Accordingly, this component has not been selected as a VC. However, 'other ocean use' is discussed generally in the EIS as indicated.	• Offshore oil and gas exploration in Canadian waters is a highly regulated activity. Standard guidelines and protocols govern nearly every aspect of exploration activities, including avoidance of conflicts with other ocean users such as military activities and scientific research. In particular, Notices to Shipping and Notices to Mariners are issued to notify other ocean users of the presence of potential navigational obstructions posed by exploration activities. • Other ocean users with potential to be affected by the Project will be notified regarding the timing and location of Project activities and components (*e.g.*, through direct communications and/or the issuance of Notices to Shipping and Notices to Mariner) to mitigate potential disruption.

Table 3.1 VCs Assessed in the EIS and Rationale for their Selection

Environmental Components Specified in EIS Guidelines	VC Determination	Basis for Inclusion or Exclusion as a VC
Commercial Fisheries	This VC is included in consideration of its economic importance and the nature of potential Project-VC interactions.	• Commercial fishing activity is known to occur in the vicinity of the Project Area and has potential to be affected by Project activities and components as well as malfunctions and accidental events associated with the Project. • Commercial fishing activity in the nearshore waters of Nova Scotia has potential to be affected by malfunctions and accidental events associated with the Project. However, Project activities and components will not interfere with nearshore fisheries due to the use of existing shipping routes by OSVs. • Environmental effects on Aboriginal fisheries (including communal commercial fisheries) are assessed with respect to the Current Use of Lands and Resources for Traditional Purposes VC.
Recreational Fisheries	In consideration of the environmental context and the mitigation referred to in the next column, it has been determined that environmental effects on recreational fisheries do not warrant focused assessment. Accordingly, this component has not been selected as a VC.	• DFO has indicated that no recreational fishing licence holders are known to fish offshore in the vicinity of the Project Area (DFO, pers. comm. 2014). • Recreational fishing activity in the nearshore waters of Nova Scotia has potential to be affected by malfunctions and accidental events associated with the Project. However, Project activities and components will not interfere with nearshore fisheries due to the use of existing shipping routes by OSVs. • Nearshore recreational fisheries tend to target the same species that are fished commercially. In general, mitigation measures for the protection of nearshore commercial fishing activity (and associated target fish species) from Project-related malfunctions and accidental events are also protective of nearshore recreational fishing activity (and associated target fish species). It is therefore anticipated that mitigation proposed for the Fish and Fish Habitat VC and the Commercial Fisheries VC are sufficient to mitigate similar environmental effects on recreational fisheries.
Current Use of Lands and Resources for Traditional Purposes by Aboriginal Peoples	This VC is included in consideration of its socio-economic, socio-cultural and/or traditional importance; in recognition of potential or established Aboriginal and Treaty Rights; and due to the nature of potential Project-VC interactions.	• Aboriginal communal commercial fishing activity is known to occur in the vicinity of the Project Area and has potential to be affected by Project activities and components as well as malfunctions and accidental events associated with the Project. • Aboriginal commercial and traditional fishing activities are carried out under communal commercial licences and FSC licences in the nearshore waters of Nova Scotia. Nearshore Aboriginal fisheries have potential to be affected by malfunctions and accidental events associated with

Table 3.1 VCs Assessed in the EIS and Rationale for their Selection

Environmental Components Specified in EIS Guidelines	VC Determination	Basis for Inclusion or Exclusion as a VC
		the Project. However, Project activities and components will not interfere with nearshore and offshore Aboriginal fisheries due to the use of common shipping routes by OSVs. • Section 5(1)(c) of CEAA, 2012 requires consideration of project-related environmental effects, with respect to Aboriginal peoples, associated with a change to the environment on the current use of lands and resources for traditional purposes.
Human Health	In consideration of the environmental context and the mitigation referred to in the next column, it has been determined that environmental effects on human health do not warrant focused assessment. Accordingly, this component has not been selected as a VC.	• Given its distance offshore, the Project would be unlikely to affect any receptors that would be sensitive to atmospheric air or noise emissions from routine Project activities and components or from malfunctions and accidental events. • Project activities and components are not anticipated to result in any changes to the environment that would have an effect on human health. Emissions will be discharged in accordance with allowable concentrations stated in the OWTG. • Malfunctions and accidental events (*i.e.*, spills) associated with the Project could result in contamination of fish species commonly harvested for human consumption through commercial, recreational, and/or Aboriginal fisheries. However, fisheries closures would be imposed in the event of such an incident, thereby reducing human exposure to contaminated food sources. Similarly, the imposition of an exclusion zone around the affected area(s) would prevent human contact with spilled oil.
Physical and Cultural Heritage (including structures, sites or things of historical, archaeological, paleontological or architectural significance)	In consideration of the environmental context and the mitigation referred to in the next column, it has been determined that environmental effects on physical and cultural heritage do not warrant focused assessment. Accordingly, this component has not been selected as a VC.	• Project activities and components are not anticipated to result in any changes to the environment that would have an effect on physical and cultural heritage. • The results of various surveys conducted in the Project Area prior to seabed disturbance will inform the selection of drilling locations where no heritage resources are present. • OSV and helicopter transport activities will not result in any ground/seabed disturbance. Therefore, they will not affect heritage resources.

3.2.3 Spatial and Temporal Boundaries

Consideration of environmental effects in the EIS is conceptually bound in both space and time. This consideration is commonly known as defining the spatial and temporal boundaries of the assessment. The spatial boundaries must reflect the geographic range over which the Project's potential environmental effects may occur, recognizing that some environmental effects will extend beyond the Project Area. Temporal boundaries identify when an environmental effect may occur in relation to specific Project activities and components. The temporal boundaries are based on the timing and duration of Project activities and the nature of the interactions with each individual VC. Spatial and temporal boundaries are developed in consideration of:

- timing/scheduling of Project activities for all Project phases
- natural variations of each VC
- information gathered on current and traditional land and resource use
- the time required for recovery from an environmental effect
- potential for cumulative environmental effects

The temporal boundaries for the Project to be assessed includes all Project phases, inclusive of drilling, testing and abandonment and assume Project activities could occur year-round, with up to seven exploration wells drilled sequentially over a four year period (up to 130 days per well).

The spatial boundaries for the Project to be assessed are defined below and depicted on Figure 3.1.

Project Area: The Project Area encompasses the immediate area in which Project activities and components may occur and as such represents the area within which direct physical disturbance may occur as a result of the Project. Future well locations have not currently been identified, but will occur within the Project Area and represent the actual Project footprint. The Project Area is consistent for all VCs and includes portions of EL 2424, 2425, 2426, 2429 and 2430 as depicted on Figure 3.1.

Local Assessment Area (LAA): The LAA is the maximum area within which environmental effects from Project activities and components can be predicted or measured with a reasonable degree of accuracy and confidence. It consists of the Project Area and adjacent areas where Project-related environmental effects are reasonably expected to occur based on available information and professional judgement. The LAA has also been defined to include OSV routes to and from the Project Area.

Regional Assessment Area (RAA): The RAA is the area within which residual environmental effects from Project activities and components may interact cumulatively with the residual environmental effects of other past, present, and future (*i.e.*, certain or reasonably foreseeable) physical activities. The RAA is restricted to the 200 nautical mile limit of Canada's exclusive economic zone (EEZ), including offshore marine waters of the Scotian Shelf and Slope within

Canadian jurisdiction. The western extent of the RAA encompasses the Georges Bank Oil and Gas Moratorium Area and terminates at the international maritime boundary between Canada and the United States. The eastern extent of the RAA encompasses the Gully MPA and terminates at the eastern edge of Banquereau Bank. A portion of the Scotian Shelf and the Nova Scotia coastline to the Bay of Fundy is also included as part of the RAA boundary.

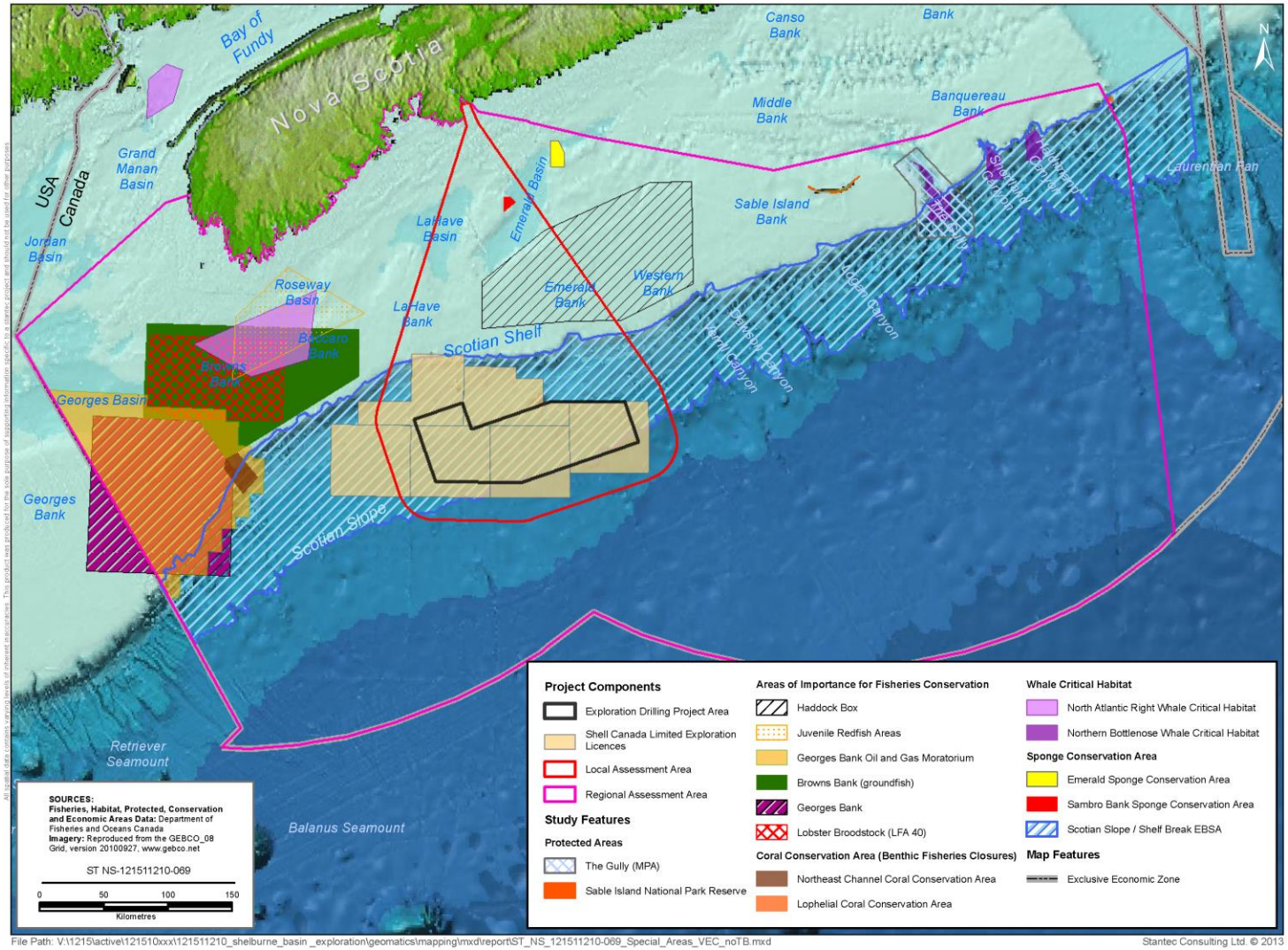

Figure 3.1 Spatial Boundaries for Environmental Assessment

4.0 Alternative Means of Carrying out the Project

As required under Section 19(1)(g) of CEAA, 2012, every environmental assessment of a designated project must take into account the alternative means of carrying out the project that are technically and economically feasible and also consider the environmental effects of any such alternative means.

The process followed for consideration of alternative means of carrying out the Project included the following steps:

- Consideration of technical feasibility of alternative means of carrying out the Project (*e.g.*, safety, schedule, operational feasibility considerations)
- Consideration of economic feasibility of alternative means of carrying out the Project
- Consideration of the environmental and socio-economic effects of the identified technically and economically feasible alternatives of carrying out the Project
- Selection of the preferred alternative means of carrying out the Project, based on the relative consideration of effects and of technical and economic feasibility

There are a limited number of viable alternative means for undertaking deepwater drilling. The alternative means of carrying out the Project identified for evaluation within the EIS are:

- type of mobile offshore drilling unit (MODU) (*e.g.*, drill ship or semi-submersible)
- selection and use of drilling fluids (*e.g.*, WBM or SBM)
- options for drilling waste management (*e.g.*, sea disposal, onshore disposal, or reinjection)
- MODU lighting alternatives (*e.g.*, reduced offshore lighting, spectral modified lighting, scheduled flaring)

A summary of the alternative means of carrying out the Project is provided in Table 4.1, including technical and economic feasibility, biophysical effects and socio-economic effects.

Table 4.1 Summary of Alternative Means of Carrying out the Project

Component of Analysis	Alternative Means of Carrying Out the Project Considered	Technical Feasibility	Economic Feasibility	Biophysical Effects	Socio-economic Effects	Preferred Option
MODU	Drill ship	Yes	Yes	There is no substantive difference in environmental effects between drill ship versus a DP semi-submersible, although a drill ship will emit a higher noise level. A drill ship travels at faster speeds than a semi-submersible during mobilization; however, the speed range of both is below that considered to be high risk for marine mammal strikes.	There is no substantive difference in socio-economic effect benefit or effect of either MODU alternative. Both require a similar-sized safety zone, resulting in similar effects on fishing activity.	✓
	Semi-submersible	Yes	Yes, but additional costs associated with mobilization/ demobilization activities			
	Jack-up	No	Not applicable (not technically feasible)	Not applicable (not technically feasible)	Not applicable (not technically feasible)	
	Anchored semi-submersible	No	Not applicable (not technically feasible)	Not applicable (not technically feasible)	Not applicable (not technically feasible)	
Drilling Fluid	WBM only	Yes, but technical issues with borehole stability	Yes, but additional costs associated with potential operation delays associated with technical issues	No substantive difference in environmental effects between WBM and WBM/SBM assuming OWTG are followed with respect to SBM discharges. SBMs generally accumulate closer to the wellsite, limiting the zone of influence. WBMs remain suspended longer with greater potential to affect filter-feeding organisms. Both types of drill muds would be treated and disposed of in	No substantive difference in socio-economic effects between WBM and WBM/SBM. Biological effects will be in compliance with the OWTG, not cause serious harm to fish, and will not affect fisheries outside the safety zone.	
	SBM/WBM	Yes	Yes			✓

Table 4.1 Summary of Alternative Means of Carrying out the Project

Component of Analysis	Alternative Means of Carrying Out the Project Considered	Technical Feasibility	Economic Feasibility	Biophysical Effects	Socio-economic Effects	Preferred Option
				compliance with the OWTG and not cause serious harm to fish.		
Drilling Waste Management	Seabed/surface disposal	Yes	Yes	Onshore disposal would have less environmental effect on marine environment; but transport of drill wastes to shore results in additional transit emissions and the potential effects of onshore waste disposal. Both types of drill muds would be in compliance with the OWTG and not cause serious harm to fish.	No substantive difference in socio-economic effects between WBM and WBM/SBM. Biological effects will be in compliance with the OWTG, not cause serious harm to fish, and will not affect fisheries in outside the safety zone.	✓
	Onshore disposal	Yes	Yes, but additional costs for transport and for possible operational delays			
	Reinjection	No, this option would require additional reinjection well to be drilled	No, increased costs for additional infrastructure and reinjection well would not make this option economically feasible	Not applicable (not technically and economically feasible)	Not applicable (not technically and economically feasible)	
MODU Lighting and Flaring	Standard lighting	Yes	Yes	MODU lighting can attract migratory birds and result in strandings and/or harm from flare. Opportunities may exist to reduce lighting and and/or direct lighting to reduce effects without compromising worker safety.	There are no socio-economic effects associated with standard lighting.	✓

Table 4.1 Summary of Alternative Means of Carrying out the Project

Component of Analysis	Alternative Means of Carrying Out the Project Considered	Technical Feasibility	Economic Feasibility	Biophysical Effects	Socio-economic Effects	Preferred Option
	Spectral modified lighting	No, not readily available for commercial use at this time	No, not considered commercially viable at this time	Not applicable (not technically and economically feasible)	Not applicable (not technically and economically feasible)	
	Timing restrictions on flaring	Yes	Yes, additional costs if result in scheduling modifications	Activities are of short-duration.	There is no socio-economic effect associated with this option, assuming health and safety of workers is not compromised by reduced flaring.	✓

Through the EIS Guidelines (CEA Agency 2014), Shell has also been asked to address the quantity and types of chemicals that may be used in support of the Project and chemical selection process to identify less toxic alternatives. Shell is in an early stage of Project planning and does not yet have detailed information on chemical selection alternatives. The OCSG provide an accepted framework for the selection of chemicals in support of offshore operations.

5.0 Public and Aboriginal Engagement

Shell is committed to managing the effects, both positive and negative, of its business activities on the communities and areas it operates in. Shell works with neighboring communities, First Nations, governments, and other interested members of the public to enhance the understanding of the Project, reduce environmental and social effects and to develop appropriate ways to provide benefits from their operations

5.1 PUBLIC CONSULTATION

Consultation and engagement with public stakeholders for the Project focused on the following objectives:

- provision of current and relevant Project information and regular updates of the proposed activities
- identification of stakeholder key areas of interest and concern
- identification and implementation of a preferred process
- discussions about the potential environmental and socio-economic effects of the Shelburne Basin Project, and the opportunities to reduce and mitigate these effects
- identification of existing activities in the Project Area, particularly as it relates to commercial and traditional use
- establishment of feedback mechanisms for stakeholders to provide input into the Project design

Key stakeholders groups for consultation included:

- Commercial fisheries interests
- Regulatory agencies
- Regional and municipal governments
- Special interest groups
- Industry associations

5.1.1 Stakeholder Consultation Activities

Engagement activities in association with the Shelburne Basin Venture have been ongoing since 2012. Initially focused on engaging stakeholders interested in or potentially affected by the Shelburne Basin 3D Seismic Survey, Shell has expanded the scope of stakeholders to include others that have been identified or expressed interest during the planning phase for the Shelburne Basin Venture Exploration Drilling Project. Focused engagement on the Project began

in August 2013 and has involved a variety of methods of engagement including, but not limited to:

- Project information packages
- Supplier information sessions
- Face-to-face meetings
- Public Project presentations (including speaking engagements at industry associations)

Identified stakeholders will continue to be engaged throughout the planning process and operational stages of the Project.

As part of the EA process under CEAA 2012, the public has also been engaged through invitation to review various EA-related documents prepared by Shell and by the Agency including the Project Description (Shell and Stantec 2013), and Draft EIS Guidelines (CEA Agency 2014) prior to completion of the EIS report. Following submission of the EIS, the document will be posted on the CEA Agency website. The public and interested stakeholders will be invited to review and comment on the EIS as well as an EA Report prepared by the CEA Agency. Shell will also engage with key stakeholders to discuss the information included in the EIS. Shell will also develop and implement a Fisheries Communication Plan that will coordinate communication prior to and during Project activities to reduce disruption to any fisheries activity.

5.1.2 Stakeholder Questions and Comments

Questions and comments raised during engagement activities for the Project have been tracked and managed since August 2013 and have been considered in the preparation of the EIS. As issues are identified and documented, key individuals within the Shell Project team with the appropriate expertise are identified to address each issue for timely response to stakeholders.

Issues and concerns raised during the consultation and engagement process can be summarized by the following themes:

- General queries on operational details of the Project
- General concerns on Project effects on the marine ecosystem (flora and fauna)
- Potential effects on fisheries activities
- Questions and concerns regarding emergency response in the event of a blowout
- Questions about the different types of drilling mud used and disposal methods

Specific questions and concerns raised as well as the associated response, can be found in Section 3.4 of the EIS. A log of meetings is included as Appendix D of the EIS.

5.2 ABORIGINAL ENGAGEMENT

Shell is committed to meaningful and productive engagement with Aboriginal Groups during Project planning and implementation. The goal of Shell's d Aboriginal engagement for the Project is to ensure that Shell, and the appropriate Crown agencies and decision makers, are aware of and informed on the potential for Project effects on the exercise of Aboriginal and Treaty rights, and potential opportunities to mitigate those effects. Both the Crown and First Nations have noted that Project-related consultation is occurring between the Crown and the Nations directly as part of pre-Confederation Peace and Friendship Treaties. As Project proponent, Shell has taken a role of Project information sharing and relationship building in support of Crown consultation efforts.

5.2.1 Aboriginal Organizations

There are 13 Mi'kmaq communities of Nova Scotia. The General Assembly of Nova Scotia Mi'kmaq Chiefs (General Assembly) currently comprises the Chiefs from 12 of the 13 First Nations in Nova Scotia (Shubenacadie/Indian Brook First Nation operates separately) and represents the governance for the Mi'kmaq of Nova Scotia. The Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO) supports and represents the Nova Scotia Assembly with respect to consultation regarding how projects may impact Mi'kmaq Aboriginal or treaty rights, and directions regarding such matters are obtained through the KMKNO. The Shubenacadie/Indian Brook Mi'kmaq Nation currently conducts its administrative affairs outside of the KMKNO.

The Maritime Aboriginal Peoples Council (MAPC) is a regional Aboriginal Peoples Leaders Institution established by the Native Council of Nova Scotia (NCNS), the Native Council of Prince Edward Island, and the New Brunswick Aboriginal Peoples Council. MAPC represents the Mi'kmaq, Maliseet, and Passamaquoddy Aboriginal Peoples of Canada who continue to live on their traditional ancestral homelands (off-reserve). In Nova Scotia, the NCNS advocates for all off-reserve Mi'kmaq/Aboriginal people throughout traditional Mi'kmaq territory (NCNS 2013) and has established 13 geographic "Community Zones" encompassing the province of Nova Scotia to administer their affairs.

In addition to the Mi'kmaq of Nova Scotia, the Project has the potential to interact with other Aboriginal users of the lands and resources in the vicinity of the Project. There are 15 First Nation Bands in New Brunswick, three of which have been identified by the CEA Agency for engagement based on fisheries interests in and around the Project Area. These include Fort Folly Mi'kmaq First Nation, St. Mary's Maliseet First Nation, and Woodstock Maliseet First Nation.

5.2.2 Aboriginal Engagement Activities

Shell's Aboriginal engagement approach has included:

- Project information packages
- face-to-face meetings

- conduct of a Traditional Use Study (TUS)
- phone calls and emails seeking input and feedback
- development and participation by First Nations in Supplier Information Sessions in Nova Scotia
- input to the development of Fisheries Communication and Emergency Response Plans, as requested

A log of meeting dates is provided in Appendix D of the EIS. Ongoing Project updates, check-ins and timely responses to questions or concerns will take place throughout the Project.

In an effort to better understand traditional use of marine areas and resources by Aboriginal peoples and potential Project-related effects on potential or established Aboriginal rights and related interests, Shell commissioned Membertou Geomatics Solutions (MGS) and Unama'ki Institute of Natural Resources (UINR) to undertake a TUS. First Nation communities were selected for interviews based on knowledge of fishing interests and/or through consultation with the CEA Agency; these include: Millbrook, Shubencadie, Acadia, Eskasoni, Bear River, and Glooscap First Nations in Nova Scotia, and Fort Folly, St. Mary's, and Woodstock First Nations in New Brunswick. The Native Council of Nova Scotia was also included in the list of organizations to be contacted.

Interviews with fisheries managers, captains, and fishers, along with literature reviews and a review of DFO licences, were used to help characterize traditional and/or communal commercial fisheries activities for each group. In particular, species of commercial and cultural significance, general fishing areas, and fishing seasons were discussed, along with any additional information pertaining to fish or sensitive areas, or issues or concerns regarding potential Project interactions. Nations that were interested and available to participate up until the time of EIS submission are included in the TUS results.

The TUS report has been appended to the EIS (Appendix B) and is not intended to represent an exhaustive inventory of Aboriginal fisheries occurring offshore Nova Scotia, but helps characterize potential interactions with the Project. Shell will continue to engage Aboriginal organizations in Nova Scotia and New Brunswick as applicable to share information on the Project and identify potential issues and concerns that it will seek to address.

5.2.3 Aboriginal Questions and Comments

Key issues raised during meetings with NS and NB Aboriginal organizations focused on the following themes:

- Well process safety
- Environmental effects of oil/gas activity on commercial, and food, social, ceremonial (FSC) fish species
- Drilling program exclusions zones

- Socio-economic effects of an accidental spill on commercial and FSC fishing activity
- Potential socio-economic benefits of the Shelburne Basin Project
- Compensation for damages in the event of an accidental event

In response to these questions and concerns, Shell hosted meetings where it presented on Well Process Safety, general safety policies, and spill response. Shell has also committed to implementing a Fisheries Communication Plan to reduce disruption to any fisheries activity.

Specific questions and concerns raised as well as the associated response, can be found in Section 4.5 of the EIS.

6.0 Summary of Environmental Effects Assessment

6.1 FISH AND FISH HABITAT

Fish and fish habitat was selected as a VC in consideration of the ecological value provided to marine ecosystems, the socio-economic importance of fisheries resources (*i.e.*, target fish species), the EIS Guidelines, and the potential for interactions with Project activities and components. Key issues raised during stakeholder and Aboriginal engagement for the Project to date include a general concern about the effects of routine activities and accidental events on fish and fish habitat and the biodiversity of marine life in and around the Project Area.

6.1.1 Existing Conditions

Marine benthic, demersal, and pelagic fish species and habitat are present in and around the Project Area, LAA and RAA. Section 5.2.3 of the EIS provides life history details, including information about seasonal occurrence and sensitive periods, for certain marine fish species (*i.e.*, SOCI and species of importance to CRA fisheries) that are likely to occur in the RAA and could potentially interact with the Project.

Available benthic habitat mapping in the vicinity of the Project Area suggests the presence of a low energy, Holocene mud and clay benthos with Ophuroid, burrowing anemone and sea urchin as typical benthic fauna likely to be encountered. A seabed survey to be conducted in Q2 2014, as well as the pre-drilling ROV survey at the wellsite, will confirm the absence of coral concentrations or other sensitive or unique benthic habitat at the proposed drilling locations.

Eggs and larvae of the majority of fish species of commercial, recreational or Aboriginal (CRA) fisheries that may occur in the vicinity of the Project Area tend to be found on the banks of the Scotian Shelf and/or in nearshore waters, rather than on the Slope. In particular, most larval fish species were found to occur along the banks of the Scotian Shelf from Emerald Bank to Sable Island, with some occurring even further east (towards the Laurentian Channel), and others found in nearshore waters. The following fish species are identified as potentially having eggs/larvae located on the Scotian Slope and in the vicinity of the Project Area: Acadian redfish, deepwater redfish, roundnose grenadier, silver hake, and witch flounder (Horsman and Shackell 2009). The eggs/larvae of these species are present on the Scotian Shelf and Slope during June-October (silver hake), April-August (Acadian redfish and deepwater redfish), May-December (witch flounder), and in some cases, year-round (roundnose grenadier).

Table 6.1 lists the key fish species of CRA value that are most likely to occur in the RAA.

Table 6.1 Fish Species of Commercial, Recreational or Aboriginal Value Found in the RAA

Common Name	Scientific Name
Groundfish Species	
Acadian redfish	*Sebastes fasciatus*
American plaice	*Hippoglossoides platessoides*
Atlantic cod	*Gadus morhua*
Atlantic halibut	*Hippoglossus hippoglossus*
Cusk	*Brosme brosme*
Deepwater redfish	*Sebastes mentalla*
Haddock	*Melanogrammus aeglefinus*
Hagfish	*Myxine glutinosa*
Monkfish	*Lophius americanus*
Pollock	*Pollachius virens*
Red hake	*Urophycis chuss*
Sandlance	*Ammodytes dubius*
Silver hake	*Merluccius bilinearis*
Turbot – Greenland flounder	*Reinhardtius hippoglossoides*
White hake	*Urophycis tenuis*
Witch flounder	*Glyptocephalus cynoglossus*
Yellowtail founder	*Limanda ferruginea*
Pelagic Species	
Albacore tuna	*Thunnys alalunga*
Atlantic herring	*Clupea harengus*
Atlantic mackerel	*Scomber scombrus*
Bigeye tuna	*Thunnus obesis*
Black dogfish	*Centroscyllium fabricii*
Bluefin tuna	*Thunnus thynnus*
Blue shark	*Prionace glauce*
Capelin	*Mallotus villosus*
Porbeagle shark	*Lamna nasus*
Shortfin mako shark	*Leurus oxyringus*
Swordfish	*Xiphias gladuis*
White marlin	*Tetrapturus albidus*
Yellowfin tuna	*Thunnus albacores*
Invertebrates	
American lobster	*Homarus americanus*

Table 6.1 Fish Species of Commercial, Recreational or Aboriginal Value Found in the RAA

Common Name	Scientific Name
Jonah crab	*Cancer borealis*
Atlantic sea scallop	*Placopecten magellanicus*
Iceland sea scallop	*Chlamys islandica*
Northern shrimp	*Panadalus borealis*
Sea cucumber	*Class holothuroidea*
Shortfin squid	*Illex illecebrosus*
Snow crab	*Chionoecetes opilio*
Striped shrimp	*Panadalus montagui*
Stimpson's surf clam	*Mactromeris polynyma*

Table 6.2 lists the fish SOCI that can be found in the RAA, and their respective statuses under SARA and COSEWIC.

Table 6.2 Fish Species of Conservation Interest Found in the RAA

Common Name	Scientific Name	Status	
		SARA	COSEWIC
Groundfish Species			
Acadian redfish (Atlantic population)	*Sebastes fasciatus*	Not Listed	Threatened
American plaice (Maritime population)	*Hippoglossus platessoides*	Not Listed	Threatened
Atlantic cod (Laurentian South population)	*Gadus morhua*	Not Listed	Endangered
Atlantic cod (Southern population)		Not Listed	Endangered
Atlantic (striped) wolffish	*Anarhichas lupus*	Special Concern	Special Concern
Cusk	*Brosme brosme*	Not Listed	Endangered
Deepwater redfish (Northern population)	*Sebastes mentalla*	Not Listed	Threatened
Northern wolffish	*Anarhichas denticulatus*	Threatened	Threatened
Roughhead grenadier	*Macrourus berglax*	Not Listed	Special Concern
Roundnose grenadier	*Coryphaenoides rupestris*	Not Listed	Endangered
Smooth skate (Laurentian-Scotian population)	*Malacoraja senta*	Not Listed	Special Concern
Spiny dogfish (Atlantic population)	*Squalus acanthias*	Not Listed	Special Concern
Spotted wolffish	*Anarhichas minor*	Threatened	Threatened
Thorny skate	*Amblyraja radiate*	Not Listed	Special Concern

Table 6.2 Fish Species of Conservation Interest Found in the RAA

Common Name	Scientific Name	Status	
		SARA	COSEWIC
Pelagic Species			
American eel	*Anguilla rostrata*	Not Listed	Threatened
Atlantic bluefin tuna	*Thunnus thynnus*	Not Listed	Endangered
Atlantic salmon (Inner Bay of Fundy population)	*Salmo salar*	Endangered	Endangered
Atlantic salmon (Outer Bay of Fundy population)		Not Listed	
Atlantic salmon (Eastern Cape Breton population)			
Atlantic salmon (Nova Scotia Southern Upland population)			
Atlantic sturgeon (Maritimes Populations)	*Ancipenser oxyrinchus*	Not Listed	Threatened
Basking shark (Atlantic population)	*Cetorhinus maximus*	Not Listed	Special Concern
Blue shark (Atlantic population)	*Priomace glauca*	Not Listed	Special Concern
Porbeagle shark	*Lamna nasus*	Not Listed	Endangered
Shortfin mako	*Isurus oxyrinchus*	Not Listed	Threatened
Striped bass (Southern Gulf of St. Lawrence population)	*Morone saxatilis*	Not Listed	Special Concern
Striped bass (Bay of Fundy population)		Not Listed	Endangered
White shark	*Carcharodon Carcharias*	Endangered	Endangered

6.1.2 Potential Environmental Effects

Potential environmental effects of the Project on fish and fish habitat are:

- Change in Risk of Mortality or Physical Injury
- Change in Habitat Quality and Use

Fish within the LAA may be subject to increased risk of mortality or physical injury due to underwater noise emissions during certain Project activities (*i.e.*, MODU operation and VSP surveys), and the smothering of marine benthos during the deposition of routine discharges of drill muds and cuttings. VSP surveys are estimated to emit the highest sound level of Project activities and components, although they are expected to occur for only a period of one day per well, if required. Based on the conservative application of predictive sound modelling

conducted for Shell's Shelburne Basin 3D Seismic Survey (refer to LGL 2013) as well consideration of accepted thresholds for auditory injury in fish species from impulsive noise (*i.e.* 206 dB_{0-p} re 1 µPa), it is estimated that sound levels from VSP surveys could potentially result in some physical injury mortality of fish located within an 80 m radius of the wellsite during the VSP. Given that the majority of mobile fish species are expected to avoid underwater noise at lower levels than those at which injury or mortality would occur, SPLs received by fish from the MODU and VSP are unlikely to result in any physical effects. Mortality of fish eggs/larvae could also occur within a few metres of the seismic source; however the diversity and abundance of fish eggs/larvae in the Project Area and surrounding LAA is generally expected to be low. It is therefore assumed that the amount of eggs/larvae with potential to be adversely affected by Project activities and components will be negligible relative to the total amount present in the RAA; any mortality attributed to the seismic survey would be within the natural range of mortality of fish eggs and larvae.

A change in risk of mortality or physical injury could also occur as a result of drill waste which will be discharged in accordance with the OWTG. Based on sediment dispersion modelling conducted for the Project (refer to Appendix C of the EIS), it is predicted that approximately 1.89 ha per well of benthos will experience drill waste deposition thicknesses at or above 10 mm (an average thickness shown to cause smothering of benthic communities comprised of sedentary or slow moving species (Neff *et al*. 2000; Neff 2004)).

A change in habitat quality could result from underwater noise emissions from MODU operation, VSP surveys, OSV operations, and well abandonment, as well as routine discharges may also affect habitat quality to the extent that it may result in sensory disturbance that triggers behavioural responses (*e.g*., change in swimming patterns) in fish within the LAA.

No residual environmental effects have been identified, and environmental effects on Fish and Fish Habitat are not predicted to be significant. No serious harm to fish that are part of a CRA fishery, or permanent alteration or destruction of habitat for fish that are part of a CRA fishery or fish that support such a fishery is predicted to occur as a result of the Project. Effects of accidental events are presented in Section 6.7.5. Mitigative commitments to address potential adverse environmental effects are presented in Section 7.

6.2 MAMMALS AND SEA TURTLES

Marine Mammals and Sea Turtles was selected as a VC in recognition of the ecological value they provide to marine ecosystems, specific regulatory requirements of SARA, requirements of the EIS Guidelines, and potential interactions with the Project.

During consultation and engagement, questions were raised about how Shell has incorporated marine mammal migration routes into Project planning and effects assessment of accidental events on the marine environment in and around the Project Area. General questions were also raised around the effects of routine Project activities on the marine environment.

6.2.1 Existing Conditions

A number of marine mammal and sea turtle SOCI are known to occur within the Scotian Slope region and may potentially interact with the Project. There are six species of mysticetes and ten species of odontocetes known to occur on the Western Scotian Slope which could potentially interact with the Project. Marine mammals are present on the Scotian Shelf and Slope year-round, although more species are commonly present between May and September. Cetaceans are sighted more often in areas where there are greater bathymetric changes such as along the shelf edge, in the slopes of basins on the shelf, and in the canyons connecting the deep slope waters up to the shallower waters of the shelf as a result of high levels of primary productivity due to bathymetric variations. There are five species of pinnipeds (seals) that can be found foraging year-round in the waters over the Scotian Shelf and Slope, although only the grey seal and harbour seal are known to breed offshore Nova Scotia (Sable Island) and their presence would be rare in the Project Area. There are four species of sea turtles that can be found migrating and foraging on the Scotian Shelf and Slope, although only the endangered leatherback turtle and the loggerhead turtle are known to regularly forage in Atlantic Canada waters. These species are known to occur in the vicinity of the Project Area primarily between April and December.

Table 6.3 lists the marine mammal and sea turtle SOCI which have the potential to occur in the RAA, and their respective statuses under SARA and COSEWIC. This list of SOCI represents approximately half of the total marine mammal and sea turtle species that may occur in the RAA. No seal populations within the RAA are considered SOCI.

Table 6.3 Marine Mammal and Sea Turtle Species of Conservation Interest Found in the RAA

Common Name	Scientific Name	Status	
		SARA	COSEWIC
Marine Mammals			
Mysticetes			
Blue whale (Atlantic population)	*Balaenoptera musculus*	Schedule 1, Endangered	Endangered
Fin whale (Atlantic Population)	*Balaenoptera physalus*	Schedule 1, Special Concern	Special Concern
Humpback whale (Western North Atlantic population)	*Megaptera novaeangliae*	Schedule 3, Special Concern	Not at Risk
North Atlantic right whale	*Eubalaena glacialis*	Schedule 1, Endangered	Endangered
Odontocetes			
Harbour porpoise (Northwest Atlantic population)	*Phocoena phocoena*	Schedule 2, Threatened	Special Concern
Killer whale	*Orcinus orca*	Not Listed	Special Concern

Table 6.3 Marine Mammal and Sea Turtle Species of Conservation Interest Found in the RAA

Common Name	Scientific Name	Status	
		SARA	COSEWIC
(Northwest Atlantic/Eastern Arctic population)			
Northern bottlenose whale (Scotian Shelf Population)	*Hyperoodon ampullatus*	Schedule 1, Endangered	Endangered
Sowerby's beaked whale	*Mesoplodon bidens*	Schedule 1, Special Concern	Special Concern
Sea Turtles			
Leatherback sea turtle	*Dermochelys coriacea*	Schedule 1, Endangered	Endangered
Loggerhead sea turtle	*Caretta caretta*	Not Listed	Endangered

No critical habitat for marine mammals or sea turtle species has been designated within the Project Area or LAA presently, but critical habitat for marine mammal SOCI does occur within the RAA. Critical habitat for the North Atlantic right whale has been identified in Roseway Basin (approximately 95 km northwest of the Project Area and 65 km from the LAA) and critical habitat for the northern bottlenose whale has been identified in the Gully, and Shortland and Haldimand canyons (approximately 260 km northeast of the Project Area and 230 km from the LAA). Although critical habitat has not yet been designated for the leatherback sea turtle they and other sea turtles are known to migrate through and forage along the Scotian Slope. Critical habitat for the leatherback sea turtle is expected to be designated in 2014 and will likely encompass a large area within the RAA.

6.2.2 Potential Environmental Effects

Potential environmental effects of the Project on marine mammals and sea turtles are:

- Change in Risk of Mortality or Physical Injury
- Change in Habitat Quality and Use

Marine mammal and sea turtles within the LAA may be subject to increased risk of mortality or physical injury due to auditory damage from underwater noise emissions during certain Project activities (*i.e.*, MODU operation and VSP surveys) and potential collisions with transiting OSVs. Based on a conservative approach of applying predictive modelling results from Shell's Shelburne Basin 3D Seismic Survey EA (refer to LGL 2013) to estimate effects from VSP, a Change in Risk of Mortality or Physical Injury for marine mammals and sea turtles has potential to occur up to approximately 244 m from the VSP sound source. However, based on mitigation to reduce effects of seismic sound (*e.g.*, ramping up of sound levels and use of marine mammal observers

to communicate appropriate shut-down; refer to Section 7) marine mammals and sea turtles are unlikely to approach close enough to the VSP sound source to be exposed to sound levels capable of causing auditory injury. Based on consideration of thresholds for auditory injury for various marine mammals as well as the estimated SPLs generated by the MODU, there is potential that some marine mammals (odontocetes) may experience auditory injury from drilling noise. In consideration of some studies that have documented avoidance by marine mammals of intense sounds sources, it is expected that marine mammals may not approach close enough to the MODU to be exposed to sound levels capable of causing auditory injury. The presence and operation of OSVs potentially increases the risk of mortality or physical injury through collisions with marine mammals or sea turtles. Reduced vessel speed, use of existing shipping lanes and seasonal avoidance of the Roseway Basin (refer to Section 7) will mitigate this risk.

Underwater noise emissions from MODU operation, VSP surveys, and OSV operations, as well as routine operational discharges may temporarily affect the quality of marine mammal and sea turtle habitat and result in sensory disturbance that triggers behavioural responses in marine mammals and sea turtles within the LAA. Sensory disturbance associated with well abandonment and helicopter traffic may similarly elicit temporary behavioural changes during these activities. Any change in habitat quality and use would be expected to be restricted to within the LAA. Behavioural effects are not expected to occur outside of the LAA, or extend beyond the end of the drilling or VSP program. , There is no known unique habitat or feeding areas for marine mammals or sea turtles that occurs exclusively within the Project Area or the LAA. Any temporary avoidance of the LAA by marine mammals or sea turtles is not likely to result in population level effects. With the application of proposed mitigation and environmental protection measures, the residual environmental effects on Marine Mammals and Sea Turtles from Project activities and components are predicted to be not significant. Effects of accidental events are presented in Section 6.7.5. Mitigative commitments to address potential adverse environmental effects are presented in Section 7.

6.3 MARINE BIRDS

Marine Birds was selected as a VC due to their ecological value to marine and coastal ecosystems, potential interaction with Project activities and components, regulatory requirements of the MBCA, SARA, and the NS *Endangered Species Act* and requirements in the EIS Guidelines. The Marine Birds VC includes pelagic (*i.e.*, offshore) and neritic (*i.e.*, inshore) seabirds, waterfowl, and shorebirds that are protected under the MBCA.

Based on feedback from consultation and engagement activities conducted to date by Shell for the Project, there have been no issues or concerns specifically raised with respect to Marine Birds. However, general issues and concerns about the effects of Project activities and components on the marine environment have been raised and are addressed as applicable in this VC.

6.3.1 Existing Conditions

Waters off the Scotian Shelf are known to be nutrient rich and highly productive due to the complex oceanographic conditions of the area and it has been estimated that over 30 million seabirds use eastern Canadian waters each year (Fifield *et al.* 2009). Large numbers of breeding marine birds as well as millions of migrating birds from the southern hemisphere and northeastern Atlantic can be found using the area throughout the year (Gjerdrum *et al.* 2008, 2012). The combination of northern hemisphere birds and southern hemisphere migrating birds results in a diversity peak during spring months (Fifield *et al.* 2009). During the fall and winter, significant numbers of overwintering alcids, gulls, and Northern Fulmars can be found in Atlantic Canadian waters (Brown 1986); in the summer, species assemblages are dominated by shearwaters, storm-petrels, Northern Fulmars, and gulls (Fifield *et al.* 2009).

The waters of the RAA are known to support approximately 19 species of pelagic seabirds, 14 species of neritic seabirds, 18 species of waterfowl, and 22 shorebird species (Table 6.4), with more occurring in the area as rare vagrants or incidentals. However, many of these species have a coastal affinity and would therefore not be expected to regularly occur in waters of the Project Area.

There are six marine bird SOCI that occur within the RAA for the Project: Ivory Gull, Piping Plover, Roseate Tern, Red Knot, Harlequin Duck, and Barrow's Goldeneye. Critical habitat is identified for both Piping Plover and Roseate Tern within the RAA but does not occur within the LAA.

Table 6.4 Marine Birds Found in the RAA[1]

Common Name	Species Name
Pelagic Seabirds	
Atlantic Puffin	*Fratercula arctica*
Black-legged Kittiwake	*Rissa tridactyla*
Common Murre	*Uria aalge*
Cory's Shearwater	*Calonectris diomedea borealis*
Dovekie	*Alle alle*
Great Shearwater	*Puffinus gravis*
Great Skua	*Stercorarius skua*
Leach's Storm-Petrel	*Oceanodroma leucorhoa*
Long-tailed Jaeger	*Stercorarius longicaudus*
Manx Shearwater	*Puffinus puffinus*
Northern Fulmar	*Fulmarus glacialis*
Northern Gannet	*Morus bassanus*
Parasitic Jaeger	*Stercorarius parasiticus*
Pomarine Jaeger	*Stercorarius pomarinus*
Razorbill	*Alca torda*
Sooty Shearwater	*Puffinus griseus*
South Polar Skua	*Stercorarius maccormicki*
Thick-Billed Murre	*Uria lomvia*
Wilson's Storm-Petrel	*Oceanites oceanicus*

Table 6.4 Marine Birds Found in the RAA[1]

Common Name	Species Name
Neritic Seabirds	
Arctic Tern	*Sterna paradisaea*
Black Guillemot	*Cepphus grille*
Black-headed Gull	*Larus ridibundus*
Bonaparte's Gull	*Larus philadelphia*
Common Tern	*Sterna hirundo*
Double-Crested Cormorant	*Phalacrocorax auritus*
Glaucous Gull	*Larus hyperboreus*
Great Black-backed Gull	*Larus marinus*
Great Cormorant	*Phalacrocorax carbo*
Herring Gull	*Larus argentatus*
Iceland Gull	*Larus glaucoides*
Ivory Gull[2]	***Pagophila eburnea***
Ring-billed Gull	*Larus delawarensis*
Roseate Tern[3]	***Sterna dougallii***
Waterfowl	
American Black Duck	*Anas rubripes*
American Green-winged Teal	Anas crecca
Barrows Goldeneye[4]	***Bucephala islandica***
Black Scoter	Melanitta nigra
Bufflehead	*Bucephala albeola*
Canada Goose	*Branta Canadensis*
Common Eider	*Somateria mollissima*
Common Goldeneye	*Bucephala clangula*
Common Loon	*Gavia immer*
Greater Scaup	*Aythya marila*
Harlequin Duck[5]	***Histrionicus histrionicus***
Lesser Scaup	Aythya affinis
Long-tailed Duck	*Clangula hyemalis*
Mallard	Anas platyrhynchos
Red-breasted Merganser	*Mergus serrator*
Red-throated Loon	*Gavia stellata*
Surf Scoter	Melanitta perspicillata
White-winged Scoter	Melanitta fusca
Shorebirds	
American Golden-Plover	*Pluvialis dominica*
Black-bellied Plover	*Pluvialis squatarola*
Dunlin	*Calidris alpina*
Greater Yellowlegs	*Tringa melanoleuca*
Killdeer	*Charadrius vociferus*
Least Sandpiper	*Calidris minutilla*
Lesser Yellowlegs	*Tringa flavipes*
Pectoral Sandpiper	*Calidris melanotos*
Piping Plover (melodus subspecies)[6]	***Charadrius melodus melodus***

Table 6.4 Marine Birds Found in the RAA[1]

Common Name	Species Name
Purple Sandpiper	*Calidris maritima*
Red Knot rufa ssp[7]	***Calidris canutus rufa***
Red Phalarope	*Phalaropus fulicaria*
Red-necked Phalarope	*Phalaropus lobatus*
Ruddy Turnstone	*Arenaria interpres*
Sanderling	*Calidris alba*
Semipalmated Plover	*Charadrius semipalmatus*
Semipalmated Sandpiper	*Calidris pusilla*
Short-billed Dowitcher	*Limnodromus griseus*
Spotted Sandpiper	*Actitis macularius*
Whimbrel	*Numenius phaeopus*
White-rumped Sandpiper	*Calidris fuscicollis*
Willet	*Tringa semipalmata*

[1]Excludes rare transients / vagrants, except for Species at Risk which are known to occasionally occur (*e.g.*, Ivory Gull).
[2]Ivory Gull is designated as endangered under SARA (Schedule 1) and by COSEWIC.
[3]Roseate Tern is designated as endangered under SARA (Schedule 1), the NS ESA, and by COSEWIC.
[4]Barrows Goldeneye is designated as a species of special concern under SARA (Schedule 1) and by COSEWIC.
[5]Harlequin Duck is designated as a species of special concern under SARA (Schedule 1) and by COSEWIC; and is listed as endangered under the NS ESA.
[6]Piping Plover (melodus subspecies) is designated as endangered under SARA (Schedule 1), the NS ESA, and by COSEWIC.
[7]Red Knot rufa ssp is designated as endangered under SARA (Schedule 1), the NS ESA, and by COSEWIC.

The richness and abundance of marine birds on the Scotian Shelf and Slope during summer months reflects the presence of migrating birds and those that breed in nearby areas. During summer months, the coastline of the RAA supports over a hundred colonies of nesting marine birds, ranging in size from a few individuals to thousands of breeding pairs. These colonies are known to support Atlantic Puffins, Black-legged Kittiwakes, Common Eiders, cormorants, Leach's Storm-Petrels, Great Black-back Gulls, Herring Gulls, Razorbills, and terns (including Common, Arctic, and Roseate Terns). Leach's Storm-Petrel is the most numerous breeding seabird in the RAA with the vast majority breeding on Bon Portage Island near Cape Sable Island.

Nine coastal Important Bird Areas (IBAs) are present within the RAA: The Brothers (NS003), Bon Portage Island (NS015), South Shore (Barrington Bay Sector) (NS018), Eastern Cape Sable Island (NS016), South Shore (Roseway to Baccaro) (NS017), South Shore (Port Joli Sector) (NS004), South Shore - East Queens Co. Sector (NS024), Grassy Island Complex (NS026), and Sable Island (NS025). These areas have been designated as IBAs for a variety of reasons including the presence of breeding habitat for species at risk, important shorebird migration habitat, important coastal waterfowl habitat, and/or the occurrence of regionally significant colonial marine bird colonies.

6.3.2 Potential Environmental Effects

Potential environmental effects of the Project on marine birds are:

- Change in Risk of Mortality or Physical Injury
- Change in Habitat Quality and Use

Marine birds within the LAA may be subject to increased risk of mortality or physical injury due to auditory damage from underwater noise emissions during VSP surveys; collisions with the MODU, helicopters, and OSVs; harm from flaring on the MODU; and exposure to other platform or vessel -based threats. The presence of potential marine bird attractants (*e.g.*, Project-related lights, flares, sanitary wastes) may affect habitat quality and use to further increase risk of mortality or physical injury.

Artificial lighting associated with the MODU and OSVs and/or short-term flaring during well testing have potential to result in strandings and increased opportunities for predation, collisions and exposure to vessel-based threats. In particular, lights and flares are known to attract storm-petrels, Dovekies, and shearwaters (Wiese *et al.* 2001). A number of factors influence the potential severity of marine bird interactions with flares, including the time of year, location, height, light and cross-sectional areas of the obstacle and weather conditions (Weir 1976; Wiese *et al.* 2001). In addition to damage from the flare, seabirds have been observed to circle flares for days, eventually dying of starvation (Bourne 1979).

Underwater noise emissions from MODU operation and VSP surveys may temporarily affect the ambient sound conditions of marine bird habitat and result in sensory disturbance that triggers behavioural responses in marine birds within the LAA. Project discharges will be in accordance with the OWTG and/or MARPOL as applicable; although there may be residual hydrocarbons in some allowable discharges (*e.g.*, bilge water, ballast water, deck drainage), these discharges are not predicted to have a measurable effect on marine birds. With the application of proposed mitigation and environmental protection measures, the residual environmental effect on Marine Birds during routine Project activities is predicted to be not significant. Effects of accidental events are presented in Section 6.7.5. Mitigative commitments to address potential adverse environmental effects are presented in Section 7.

6.4 SPECIAL AREAS

Special Areas has been selected as a VC due to their ecological and/or socio-economic importance, stakeholder and regulatory interests, and potential to interact with the Project. The Project Area overlaps spatially with a portion of the Scotian Slope/Shelf Break EBSA. The Haddock Box and the Sambro Bank Sponge Conservation Area are within the LAA portion surrounding the OSV route to Halifax Harbour. Several other Special Areas are also located within the RAA (refer to Figure 3.1).

Although no specific issues have been raised to date in stakeholder and Aboriginal engagement with respect to Special Areas, general questions and concerns around effects on fish and fish habitat (including the seabed), the biodiversity of marine life in and around the Project Area, and marine mammal migration have been considered as applicable to this VC.

6.4.1 Existing Conditions

Other than the Scotian Slope/Shelf Break Ecologically and Biologically Significant Area (EBSA), there are no Special Areas located within the Project Area. The Scotian Slope/Shelf Break EBSA is recognized for: unique geology; high finfish and squid diversity; value as a migratory route for large pelagic fishes, cetaceans, and sea turtles; overwintering habitat for a number of shellfish and finfish species (*e.g.*, lobster, Atlantic halibut); foraging area for leatherback sea turtles; feeding and overwintering area for seabirds; and habitat for Greenland sharks (Doherty and Horsman 2007). Approximately 97 % of the Project Area falls within the Scotian Slope/Shelf Break EBSA. However, the EBSA is very large (approximately 68 603 km^2) and the Project Area constitutes only about 11 % of the total area of the EBSA.

The LAA for the OSV route crosses through the Haddock Box and encompasses the Sambro Bank Sponge Conservation Area. Located 60 km and 152 km, respectively, from the Project Area, these Special Areas are not expected to be affected by well drilling, testing or abandonment activities, including noise or other discharges from routine activities.

Table 6.5 lists the Special Areas in the RAA and the approximate distance (in order of proximity) to the Project Area.

Table 6.5 Proximity of Special Areas to the Project Area and LAA

Special Area	Distance from Project Area	Distance from LAA
Scotian Slope/Shelf Break EBSA	0 km	0 km
Browns Bank (Haddock Spawning Closure)	56 km	26 km
Haddock Nursery Closure, Emerald/Western Bank (Haddock Box)	60 km	0 km
Redfish Nursery Closure Area (Bowtie)	92 km	33 km
North Atlantic Right Whale Critical "Habitat/Area to be Avoided	95 km	65 km
Lobster Fishing Area 40 (Georges Bank)	105 km	75 km
Georges Bank Oil and Gas Moratorium Area	120 km	107 km
Northeast Channel Coral Conservation Area	130 km	100 km
Hell Hole (Northeast Channel)	135 km	105 km
Sambro Bank and Emerald Basin Sponge Conservation Areas	152 km, 182 km	0 km, 27 km
Georges Bank Fishery Closure (5Z)	158 km	117 km

Table 6.5 Proximity of Special Areas to the Project Area and LAA

Special Area	Distance from Project Area	Distance from LAA
Sable Island National Park Reserve	220 km	185 km
The Gully Marine Protected Area (MPA)	262 km	232 km
Northern Bottlenose Whale Critical Habitat (Sanctuaries): The Gully, Shortland Canyon, Haldimand Canyon	273 km, 330 km, 366 km	243 km, 300 km, 336 km
Lophelia Conservation Area (LCA)	442 km	412 km

6.4.2 Potential Environmental Effects

The potential environmental effect of the Project on Special Areas is a Change in Habitat Quality and Use. Underwater noise emissions from MODU operation, VSP surveys, OSV operations, and well abandonment may temporarily reduce the quality of habitat in the portions of Special Areas encompassed by the LAA and result in sensory disturbance that triggers behavioural responses in marine species within these areas. Artificial night lighting and other attractants associated with MODU operation, and the degradation of water and sediment quality as a result of routine operational discharges and emissions may similarly affect habitat quality and use within these areas. The deposition of drill muds and cuttings may smother marine benthos and cause changes to the composition of the benthic macrofauna community within a highly localized area of the Scotian Slope/Shelf Break EBSA (refer to Section 6.12). The majority of Special Areas on the Scotian Shelf and Slope are located outside the LAA and are not expected to interact with the Project during routine operations. With the application of proposed mitigation and environmental protection measures, the residual environmental effect on Special Areas during routine Project activities is predicted to be not significant. Effects of accidental events are presented in Section 6.7.5.

6.5 COMMERCIAL FISHERIES

Commercial Fisheries is included as a VC due to the commercial and cultural importance of commercial fisheries to the region, specific regulatory requirements of the *Fisheries Act*, requirements of the EIS Guidelines, and the potential for fisheries to interact with Project activities and components. Commercial fisheries are present in and around the Project Area, LAA, and RAA.

Key issues raised during stakeholder and Aboriginal engagement for the Project to date revolve around an understanding of the effects of Project activities and components as well as accidental events on fish and fish habitat, as well as potential effects on fishing activities (*e.g.*, loss of access).

6.5.1 Existing Conditions

The Project Area is located within Commercial Fisheries Management Areas for fish, lobster, scallop and crab, mostly within NAFO Unit Area 4Wm but overlaps 4Xn and 4Xl. There is minimal fishing effort within and surrounding the Project Area. Harvesting in the LAA surrounding the Project Area is primarily focused on Atlantic halibut, Atlantic cod, Atlantic hagfish, cusk, monkfish, redfish, red hake, silver hake, swordfish, white hake, shark species such as porbeagle, and bluefin and other species of tuna.

There is a productive harvesting area approximately 50 km northwest of the Project Area between Baccaro and LaHave Banks. This region represents productive fishing grounds for Atlantic halibut, cod, haddock, pollock, cusk, flatfish, redfish, white hake, wolfish and monkfish with limited fishing for crab and lobster. Within the Project Area and LAA, in general, fishing effort appears to be low. Landed value of fisheries harvest within the Project area is shown below in Table 6.6.

Table 6.6 Landed Value of Fisheries Harvest within the Project Area (NAFO Unit Areas 4Wm, 4Xl, and 4Xn 2007 to 2012)

	2007		2008		2009		2010		2011		2012	
	Landed Weight (t)	**Landed Value ($'000)**	**Landed Weight (t)**	**Landed Value ($'000)**	**Landed Weight (t)**	**Landed Value ($'000)**	**Landed Weight (t)**	**Landed Value ($'000)**	**Landed Weight (t)**	**Landed Value ($'000)**	**Landed Weight (t)**	**Landed Value ($'000)**
Groundfish												
4Wm	40	$67	13	$31	22	$15	18	$32	52	$78	24	$61
4Xl	6	$35	8	$14	15	$27	10	$23	5	$9	-	-
4Xn	3387	$5610	3474	$5600	4648	$6219	4264	$6223	5192	$6996	5014	$8545
Total Groundfish	**3433**	**$5712**	**3495**	**$5645**	**4685**	**$6261**	**4292**	**$6278**	**5249**	**$7083**	**5038**	**$8606**
Pelagics												
4Wm	114	$936	101	$715	69	$716	28	$213	40	$281	31	$258
4Xl	93	$747	78	$521	68	$495	59	$428	124	$553	119	$1281
4Xn	222	$892	263	$1554	387	$1845	308	$1265	340	$2094	459	$3253
Total Pelagics	**429**	**$2575**	**443**	**$2790**	**524**	**$3056**	**395**	**$1906**	**504**	**$2928**	**609**	**$4792**
Shellfish												
4Wm	0	-	0	-	0	-	0	-	0	-	0	-
4Xl	No Data	-	No Data	-	No Data	-	No Data	-	No Data	-	No Data	-
4Xn	171	$1261	197	$1440	96	$622	133	$1016	99	$860	97	$786
Total Shellfish	**171**	**$1261**	**197**	**$1440**	**96**	**$622**	**133**	**$1016**	**99**	**$860**	**97**	**$786**
Other Species												
4W	0.5	$8	1	$19	0.4	$6	0.1	$1	0.1	$1	-	-
4X	15 899	$1703	16 571	$2228	43 292	$1408	41 123	$3367	16 989	$1355	11 812	$798
Total Other Species	**15 900**	**$1711**	**16 572**	**$2247**	**43 292**	**$1414**	**41 123**	**3368**	**16 989**	**$1356**	**11 812**	**$798**
GRAND TOTAL	**19 936**	**$11 259**	**20 710**	**$12 122**	**48 598**	**$11 351**	**45 945**	**$12 569**	**22 845**	**$12 227**	**17 556**	**$14 982**

6.5.2 Potential Environmental Effects

The Project could have an effect on the fisheries resource (direct effects on fished species affecting fisheries success) and/or fishing activity (displacement from fishing areas, gear loss or damage). The assessment of Project-related environmental effects on Commercial Fisheries is therefore focused on a Change in Availability of Fisheries Resources.

Effects on the fish and fish habitat are discussed in Section 6.1.2, including potential effects on fish health and behaviour. No serious harm to fish that are part of a CRA fishery, or permanent alteration or destruction of habitat for fish that are part of a CRA fishery or fish that support such a fishery is predicted to occur as a result of the Project.

Temporary and localized changes to the fisheries resource (*e.g.*, sensory disturbance that may trigger behavioural responses in targeted species) may result in a change in catch rates for commercial fishers should they be fishing in proximity to the MODU or VSP operations. The establishment of a 500-m radius safety zone around the MODU, may displace fishing activity, although given the limited size of this exclusion zone and low fishing activity in the Project Area, this effect is considered to be low.

There is also a low potential for gear loss or damage, but if it occurs, this loss would be compensated in accordance with the Compensation Guidelines with Respect to Damages Relating to Offshore Petroleum Activity (C-NLOPB and CNSOPB 2002). Shell has committed to developing and implementing a Fisheries Communications Plan for commercial fisheries representatives which will facilitate coordinated communication around routine Project activities and components as well as accidental events.

Given the localized nature of Shell's activities as well as the availability of other suitable fishing areas in proximity and the notice that will be provided to fishers, residual environmental effects on Commercial Fisheries are predicted to be not significant. Effects of accidental events are presented in Section 6.7.5. Additional information on mitigative commitments is provided in Section 7.

6.6 CURRENT ABORIGINAL USE OF LANDS AND RESOURCES FOR TRADITIONAL PURPOSES

Current Aboriginal Use of Lands and Resources for Traditional Purposes refers to communal commercial, as well as FSC fishing activities by Aboriginal peoples that could potentially interact with the Project. It is included as a VC in recognition of the cultural and economic importance of marine life and fishing to Aboriginal peoples and also in recognition of potential or established Aboriginal and Treaty rights. Aboriginal communal commercial fisheries are present in and around the Project Area, LAA, and RAA. FSC fishing activities are reported to be limited within the RAA, although this doesn't confirm that the area is not utilized for FSC fisheries or that it may not be accessed for future FSC needs (refer to the TUS, Appendix B of the EIS).

Key issues raised during Aboriginal engagement for the Project to date include a general concern about the effects of routine activities and accidental events on fish and fish habitat, the ecological significance and biodiversity of marine life of the RAA, use of the RAA by commercial or other important fish species during various life stages, the importance of the RAA as migration routes and spawning areas for many species, and the presence or use of the RAA by species that represent the primary food source for commercially or culturally important species. The inter-connectedness of the ecosystem was emphasized.

6.6.1 Existing Conditions

In the DFO Maritimes Region, communal FSC licences are held by 16 First Nations and the NCNS. Eleven of these communal licences are held by groups in Nova Scotia while the remaining five are held by groups in New Brunswick. These communal licences are for inland and inshore areas; DFO does not provide access for FSC purposes in offshore areas (DFO pers. comm, cited in Stantec 2014).

There are 144 communal commercial licences held by Aboriginal groups in the DFO Maritimes Region within the Western Scotian Shelf and Slope region. These licences are for crab, groundfish, hagfish, swordfish, bluefin tuna, mackerel, and lobster. Additional species which may be harvested in the RAA include Atlantic cod, Atlantic herring, northern shrimp, pollock, and scallop (MGS and UINR 2014; Appendix B). For more information on Aboriginal fishing, refer to Section 5.3.4 of the EIS and the TUS (Appendix B).

Membertou Geomatics and Unama'ki Institute of Natural Resources undertook a TUS (MGS and UINR 2014) which provided information on Aboriginal fishing activities in the RAA, with a focus on waters surrounding the Project Area. This scope of work included conducting a background review of commercial licences, and FSC agreements, as well as interviews with elders, fishers and fisheries managers from a representative subset of First Nations in Nova Scotia and New Brunswick, as well as the NCNS. Based on these interviews, the TUS includes information on target species, general fishing areas, and fishing seasons, along with any additional information pertaining to fish or sensitive areas.

Commercial harvesting by the Mi'kmaq of Nova Scotia and Mi'kmaq and Maliseet of New Brunswick in the RAA targets many of the same species fished by non-Aboriginal commercial fishers, including albacore tuna, bigeye tuna, bluefin tuna, cod, cusk, flounder, haddock, hagfish, hake, halibut, herring, Jonah crab, lobster, pollock, redfish, scallop, shark, shrimp, snow crab, swordfish and yellowfin tuna. Based on interviews conducted as of April 2014, 37 fish species, one mammal (seal), and nine invertebrate groups were identified as species harvested for FSC purposes. The TUS states that there is currently no FSC reported as occurring in the Project Area. However, the TUS also acknowledges that this does not confirm that FSC fisheries are not occurring in the Project Area or that the Project Area may not be accessed for future FSC fisheries needs. Lobster and herring were identified as currently being harvested within the LAA and several species (cod, herring, halibut, cusk, gaspereau, haddock, monkfish, pollock, red hake, silver hake, white hake, lobster, scallop, Jonah crab, and marine worms) were identified as

being harvested for FSC purposes within the RAA (MGS and UINR 2014). A precautionary approach is therefore taken, assuming that FSC fisheries could potentially occur in the Project Area and LAA, as well as the RAA. It is also acknowledged that species fished for FSC purposes could be harvested outside the RAA but could potentially temporarily interact with the Project during migration activities through the Project Area or LAA.

6.6.2 Potential Environmental Effects

Potential environmental effects of the Project on Aboriginal fisheries are similar to those assessed in Section 6.5.2 for Commercial Fisheries. The Project could have an effect on the fisheries resource (effects on fished species affecting fisheries success) and/or fishing activity (displacement from fishing areas, gear loss or damage. The assessment of Project-related environmental effects on the Current Aboriginal Use of Lands and Resources for Traditional Purposes is therefore focused on a Change in Traditional Use.

Effects on the fish and fish habitat are discussed in Section 6.1.2, including potential effects on fish health and behaviour. No serious harm to fish that are part of a CRA fishery, or permanent alteration or destruction of habitat for fish that are part of a CRA fishery or fish that support such a fishery is predicted to occur as a result of the Project.

Temporary and localized changes to the fisheries resource (*e.g.*, sensory disturbance that may trigger behavioural responses in targeted species) may result in a change in catch rates for Aboriginal fishers should they be fishing in proximity to the MODU or VSP operations. The establishment of a 500-m radius safety zone around the MODU, may displace fishing activity, although given the limited size of this exclusion zone and low fishing activity in the Project Area, this effect is considered to be low.

There is also a low potential for gear loss or damage, but if it occurs, this loss would be compensated in accordance with the Compensation Guidelines with Respect to Damages Relating to Offshore Petroleum Activity (C-NLOPB and CNSOPB 2002). Shell has committed to developing and implementing a Fisheries Communications Plan for Aboriginal fisheries representatives which will facilitate coordinated communication around routine Project activities and components as well as accidental events.

Given the localized nature of Shell's activities as well as the availability of other suitable fishing areas in proximity and the Notice that will be provided to fishers, residual environmental effects on Current Aboriginal Use of Lands and Resources for Traditional Purposes are not predicted to be significant. Effects of accidental events are presented in Section 6.7.5. Mitigative commitments to address potential adverse environmental effects are presented in Section 7.

6.7 ACCIDENTAL EVENTS

6.7.1 Spill Prevention and Response

Shell is committed to conducting safe and environmentally responsible operations, making spill prevention and response of critical importance in Project planning and operations. Shell's primary goal when conducting its operations is to prevent incidents, and Shell will have numerous safeguards in place to prevent a spill from occurring. While the possibility of a large-scale spill occurring during exploration drilling is considered highly unlikely, Shell's response capabilities and contingency plans will provide the ability to respond to any size of spill that could potentially occur.

Shell uses the "Bow Tie" method in the assessment of high-risk hazards (*i.e.*, risks with the greatest potential to impact people, the environment and assets). The Bow Tie makes the link between risk controls and risk prevention management systems (refer to Figure 6.1).

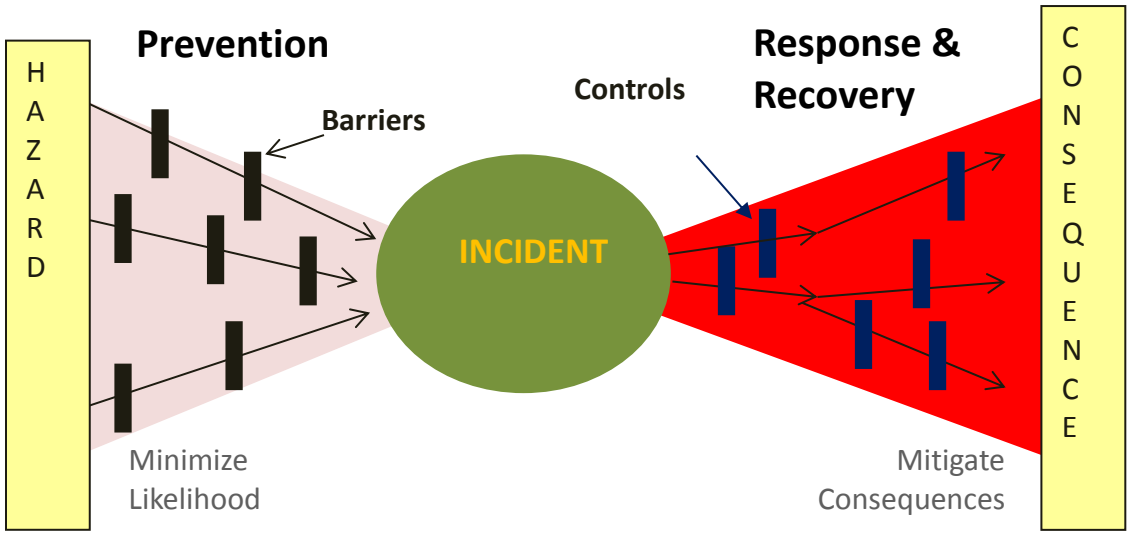

Figure 6.1 Bow Tie Method

Shell's operational focus is on the prevention side (left side) of the Bow Tie, with the goal to put in place sufficient barriers to never have to implement the response and recovery side (right side) of the Bow Tie. In the unlikely event that an incident occurs, the focus shifts to the response and recovery side (right side) of the Bow Tie, with the goal to mitigate the incident so that the full potential impact (consequence) of an incident is never realized.

Increasing the number and/or quality of barriers (prevention measures) on the left side of the Bow Tie reduces the probability of an incident occurring. Increasing the number and/or quality of barriers (response and recovery measures) on the right side of the Bow Tie reduces the impact of the potential incident. Overall, reducing the probability and/or the impact of the incident

thereby reduces the risk. More information about Shell's spill prevention and response and recovery plans is provided in Section 8.4 of the EIS.

Shell is prepared to effectively respond to an offshore oil spill, and will have a full complement of response tools and strategies available. Contingency plans will be in place to detail the associated practices and procedures for responding in an emergency. The Project Emergency Response Plans (ERP) will include a number of separate integrated contingency plans including a Well Containment Plan (WCP) and an Oil Spill Response Plan (OSRP). These plans will be submitted to the CNSOPB for review and approval as part of regulatory authorizations required to conduct drilling. More information on Shell's plans for spill prevention and response is provided in Section 8.1 of the EIS.

6.7.2 Accidental Event Scenarios

Five accidental event scenarios were selected for assessment based on consideration of Project parameters as well as potential to pose the greatest potential risk to VCs in the unlikely event of an occurrence. The five event scenarios are:

- 100 bbl batch spill
- 10 bbl batch spill
- SBM whole mud spill
- subsea blowout
- vessel spill

These scenarios were considered, as appropriate, in spill probability analysis and spill fate modelling studies, with results integrated into the effects assessment.

6.7.3 Spill Risk and Probabilities

A detailed analysis of the probability of potential blowouts and spills from offshore wells and activities was conducted by Environmental Research Consulting and is presented in Appendix F of the EIS. In consideration of the spill probability analysis as well as international and national spill data, well blowouts and other well-related spills from offshore drilling activities are considered rare events. The estimated probability that any one of the wells would have a blowout creating an oil spill is 0.00544. Overall, the probabilities of large Project spills are very low. Return periods are the amount of time that would typically be required for an event to occur once. Return periods for the two modelled blow-out scenarios (two hypothetical wells in the Project Area) are 18 392 and 3,678 years respectively. In addition, the results of the analysis indicate that if a spill were to occur, the spill volume is likely to be relatively small. The estimated probabilities of the specific spill volumes associated with the scenarios that were modelled for this Project are shown in Table 6.7.

Table 6.7 Probabilities of Project Scenario Spills

Scenario	Volume (bbl)	Probability	Return Period (years)
Batch Spill-10 barrels (bbl) (Diesel)	**10 bbl**	0.121940	41
Batch Spill-100 bbl (Diesel)	**100 bbl**	0.006200	806
SBM Spill-1	**377.4 bbl**	0.004960	1,008
SBM Spill-2	**3,604.2 bbl**	0.000620	8,065
Spill (Site-1) - Blowout	**1,474,500 bbl**	0.000054	18,392
Spill (Site-2) - Blowout	**747,000 bbl**	0.000270	3,678

Source: ERC 2014

6.7.4 Spill Fate and Behaviour

Synthetic-based whole muds are recovered and reused as much as possible and safeguards are in place to prevent the release of hydrocarbons from OSVs and the MODU. However, accidental discharges into the marine environment are possible. The size of the release, mode of release and the ocean current conditions at the time of release will influence the spill deposition footprint.

Two scenarios were modelled for the assessment of an accidental release of drilling muds: a spill of 377.4 bbl; and a spill of 3604.2 bbl (refer to Appendix C of the EIS). Both of these spill scenarios have a return period of at least 1000 years (see Appendix F of the EIS). In the unlikely event of an SBM spill, the water column is predicted to return to ambient conditions (<1 mg/L) within 30 hours of the release (RPS ASA 2014a). The potential for adverse environmental effects, given the limited spatial and temporal footprint of the affected area is therefore low.

Three-dimensional oil spill fate and trajectory modelling and analyses were performed to support the evaluation of the potential effects from accidental spills associated with a blowout or batch spill from the MODU/OSV (RPS ASA 2014b). Continuous subsurface blowout scenarios were developed at two locations, which bound the expected water depths that may be drilled within the Project Area. The models were run over 30 days, to simulate a continuous 30-day unmitigated release blowout scenario. In addition, surface releases of 10 bbl and 100 bbl of marine diesel were modelled at a third location in the Project Area.

All modelled scenarios were conservatively run without any mitigation to reflect a worst-case scenario whereby no measures are put in place to minimize or reduce its effects. In the unlikely event of an actual spill response measures inclusive of oil spill containment, recovery and shoreline protection operations would serve to reduce adverse effects to marine and coastal resources thereby mitigating the full impact of a spill. A 30-day scenario was selected for the modelling as a conservative estimate to simulate a conservative amount of time required to cap and contain the spill. Shell expects that in the unlikely event of a real blowout, the well could be capped and contained in less time (12 to 21 days) than the timeline modelled.

Footprints from surface oiling and oil dissolved in the water column from unmitigated, 30-day release blowout scenarios indicated that oil generally travels to the east and northeast of the

spill sites. A seasonal trend was observed: during winter conditions, oil was more likely to be transported to the east further offshore; while under summer conditions transport was uniformly multi-directional.

Higher percentages of the released oil were found within the water column during winter months; this is the result of increased wind and wave action, which entrains surface oil droplets into the water column. Conversely, the greatest surface oiling occurred during summer months, with calmer conditions reducing entrainment from wind and waves.

Following an unmitigated release, the likelihood of shoreline oiling was demonstrated to be very low. The possibility of shoreline oiling was found only to occur during the summer months when a higher percentage of oil remains on the surface and there is a slightly increased probability of winds from the east and northeast transporting surface oil towards land. The probability of shoreline oiling for the modelled scenarios was found to be between 0.83 and 1.88 % of all model runs conducted for the two individual blowout scenarios, and was only observed during the May, June, and July model runs. Maps showing the potential locations and extent of oiling from a 30 day unmitigated blowout are provided in Section 8.4.5.2 of the EIS.

Accidental discharges of marine diesel (*e.g.*, 10 bbls and 100 bbl batch spill scenarios) resulted in limited modelled effects. Approximately 80 % of the two batch spill releases evaporated within the first 2–3 days, with approximately 2 km^2 and 20 km^2 receiving in-water concentrations of dissolved aromatics in excess of 1 ppb at any time for the 10 bbl and 100 bbl spill, respectively. The modelling predicted that a portion of weathered diesel may continue to be transported at the surface for some distance; however the surface oil would likely be small in areal extent and patchy. Additional information on spill modelling results is provided in Section 8.3 and Appendix G of the EIS.

6.7.5 Potential Environmental Effects

The potential accidental event scenarios identified above could affect Fish and Fish Habitat, Marine Mammals and Sea Turtles, Marine Birds, Special Areas, Commercial Fisheries, and the Current Aboriginal Use of Lands and Resources for Traditional Purposes.

Results of spill modelling (Refer to Section 8.4 and Appendix G of the EIS) demonstrate that the geographic extent of an unmitigated spill will most likely be limited within the RAA. It is possible, however, that some blowout spill scenarios could result in some oil extending beyond the boundaries of the RAA. To be conservative, this potential has been considered in the individual VC assessments, where relevant.

6.7.5.1 Fish and Fish Habitat

With respect to a Change in Risk of Mortality or Physical Injury, following a spill of diesel either from the MODU or the OSV offshore, the majority of the oil will evaporate and disperse within the first 2–3 days following the release (RPS ASA 2014b). Oil spill containment and recovery operations will reduce residual effects on fish and fish habitat associated with dissolved

aromatics. Although there is a risk of mortality of phytoplankton and zooplankton (food sources), and sub-lethal and lethal effects to larval and juvenile fish species present in the mixed surface layer of the water column, these residual effects will likely be restricted to a highly localized area. Adult fish species in surface waters will largely be unaffected due to avoidance mechanisms; demersal (bottom dwelling) species will unlikely to be exposed to harmful concentrations of dissolved aromatics. Given the temporary, localized, and reversible nature of the potential effects, the residual environmental effects from a diesel spill are predicted to be not significant. Residual effects following a nearshore diesel spill from the OSV would likely included localized mortality and sub-lethal effects to fish eggs, larvae and juveniles. Depending on the location and extent of the spill, nearshore spawning and nursery areas could potentially be affected. However, given the small-scale nature of the spill, effects on nearshore areas are expected to be limited and not significant. Residual effects on Fish and Fish Habitat following a SBM whole mud spill would be highly localized (to tens of metres from the spill site) and in the case of both the surface and subsurface release restricted to smothering effects on highly immobile individuals and benthic prey species. The residual environmental effect from an SBM spill are predicted to be not significant.

Following a continuous, 30-day unmitigated blowout scenario the geographic extent of residual effects on Fish and Fish Habitat could extend into the RAA with a low probability of extension beyond the RAA and a low probability of nearshore/shoreline effects. In offshore waters, effects would be similar to those of diesel on phytoplankton, zooplankton, larval and juvenile fish species but over a greater area. Greater concentrations of dissolved aromatics present in the surface mixed layer following an incident during winter conditions, may be expected to result in higher mortalities and sub-lethal effects on fish eggs, larvae and juveniles. In the unlikely event that dissolved aromatics are transported towards nearshore waters, residual effects on fish may extend to low level sub-lethal effects on the eggs, larvae and juveniles of demersal species and other fish species with nearshore spawning and nursing areas. There is a low possibility of a spill reaching important spawning areas on the Scotian Shelf and Georges Bank.

Spills associated with the MODU could involve batch spills or a continuous blowout; these would result in short- to medium-term Change in Habitat Quality and Use for fish. For all scenarios, residual effects on Fish and Fish Habitat are considered reversible.

Based on information presented above, the conservative nature of the spill modelling and the use of mitigation to prevent and minimize impacts from a spill, the low possibility of a spill reaching important spawning areas and a consideration of the significance criteria, it is predicted residual adverse environmental effects from any of the accidental event scenarios on Fish and Fish Habitat would be not significant.

6.7.5.2 Marine Mammals and Sea Turtles

With respect to Change in Habitat Quality and Use, a hydrocarbon spill may indirectly reduce habitat availability to marine mammals or sea turtles by rendering it unsuitable for foraging and other activities. This effect would be short-term until the slick disperses and oil content in water

reaches background levels, or medium-term if prey abundance and quality is affected. No permanent or irreversible changes in habitat, including possible critical habitat, are expected to occur as a result of accidents and malfunctions.

With respect to a Change in Risk of Mortality or Physical Injury, the accidental release of hydrocarbons may affect several physical and internal functions of marine mammals and sea turtles. Non fur-bearing marine mammals and juvenile and adult sea turtles are not considered to be at high risk from the effects of oil exposure, and it is probable that only small proportions of any populations at risk would be within the affected area and likely to be exposed. Depending on the time of year, location of animals within the affected area, and type of oil spill or blowout, the effects of an accidental release on the health of cetaceans and sea turtles will vary. Based the information above, the use of mitigation measures to prevent and minimize impacts from a spill and the conservative nature of the spill modeling, residual environmental effects are predicted to be not significant.

6.7.5.3 Marine Birds

Marine birds are among the most vulnerable and visible species to be affected by oil spills. At risk are pelagic species that come inshore only to nest, but also shorebirds and other coastal water birds. Reported effects vary with species, type of oil, weather conditions, time of year and duration of the spill (Gorsline *et al.* 1981). A change in risk of mortality or physical injury can occur through: oiling of feathers which can result in the deaths from combinations of heat loss, starvation, and drowning; exposure of eggs from oiled birds returning to nests, causing high mortality of embryos; and ingestion of oil as a result of preening or consumption of contaminated food or water (Leighton 1993). Long-term physiological changes may eventually result in lower reproductive rates or premature death (Ainley *et al.* 1981; Williams 1985; Frink and White 1990; Fry 1990), or decrease long-term survival (Esler *et al.* 2002).

In the remote possibility (less than 2 % probability based on unmitigated modelling results for the Project) that hydrocarbons released at the Project site reached the exposed coasts, the slick would likely be rapidly weathered and dispersed on the high energy coastline reducing direct effects on nesting habitat. The areas with the potential to be exposed to shoreline oiling, including the Yarmouth, Barrington, and Shelburne region, as well as Sable Island National Park, correspond to areas known to support breeding bird populations. A particularly dense aggregation of marine bird nesting colonies is located in the area between Cape Sable Island and Yarmouth. This area has a large number of small islands which provide a high density of potential nesting sites. The timeframe required for oil to potentially reach these areas (20 to 30 days) would allow for response measures and containment equipment to be placed in advance to reduce or avoid effects. Response measures could, however, result in hazing of nesting birds and reproductive failure. Although potential of effects on nesting habitat is unlikely, there is greater potential for effects on foraging habitat at sea.

Although hydrocarbon spills could result in some mortality at the individual level (Camphuysen 2011), these environmental effects are predicted to be reversible at the population level within one generation (three to five years). However, because even small amounts of oil have the

potential to affect marine birds, and the mortality of an individual bird Species at Risk under the *Species at Risk Act* is defined as a significant effect, the potential environmental effects on Marine Birds are considered significant. Therefore, a precautionary conclusion is drawn here which is that the residual environmental effect of a large hydrocarbon spill on birds, or in the event of chronic exposure following a large spill (*i.e.*, large batch spill) or nearshore spill, is predicted to be significant but not likely. Infrequent small spills and an SBM spill are predicted to be not significant for Marine Birds.

6.7.5.4 Special Areas

The nature and extent of the effects of an accidental event on Special Areas on Habitat Quality and Use vary considerably depending on the type and magnitude of the event, the proximity to the Special Area, and the ecological importance of the Special Area. In particular, a spill of SBM whole mud, and a 10 bbl batch spill will be limited in magnitude, geographic extent and duration. A 100 bbl batch spill and a vessel spill could be wider spread, but would still be temporary and lower in magnitude for the majority of marine resources, as diesel would rapidly spread to a thin sheet and most of the diesel fuel would evaporate. As marine birds are vulnerable to oiling from even thin sheens, a diesel spill could still result in a measurable effect, depending on the location and timing of the spill and any aggregations of seabirds in the area. Although the Project Area only encompasses a very small portion of the Scotian Slope/Shelf Break EBSA, this area has been identified as an EBSA for a number of important ecological functions that occur in the larger region inclusive of seabird feeding and overwintering areas. For this reason as well as the information considered above and the significance criteria, this event could result in a significant adverse effect on the Scotian Slope/Shelf Break EBSA.

A blowout represents the accidental event with the most widespread effects. However, with the exception of the Scotian Slope/Shelf Break EBSA, the potential for either surface or water column oiling to interact with other Special Areas in the RAA, given their relative distance from the Project Area or LAA is relatively low (0 to 10 % or 0 to 25 %; refer to Table 8.5.7 of the EIS). Similar to a diesel spill, the potential for adverse effects on marine bids, particularly species at risk, including the Roseate Tern which is known to breed on Sable Island result in precautionary prediction of a significant adverse effect. This event is considered highly unlikely, however, given the low probability of shoreline oiling indicated by the conservative spill modeling, time it would take for the oil to reach Sable Island (>20 days), and the mitigation measures that would be put in place to prevent and respond to a spill event.

6.7.5.5 Commercial Fisheries

The potential adverse effects of a spill on commercial fisheries depends on the magnitude, location and timing of a spill. A 10 bbl batch spill offshore is unlikely to measurably affect fisheries occurring outside the MODU operational safety (fisheries exclusion) zone and therefore would not result in a significant adverse environmental effect on Commercial Fisheries. A spill of the same material and volume occurring in the nearshore environment could have greater effects on nearshore fisheries, with potential displacement from preferred fishing areas. .

Given the predicted affected area (up to 10 km), temporary period of measurable effect on water quality (up to 30 hours), and the low toxicity of the product, effects of a SBM spill are predicted to be not significant for Commercial Fisheries.

Although the probability of a subsea blowout occurring is extremely low, local fishers could potentially be displaced or unable to use substantial portions of the areas traditionally or currently fished for all or most of a fishing season (*e.g.*, implementation of a spill-related fishery closure). Fishers could also experience reduced catches, reduced marketability of fish; and/or increased expenses. For this reason, this event could result in a significant adverse effect on Commercial Fisheries. Although significant adverse effects may occur in the event of a subsea blowout, given the low probability of an event occurring, the conservative nature of the spill modeling, the implementation of response procedures that could reduce the affected area, and the ability to compensate fishers for their losses, significant effects from an accident blowout on Commercial Fisheries is considered unlikely.

6.7.5.6 Current Aboriginal Use of Lands and Resources for Traditional Purposes

The potential adverse effects of a spill depend on the magnitude, location and timing of a spill. . A small spill offshore is unlikely to measurably affect fisheries occurring outside the MODU safety (fisheries exclusion) zone and therefore would not result in a significant adverse environmental effect on Current Aboriginal Use of Lands and Resources for Traditional Purposes. A spill of the same material and volume occurring in the nearshore environment could have greater effects on nearshore fisheries.

As discussed above for the SBM spill, effects are not predicted to be significant.

As discussed above with respect to commercial fisheries, although significant adverse effects may occur in the event of a subsea blowout, given the low probability of an event occurring, the conservative nature of the spill modeling, the implementation of response procedures that could reduce the affected area, and the ability to compensate fishers for their losses, significant effects from an accident blowout on Current Aboriginal Use of Lands and Resources for Traditional Purposes are considered unlikely.

6.8 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Aspects of the environment which could potentially the Project include: fog, sea ice and superstructure icing, seismic events and tsunamis, hurricanes, winds, waves and extreme weather events and sediment and seafloor stability. Effects from sea ice, seismic activity, tsunamis and sediment and seafloor stability will be minimal given the limited duration of offshore activities (*i.e.*, approximately 130 days to drill an individual well over the four-year period), the absence of permanent offshore infrastructure, and lack of site-specific risk factors (*e.g.*, low potential for sea ice in Project Area). MODU design standards for harsh weather conditions and standard operating procedures for the MODU and OSVs including the monitoring of meteorological conditions, stop-work procedures and safe work practices will further reduce the risk of adverse effects of the environment on the Project.

6.9 CUMULATIVE ENVIRONMENTAL EFFECTS

Projects and activities identified as having potential to act in combination with the Project to result in cumulative environmental effects were evaluated in the context of each VC. These included consideration of: current offshore gas development projects on the Scotian Shelf (*e.g.*, Sable Offshore Energy Project (SOEP) and Deep Panuke); fisheries; other ocean uses; and BP's proposed Tangier 3D Seismic Survey.

The residual environmental effects of the Project on each VC (*i.e.*, Fish and Fish Habitat, Marine Mammals and Sea Turtles, Marine Birds, Special Areas, Commercial Fisheries, and Current Aboriginal Use of Lands and Resources for Traditional Purposes) could overlap temporally with the environmental effects of each of the past, present and future (*i.e.*, certain or reasonably foreseeable) physical activities identified. Potential temporal overlap between the Project and BP's proposed Tangier 3D Seismic Survey will be limited to the approximately 113 day NATS survey phase between April 2015 and the end of November 2015 (during which time data acquisition will only be carried out for approximately 85 days), as Shell's exploration drilling activities are not currently planned to commence until Q2 2015.

Spatially, the residual environmental effects of the Project on each VC will be limited to the Project Area and LAA. Despite the lack of spatial overlap between the residual environmental effects of the Project and the residual environmental effects of offshore gas development projects on any VC, certain VCs may nonetheless be adversely affected by sequential exposure to the residual environmental effects of the Project, Deep Panuke, and/or SOEP. The life cycles of several species of fish, marine mammals, sea turtles, and marine birds include long-distance movement within the RAA, and there is potential for members of these species to be adversely affected by the combined residual environmental effects of the Project and offshore gas development projects (*i.e.*, the same individuals may be exposed to the residual environmental effects of multiple physical activities during the course of their migrations within the RAA). Similarly, because the customary or traditional fishing grounds of any given commercial or Aboriginal fisher may encompass a broad area or include multiple areas, there is potential for some fishers to be adversely affected by the combined residual environmental effects of the Project and fisheries and other ocean users (*i.e.*, the same fishers may be exposed to the residual environmental effects of multiple physical activities during the course of their harvesting activities within the RAA).

As per the CEA Agency's OPS*, Assessing Cumulative Environmental Effects Under the Canadian Environmental Assessment Act, 2012*, "the environmental effects of accidents and malfunctions must be considered in the assessment of cumulative environmental effects if they are likely to result from the designated project in combination with other physical activities that have been or will be carried out" (CEA Agency 2013b).

Accidental event scenarios assessed in Section 8 of the EIS are considered very unlikely to occur, with the exception of platform small spills (*i.e.*, spills less than 50 bbls). Based on Canadian offshore data, spills of less than 50 bbls occur at a frequency of one for every 37 wells (0.027)

(ERC 2014; Appendix F of the EIS). Although a platform small spill could cause residual adverse environmental effects to various VCs, it would be unlikely to interact with the residual environmental effects of discharges from offshore gas development projects, BP's proposed Tangier 3D Seismic Survey, fisheries, or other ocean users in such a way that causes a cumulative environmental effect. The potential contribution of the residual environmental effects of a platform small spill to the residual environmental effects of another physical activity in the RAA is not considered a likely scenario.

7.0 Mitigation Measures and Commitments

Shell has committed to undertake various mitigation, reporting and monitoring activities to reduce or eliminate adverse environmental effects. Most potential Project and cumulative effects will be addressed by mitigation measures for each VC. Design features and mitigation measures have been incorporated into the Project to prevent or reduce potential environmental effects (*e.g.*, the "Bow Tie" method). A summary of mitigation and monitoring commitments is provided in Table 7.1.

Table 7.1 Summary of Commitments

No.	Proponent Commitments	EIS Section Reference	Relevant Category of Environmental Effect Under Section 5 of CEAA, 2012				
			Changes to the Environment			Effects of Changes to the Environment	
			Changes to Components Within Federal Jurisdiction	Changes Occurring on Federal or Transboundary Lands	Changes that are Directly Linked or Necessarily Incidental to Federal Decisions	Effects On Aboriginal People	Effects that are Directly Linked or Necessarily Incidental to Federal Decisions
GENERAL							
1	Shell will comply with the terms and conditions of approval, for all permits, authorizations, and licences obtained in support of the Project.	13.2	✓	✓	✓	✓	✓
2	Prior to mobilization at the selected drilling site, the MODU will undergo the required regulatory inspections to demonstrate that it meets Canadian and CNSOPB safety and technical specifications.	2.4	✓	✓	✓	✓	✓
3	Shell will obtain a Certificate of Fitness from an independent third party Certifying Authority for the MODU prior to commencement of drilling operations in accordance with the *Nova Scotia Offshore Certificate of Fitness Regulations*.	9.3	✓	✓	✓	✓	✓
4	Flaring, during exploration drilling, will be restricted to the amount necessary to characterize the well potential (refer to Section 2.4.3) and as necessary for the safety of the operation.	2.7, 7.4	✓	✓	✓		✓

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5	All operations relating to the Project will be required at a minimum to comply with Shell standards and with external regulatory standards. Where requirements differ, the more stringent requirement will apply. Shell will require contractors to demonstrate that they have in place a Health, Safety and Environment Management System compatible with these standards, and that they are committed to implementing it.	2.8, 13.1	✓	✓	✓	✓	✓
6	Routine checks for stranded birds will be conducted on the MODU and OSVs and appropriate procedures for release will be implemented. If stranded birds are found during routine inspections, they will be handled using the protocol outlined in *The Leach's Storm Petrel: General Information and Handling Instructions* (Williams and Chardine 1999), including obtaining the associated permit from CWS, and in compliance with the requirements for documenting and reporting strandings and mortalities to the CWS.	7.4, 13.2	✓	✓	✓		✓
7	The observation, forecasting and reporting of physical environment data will be conducted in accordance with the *Offshore Physical Environment Guidelines* (NEB *et al.* 2008) to promote the safe and prudent conduct of routine operations and emergency response.	9.3, 13.2	✓	✓	✓	✓	✓
8	The following Project-specific management plans will be developed and submitted to the CNSOPB for review	2.7, 2.8, 8.4, 13.1, 13.2	✓	✓	✓	✓	✓

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	and approval: • Environmental Protection Plan • Safety Plan • Emergency Response Plan, Well Control Plan, Oil Soil Response Plan, and Relief Well Contingency Plan • Waste Management Plan						
OSVs and Helicopters							
9	OSVs will be compliant with the *Canada Shipping Act* and national and international regulations while at sea, *Eastern Canadian Vessel Traffic Services Zone Regulations* when operating in nearshore or harbour areas, and applicable Port Authority requirements when in a port. Ship operations will also adhere to Annex I of MARPOL, of which Canada has incorporated provisions under various sections of *the Canada Shipping Act* and its regulations.	2.4, 7.4	✓	✓	✓	✓	✓
10	In preparation for the Project, OSVs will undergo Shell's internal audit process as well as additional external inspections/audits, including the CNSOPB pre-authorization inspection process, during Q4 of 2014 or Q1 of 2015.	2.4	✓	✓	✓	✓	✓
11	OSVs will avoid the Gully, as per the *Gully Marine Protected Area Regulations*, when travelling to and from the MODU.	7.5	✓	✓	✓		✓
12	Fuelling of OSVs will be conducted at a permitted facility and in accordance with fuelling procedures, reducing the risk of a	8.1	✓	✓	✓	✓	✓

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	spill during transfer operations.						
13	OSVs will use existing shipping routes when travelling to and from the MODU, adhere to standard navigation procedures, and reduce speeds to 18.5 km/hour (10 knots) within the Project Area.	7.4, 7.7, 7.3, 7.6	✓	✓	✓	✓	✓
14	To reduce risk of collision, Project OSVs will avoid critical habitat for the northern bottlenose whale (The Gully, and Shortland and Haldimand canyons) and will avoid critical habitat for the North Atlantic right whale (Roseway Basin) from June 1 to December 31. OSVs will also maintain a 2 km avoidance buffer around Sable Island.	7.3, 7.5	✓	✓	✓		✓
15	Except in the case of an emergency, Project helicopters will avoid flying over Roseway Basin and Sable Island.	2.4, 7.3	✓	✓	✓		✓
16	Helicopters transiting to and from the MODU will fly at altitudes greater than 300 m and at a lateral distance of 2 km from active colonies when possible.	7.4, 7.5	✓	✓	✓		✓
17	Measures will be taken as appropriate to monitor and mitigate effects of the environment (*e.g.*, icing, fog) on OSV and helicopter transportation. Pilots and OSV operators will have the authority and obligation to suspend or modify operations in case of adverse weather that compromises the safety of helicopter or OSV operations.	9.3	✓	✓	✓	✓	✓

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Project Design							
18	Engineering design for the Project will adhere to national/international standards for site-specific normal and extreme physical environmental conditions.	9.3	✓	✓	✓	✓	✓
19	Lighting on Project infrastructure will be reduced to the extent that worker safety is not compromised.	7.4	✓	✓	✓		✓
20	Well design reviews will be carried out and approved by appropriate qualified internal discipline authorities and technical experts. The same principles apply to the input parameters, which are used as the basis for the well design.	8.4	✓	✓	✓	✓	✓
21	The transfer of SBM to the OSV and spent SBM from the OSV will occur through a closed system thereby minimizing the risk of spillage to the marine or terrestrial environment.	8.1	✓	✓	✓	✓	✓
22	Shell will conduct a seabed survey in the Project Area in 2014 to obtain site-specific information on the seafloor conditions at the potential wellsites and identify potential geohazards (*e.g.*, sediment scour, liquefaction of sediments from seismic events, shallow gas pockets, and slope failure) that could be present in the vicinity of proposed drilling sites and therefore require avoidance. Any evidence of sediment scour or seafloor instability will be noted and incorporated into Project planning and design as appropriate.	9.2, 9.3, 11.2	✓	✓	✓	✓	✓

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23	The results of the seabed survey conducted in the spring of 2014 and pre-drill ROV surveys conducted at each potential wellsite will inform the selection of drilling locations that avoid areas where known heritage resources, coral concentrations, or other sensitive or unique benthic habitat are present.	6.2, 7.2, 7.5	✓	✓	✓	✓	✓
24	Once the MODU is in position, pre-drill site surveys will be conducted using an ROV deployed to the seabed. These surveys will be conducted to confirm that no potential surface seabed hazards or sensitivities are present at the drilling location.	2.4, 11.2	✓	✓	✓	✓	✓
25	Two independent barriers will be maintained at all times once the BOP is installed on the wellhead. These barriers will be verified by testing both prior to and following installation; should one barrier be lost, operations will be stopped and the focus of operations will shift to regaining a two-barrier status.	8.4	✓	✓	✓	✓	✓
WASTE/DISCHARGES							
26	The OCSG will be applied in selecting chemicals for drilling, as well as to guide the proper treatment and disposal of chemicals selected.	2.7	✓	✓	✓	✓	✓
27	Constituents in drilling muds will be screened using the OCSG to assess the viability of using lower toxicity chemicals.	7.5	✓	✓	✓	✓	✓
28	Offshore waste discharges and emissions associated with the Project (*i.e.*,	2.7, 7.2, 7.3, 7.4, 7.5	✓	✓	✓	✓	✓

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	operational discharges and emissions from the MODU and OSVs) will be managed in compliance with MARPOL and treated in accordance with the OWTG, as applicable.						
29	In accordance with the OWTG, drilling solids associated with the use of SBM will be treated prior to marine disposal such that the "synthetic-on-cuttings" does not exceed 6.9 g/100 g oil on wet solids.	2.7, 7.2, 7.5	✓	✓	✓	✓	✓
30	No whole SBM base fluid or any whole mud containing SBM as a base fluid will be discharged at sea.	2.7	✓	✓	✓	✓	✓
31	Waste discharges that do not meet OWTG requirements will not be discharged to the ocean, but brought to shore for disposal.	7.5	✓	✓	✓	✓	✓
32	Hazardous wastes, including any waste dangerous goods, generated during the Project will be stored in the appropriate containers/containment and in designated areas on board the MODU for transportation to shore.	2.7	✓	✓	✓	✓	✓
33	The transportation of any dangerous goods, waste dangerous goods or hazardous substances will occur in compliance with the *Transportation of Dangerous Goods Act* and its associated regulations.	2.7	✓	✓	✓	✓	✓
34	Wastes destined for onshore treatment, recycling and/or disposal will be managed in accordance with the Nova Scotia *Solid Waste-Resource Management Regulations* and will comply with any applicable	2.7			✓		✓

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	federal and provincial waste requirements as well as municipal by-laws.						
35	The air emissions from the Project will comply with the *Air Quality Regulations* under the Nova Scotia *Environment Act*, and meet the National Ambient Air Quality Objectives under CEPA, 1999.	2.7		✓	✓		✓
36	Any flaring required as an essential safety component of well drilling will occur in accordance with the CNSOPB *Drilling and Production Guidelines*.	2.7	✓	✓	✓		✓
37	Prior to transiting into Canadian waters, the MODU will undergo normal ballast tank flushing procedures, as required under IMO's *Ballast Water Management Convention* and Transport Canada's *Ballast Water Control and Management Regulations*.	2.7	✓	✓	✓	✓	✓
ACCIDENTAL EVENTS							
38	Shell and its contractors will have measures in place to reduce the potential for vessel spills. This includes: • All activities adhering to Annex I of MARPOL • Adherence to standard navigation procedures, Transport Canada regulations and CCG requirements, and • Special attention to activities presenting increased risks for marine traffic including loading and	8.2	✓	✓	✓	✓	✓

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	offloading, docking and extreme weather events						
39	A Dispersants Operations Plan will be developed as part of the OSRP, which will outline the process and procedures for determining whether to utilize dispersants and initiate deployment of dispersants in the unlikely event of an oil spill incident in the Project Area.	8.1	✓	✓	✓	✓	✓
40	Shell will have available local staff and agencies, and Aboriginal representatives trained in accordance with its Incident Command System and able to respond to accidental spills. Dependent on the size and scale of the incident, Shell will draw on various support organizations/agencies to provide the appropriate and necessary resources and response.	8.1	✓	✓	✓	✓	✓
41	Personnel potentially involved in oil spill response will receive specialized training, and drills will be conducted periodically to familiarize personnel with on-site equipment, proper deployment techniques and maintenance procedures, and management of incidents.	8.1	✓	✓	✓	✓	✓
42	Shell will work with the appropriate government agencies and undertake a Net Environmental Benefits Analysis (NEBA) to evaluate the risks and benefits of dispersing oil in the water column.	8.1, 8.5	✓	✓	✓	✓	✓
43	If required, for a nearshore spill, shoreline clean-up and possible collection and cleaning of fur-bearing marine mammals	8.5	✓	✓	✓	✓	✓

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	and oiled marine birds would be conducted.						
44	As part of spill response, marine mammal and marine bird hazing techniques may be used if deemed necessary to deter animals from entering affected areas and prevent further oiling.	8.5	✓	✓	✓		✓
45	In the unlikely event of an accidental spill, oiled birds will be collected and rehabilitated as practical.	8.5	✓	✓	✓		✓
46	In the event that a vessel collision with a marine mammal or sea turtle occurs, Shell will contact the Marine Animal Response Society (MARS) or the Coast Guard to relay the incident information.	7.3, 13.2	✓	✓	✓		✓
47	Incidents will be reported in accordance with the *Incident Reporting and Investigation Guidelines* (C-NLOPB and CNSOPB 2012).	13.2	✓	✓	✓	✓	✓
48	In the unlikely event of an accidental spill, specific monitoring (*e.g.*, environmental effects monitoring) and follow-up programs may be required and will be developed in consultation with applicable regulatory agencies.	8.5, 13.2	✓	✓	✓	✓	✓
49	As part of any spill monitoring, records will be kept of any marine mammals or sea turtles encountered and any evidence of visible oiling.	8.5	✓	✓	✓		✓
50	Project-related damage to fishing gear, if any, will be compensated in accordance with the *Compensation Guidelines with*	7.6, 7.7, 8.5		✓	✓	✓	✓

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	Respect to Damages Relating to Offshore Petroleum Activity (C-NLOPB and CNSOPB 2002).						
VSP							
51	VSP surveys will adhere, at a minimum, with mitigation measures described in the SOCP.	7.3	✓	✓	✓	✓	✓
52	A ramp-up procedure will be implemented before any VSP activity begins. Additionally, VSP shutdown procedures will be implemented if a marine mammal or sea turtle species listed on Schedule 1 of SARA, as well as all other baleen whales and sea turtles are observed within 1 km of the wellsite.	7.3	✓	✓	✓		✓
53	MMOs will be employed to monitor and report on marine mammal and sea turtle sightings during VSP surveys to enable shutdown or delay in the presence of a marine mammal or sea turtle species listed on Schedule 1 of SARA, as well as all other baleen whales and sea turtles. Monitoring will involve visual observations. Following the program, copies of the marine mammal and sea turtle observer reports will be provided to DFO.	7.3, 13.2	✓	✓	✓		✓
CONSULTATION AND ENGAGEMENT							
54	Shell will communicate with fishers before, during, and after drilling programs. Details of safety zones will be published in Notices to Mariners and Notices to Shipping, which will allow fishers and other ocean users to	7.6, 7.7		✓	✓	✓	✓

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	plan accordingly.						
55	Shell will continue to engage commercial and Aboriginal fishers to share Project details as applicable. A Fisheries Communications Plan will be used to help facilitate coordinated communication with commercial and Aboriginal fishers.	3, 4, 13.2		✓	✓	✓	✓

8.0 Proposed Significance Determination

Criteria or thresholds establish a level beyond which a residual environmental effect would be considered significant (*i.e.*, an unacceptable change). These thresholds may be based on regulations, standards, resource management objectives, scientific literature, or ecological processes (*e.g.*, desired states for fish or wildlife habitats or populations). A general list of significance criteria is provided in Section 3.2.1. VC-specific significance thresholds are provided in Section 7 of the EIS.

Project activities and components assessed include potential effects from the presence of MODU (including lights and underwater noise), discharge of drill muds and cuttings, other discharges and emissions, vertical seismic profiling, helicopter transportation, OSV operations and well abandonment. These activities reflect the scope of the Project as outlined in the EIS Guidelines and represent physical activities and components that would occur throughout the life of the Project forming the basis of the effects assessment. With the implementation of the proposed mitigation measures, adverse residual environmental effects of routine Project activities, including cumulative effects, are predicted to be not significant for all VCs.

Adverse residual environmental effects of accidental events are predicted to be significant for Marine Birds, Special Areas, Commercial Fisheries, and Current Aboriginal Use of Lands and Resources for Traditional Purposes in the highly unlikely event of a large spill. These significance determinations are made as a precautionary measure, acknowledging that the timing, volume, nature and location of the spill, along with seasonal sensitivities of the specific VC influence the actual magnitude, duration, and reversibility (*e.g.*, recovery) of effects. Spill fate modelling has been presented without consideration of spill countermeasures and therefore the predicted geographic extent of interactions with VCs with spilled material contributes to a conservative assessment. While these environmental effects are considered to be significant, they are not likely to occur given the low probability of occurrence of the accidental event, the conservative nature of the spill modelling and the mitigative measures that would be in place to prevent and respond to an incident.

Table 8.1 summarizes the effects determination for routine activities, accidental events, and cumulative interactions, and, where applicable, the likelihood of significant residual adverse environmental effects occurring.

Table 8.1 Summary of Residual Environmental Effects

VC	Routine Operations	Accidental Effects		Cumulative Effects
	Significance of Residual Environmental Effect	Significance of Residual Environmental Effect	Likelihood of Significant Effect	Significance of Residual Environmental Effect
Fish and Fish Habitat	N	N	N/A	N
Mammals and Sea Turtles	N	N	N/A	N
Marine Birds	N	S	L	N
Special Areas	N	S	L	N
Commercial Fisheries	N	S	L	N
Current Aboriginal Use of Land and Resources for Traditional Purposes	N	S	L	N

Key:
N = Not significant residual environmental effect (adverse)
S = Significant residual environmental effect (adverse)
L = Low likelihood

In summary, the Project is not likely to result in significant adverse residual environmental effects, including cumulative effects, provided that the proposed mitigation, including spill prevention and response is implemented.

9.0 References

Ainley, D.G., Grau, C.R., Roudybush, T.E., Morrell, S.H., Utts, J.M. 1981. Petroleum ingestion reduces reproduction in Cassin's Auklets. Mar. Pollut. Bull., 12: 314-317.

Bourne, W.R.P. 1979. Birds and gas flares. Mar. Pollut. Bull., 10: 124-125.

Breeze, H., Fenton, D., Rutherford, R.J., Silva, M.A. 2002. The Scotian Shelf: An Ecological Overview for Ocean Planning. DFO Ca. Tech. Rep. Fish. Aquat. Sci. 2393.

Brown, R.G.B. 1986. Revised Atlas of Eastern Canadian Seabirds. Bedford Institute of Oceanography, Dartmouth, NS, and Canadian Wildlife Service, Ottawa, ON.

CEA Agency [Canadian Environmental Assessment Agency]. 2013. Reference Guide: Considering Aboriginal Traditional Knowledge in Environmental Assessments Conducted Under the *Canadian Environmental Assessment Act, 2012*. Available online: http://www.ceaa-acee.gc.ca/Content/C/3/C/C3C7E0D3-8DB1-47D0-AFC2-A8D4D1EFAAB3/ATK_Reference_Guide-eng.pdf.

CEA Agency [Canadian Environmental Assessment Agency]. 2014. Guidelines for the Preparation of an Environmental Impact Statement Pursuant to the *Canadian Environmental Assessment Act, 2012,* Shelburne Basin Venture Exploration Drilling Project, Shell Canada Limited. Final version issued February 28, 2014. Available online: http://www.ceaa-acee.gc.ca/050/documents/p80058/98476E.pdf.

C-NLOPB, CNSOPB [Canadian-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board]. 2002. Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activity. Available from: http://cnsopb.ns.ca/sites/default/files/pdfs/CompGuidelines.pdf

CNSOPB [Canadian Nova Scotia Offshore Petroleum Board]. 2012a. Offshore Board Announces Results of Call for Bids NS11-1. Latest News: News for Friday, January 20, 2012. Available from: http://www.cnsopb.ns.ca/news/offshore-board-announces-results-call-bids-ns11-1

CNSOPB [Canadian Nova Scotia Offshore Petroleum Board]. 2012b. News Release: Offshore Board Announces Results of Call for Bids NS12-1. (For Immediate Release on November 16, 2012). 2pp. Available from: http://www.cnsopb.ns.ca/sites/default/files/pdfs/final_bids_award_news_release_nov_16.pdf

CNSOPB [Canadian Nova Scotia Offshore Petroleum Board]. 2013. Geoscience: Regional Geology. Available from: http://cnsopb.ns.ca/geoscience/geoscience-overview/regional-geology

DFO [Fisheries and Oceans Canada]. 2013u. Fisheries Protection Policy Statement. Available from: http://www.dfo-mpo.gc.ca/pnw-ppe/pol/index-eng.html

Doherty, P., Horsman, T. 2007. Ecologically and Biologically Significant Areas of the Scotian Shelf and Environs: A Compilation of Scientific Expert Opinion. DFO Can. Tech. Rep. Fish. Aquat. Sci. 2774: 57 + xii pp.

Environment Canada. 2013. Canadian Climate Normals 1971-2000. Station Data-Sable Island, Nova Scotia. Available from: http://climate.weather.gc.ca/climate_normals/results_e.html?stnID=6454&lang=e&dCode=0&province=NS&provBut=Go&month1=0&month2=12

Esler, D., Bowman, T.D., Trust, K.A., Ballachey, B.E., Dean, T.A., Jewett, S.C., O'Clair, C.E. 2002. Harlequin duck population recovery following the 'Exxon Valdez' oil spill: progress, process and constraints. Mar. Ecol.-Prog. Ser., 241: 271–286.

Fifield, D.A., Lewis, K.P., Gjerdrum, C., Robertson, G.J., Wells, R. 2009. Offshore seabird monitoring program. Environ. Stud. Res. Funds Rep. No. 183: v + 68pp. + App.

Frink, L., White, J. 1990. A perspective on the effects of oil on birds. In: The Effects of Oil on Wildlife: Research, Rehabilitation and General Concerns, Proceedings from the Oil Symposium, Herndon, VA, Volume 2, October 16-18, 1990. Presented by International Wildlife Research, Tri-State Bird Rescue and Research, Inc., and International Bird Rescue Research Center, pp. 13-16.

Fry, D.M. 1990. Oil exposure and stress effects on avian reproduction. In: The Effects of Oil on Wildlife: Research, Rehabilitation and General Concerns, Proceedings from The Oil Symposium, Herndon, VA, Volume 2, October 16-18, 1990. Presented by International Wildlife Research, Tri-State Bird Rescue and Research, Inc., and International Bird Rescue Research Center.

Gjerdrum, C., Allard, K., Bolduc, F. 2012. Pelagic seabird monitoring in the northwest Atlantic. Northwest Atlantic Fisheries Organization. Scientific Council Meeting-June 2012. Serial No. N6055. NAFO SCR Doc. 12/029. Available from: http://archive.nafo.int/open/sc/2012/scr12-029.pdf

Gjerdrum, C., Head, E.J.H., Fifield, D.A. 2008. Monitoring seabirds at sea in eastern Canada. Atlantic Zone Monitoring Program (AZMP) Bulletin No. 7, March 2008: 52-58. Available from: http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/azmp-pmza/docs/bulletin_7_09.pdf

Gorsline, J., Holmes, W.N., Cronshaw, J. 1981. The effects of ingested petroleum on the naphthalene-metabolizing properties of liver tissue in seawater-adapted Mallard Ducks (*Anas platyrhynchos*). Environ.Res., 24: 377-390.

Horsman, T.L., Shackell, N.L. 2009. Atlas of Important Habitat for Key Fish Species of the Scotian Shelf, Canada. DFO Can. Tech. Rep. Fish. Aquat. Sci. 2835 viii + 82pp. Available from: http://www.dfo-mpo.gc.ca/Library/337080.pdf

Hurley, G.V. 2011. Strategic Environmental Assessment-Petroleum Exploration Activities on the Southwestern Scotian Shelf. [Consultant report]. Prepared by Hurley Environment Ltd. for the Canada-Nova Scotia Offshore Petroleum Board: Nov., 2011. 94pp. + App.

IAIA [International Association for Impact Assessment]. 1999. Principles of Environmental Impact Assessment Best Practice. Available online: http://www.iaia.org/publicdocuments/special-publications/Principles%20of%20IA_web.pdf

JWEL [Jacques Whitford Environment Limited]. 2002. Deep Panuke Offshore Gas Development Comprehensive Study Report. xiv + 439pp. + App.

Leighton, F.A. 1993. The toxicity of petroleum oils to birds. Environ. Rev., 1: 92-103.

MGS & UINR [Membertou Geomatics Solutions and Unama'ki Institute of Natural Resources]. 2014. Traditional Use and Mi'kmaq Fisheries of the Shelburne Basin, Nova Scotia: Draft Report. Submitted to Stantec by MGS & UINR, April 17, 2014. 39pp.

NCNS [Native Council of Nova Scotia]. 2009. Memorandum of Association and By-laws of Native Council of Nova Scotia. Available from: http://ncns.ca/bylaws.pdf

NEB, C-NLOPB, CNSOPB [National Energy Board, Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board]. 2009. Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands. iii + 13 pp. Available from: http://www.C-NLOPB.nl.ca/pdfs/guidelines/ocsg.pdf

NEB, C-NLOPB, CNSOPB [National Energy Board, Canada-Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board]. 2010. Offshore Waste Treatment Guidelines. Available from: http://www.C-NLOPB.nl.ca/pdfs/guidelines/owtg1012e.pdf

NEB, C-NLOPB, CNSOPB [National Energy Board, Canadian Newfoundland and Labrador Offshore Petroleum Board and Canada-Nova Scotia Offshore Petroleum Board]. 2008. Guidelines Respecting Physical Environmental Programs during Petroleum Drilling and Production Activities on Frontier Lands. Minister of Public Works and Government Services Canada. September 2008.

Neff, J.M., Kjeilen-Eilersten, G., Trannum, H., Jak, R., Smit, M., Durell, G. 2004. Literature Report on Burial: Derivation of PNEC as Component in the MEMW Model Tool. ERMS Report No. 9B. AM 2004/024. 25pp.

Neff, J.M., McKelvie, S., Ayers, Jr., R.C. 2000. Environmental Impacts of Synthetic Based Drilling Fluids. OCS Study MMS 2000-64. US Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Program, New Orleans, LA. 145pp.

RPS ASA. 2014a. Sediment Dispersion Modeling in Support of the Shelburne Basin Exploration Drilling Program.

RPS ASA. 2014b. Trajectory Modeling Services in Support of the Shelburne Basin Exploration Drilling Program.

Shell and Stantec [Shell Canada Limited and Stantec Consulting Ltd.]. 2013. Project Description: Shelburne Basin Venture Exploration Drilling Project. Available from: http://www.ceaa-acee.gc.ca/050/documents/p80058/96608E.pdf

Stantec [Stantec Consulting Ltd.]. 2014. Strategic Environmental Assessment for Offshore Petroleum Exploration Activities. Western Scotian Slope (Phase 3B). Prepared for the Canada-Nova Scotia Offshore Petroleum Board, Halifax, NS. iv + 282 pp.

TC [Transport Canada]. 2013. Navigable Waters Protection Program – Overview. Available online: http://www.tc.gc.ca/eng/marinesafety/oep-nwpp-menu-1978.htm. Last updated September 19, 2013.

Walmsley, D., Theriault, J. 2011. State of the Scotian Shelf Report: Ocean Noise. Atlantic Coastal Zone Information Steering Committee [ACZISC]. 25 pp. Available from: http://coinatlantic.ca/docs/ocean-noise.pdf

Weir, C.R. 1976. Annotated bibliography of bird kills at man-made obstacles: a review of the state-of-the-art and solutions. Can. Wildl. Serv., Ont. Reg., Ottawa. 85 pp.

Wiese, F.K., Montevecchi, W.A., Davoren, G.K., Huettmann, F., Diamond, A.W., Linke, J. 2001. Seabirds at risk around offshore oil platforms in the Northwest Atlantic. Mar. Pollut. Bull., 42: 1285-1290.

Williams, A.S. 1985. Rehabilitating oiled seabirds. In: Burridge, J., Kane, M., editors. A Field Manual, International Bird Rescue Research Center, Berkely, CA. 79 pp.

Williams, U., Chardine, J. 1999. The Leach's Storm Petrel: General Information and Handling Instructions. 4 pp. Available from: http://www.cnlopb.nl.ca/pdfs/mkiseislab/mki_app_h.pdf

Worcester, T., Parker, M. 2010. Ecosystem Status and Trends Report for the Gulf of Maine and Scotian Shelf. DFO. Can. Sci. Advis. Sec. Res. Doc. 2010/070. vi + 59 pp.

Zwanenburg, K.C.T., Bundy, A., Strain, P., Bowen, W.D., Breeze, H., Campana, S.E., Hannah, C., Head, E., Gordon, D. 2006. Implications of Ecosystem Dynamics for the Integrated Management of the Eastern Scotian Shelf. DFO Can. Tech. Rep. Fish. Aquat. Sci. 2652: xiii + 91 pp.


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