BHP Canada Exploration Drilling Project (2019-2028)

EIS Summary

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Abbreviations

µg/L	microgram per litre
Accord Act	*Canada-Newfoundland Atlantic Accord Implementation Act*
ADW	Approval to Drill a Well
Bbl	Barrel
BHP	BHP Petroleum (New Ventures) Corporation
BOP	Blowout preventer
CAPP	Canadian Association of Prawn Producers
CBD	Convention on Biological Diversity
CEA Agency	Canadian Environmental Assessment Agency
CEAA	*Canadian Environmental Assessment Act*
CEAA 2012	*Canadian Environmental Assessment Act, 2012*
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
CWS	Canadian Wildlife Service
DFO	Fisheries and Oceans Canada
EA	Environmental Assessment
EBSA	Ecologically or Biologically Significant Area
ECCC	Environment and Climate Change Canada
EPP	Environmental Protection Plan
ERP	Emergency Response Plan
EEZ	Economic Exclusion Zone
EIS	Environmental Impact Statement
EIS Guidelines	Guidelines for the Preparation of an Environmental Impact Statement pursuant to the *Canadian Environmental Assessment Act, 2012*
EL	Exploration Licence
FSC	food, social and ceremonial
g	gram
IBA	Important Bird Area

IUCN	International Union for Conservation of Nature
km	kilometre
km^2	Square kilometre
KMKNO	Kwilmu'kw Maw-klusuaqn Negotiation Office
LAA	Local Assessment Area
m	metre
MARPOL	International Convention for the Prevention of Pollution from Ships
MBCA	*Migratory Birds Convention Act*
MCPEI	Mi'kmaq Confederacy of Prince Edward Island
Mg/L	milligram per litre
mm	millimetre
MODU	mobile offshore drilling unit
NAFO	Northwest Atlantic Fisheries Organization
NAVWARN	Navigational Warning
NEB	National Energy Board
NL	Newfoundland and Labrador
NL ESA	Newfoundland and Labrador *Endangered Species Act*
NOTMAR	Notice to Mariners
OA	Operations Authorization
OCSG	Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
OSRP	Oil Spill Response Plan
OWRP	Oiled Wildlife Response Plan
OWTG	Offshore Waste Treatment Guidelines
PLONOR	Pose little or no risk to the environment
PSV	Project support vessel
RAA	Regional Assessment Area
ROV	Remotely operated vehicle
SAR	Species at risk
SARA	*Species at Risk Act*
SBM	Synthetic-based mud

SiBA	Significant Benthic Area
SIMA	Spill Impact Mitigation Assessment
VC	valued component
VME	Vulnerable Marine Ecosystem
VSP	vertical seismic profiling
WBM	Water-based mud
WNNB	Wolastoqey Nation of New Brunswick

1.0 INTRODUCTION

BHP Petroleum (New Ventures) Corporation (BHP) is proposing to undertake an exploration drilling program within the areas of its existing offshore exploration licences (ELs). The ELs are in the Orphan Basin, approximately 350 kilometres (km) northeast of St. John's, Newfoundland and Labrador (NL), in the Northwest Atlantic Ocean. Over the term of the ELs (2019-2028), the BHP Canada Exploration Drilling Project (herein referred to as the "Project") will include drilling of up to 20 wells, with an initial well proposed to be drilled as early as 2021, pending regulatory approval.

In Eastern Canada, BHP's current offshore interests include two existing ELs in the Orphan Basin Area, EL 1157 and EL 1158 (Figure 1-1). These two ELs were issued to BHP, as the sole interest holder (Table 1.1), by the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) in January 2019. The term of these ELs extends from January 15, 2019 to January 15, 2028. BHP will serve as the operator for this exploration drilling program.

Table 1.1 Licence Size and Interests

EL	Size (hectares)	Interest Holder
1157	269,799	BHP (100%)
1158	273,579	BHP (100%)

The drilling, testing, and abandonment of offshore exploratory wells in the first drilling program, in an area set out in one or more of the ELs issued, requires review and approval by the Canadian Environmental Assessment Agency (CEA Agency) (now the Impact Assessment Agency of Canada) per section 10 of the *Regulations Designating Physical Activities* under the *Canadian Environmental Assessment Act, 2012* (CEAA 2012). This Environmental Impact Statement (EIS) was developed following the published project-specific guidelines (CEA Agency 2019). Pursuant to the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act* and the *Canada-Newfoundland Atlantic Accord Implementation Act* (the Accord Act), the C-NLOPB also requires a project-specific environmental assessment (EA) for offshore oil and gas activities, including the drilling of exploration wells. The EIS Guidelines (CEA Agency 2019) and the C-NLOPB Accord Acts EA requirements will both be satisfied by the preparation of this EIS.

2.0 PROJECT OVERVIEW

During the term of the ELs, BHP proposes to drill up to 20 exploration wells in total, with between one and ten wells on either, or both, EL 1157 and EL 1158. The ELs are located offshore eastern Newfoundland in the Orphan Basin, with the ELs both inside and outside Canada's 200 nautical mile Exclusive Economic Zone (EEZ) (Figure 1-1). Water depths in the ELs range from approximately 1,175 to 2,575 metres (m). Drilling operations carried out as part of the Project will be conducted within the defined boundaries of the ELs, but specific well site numbers, types, and locations will be determined as Project planning activities continue.

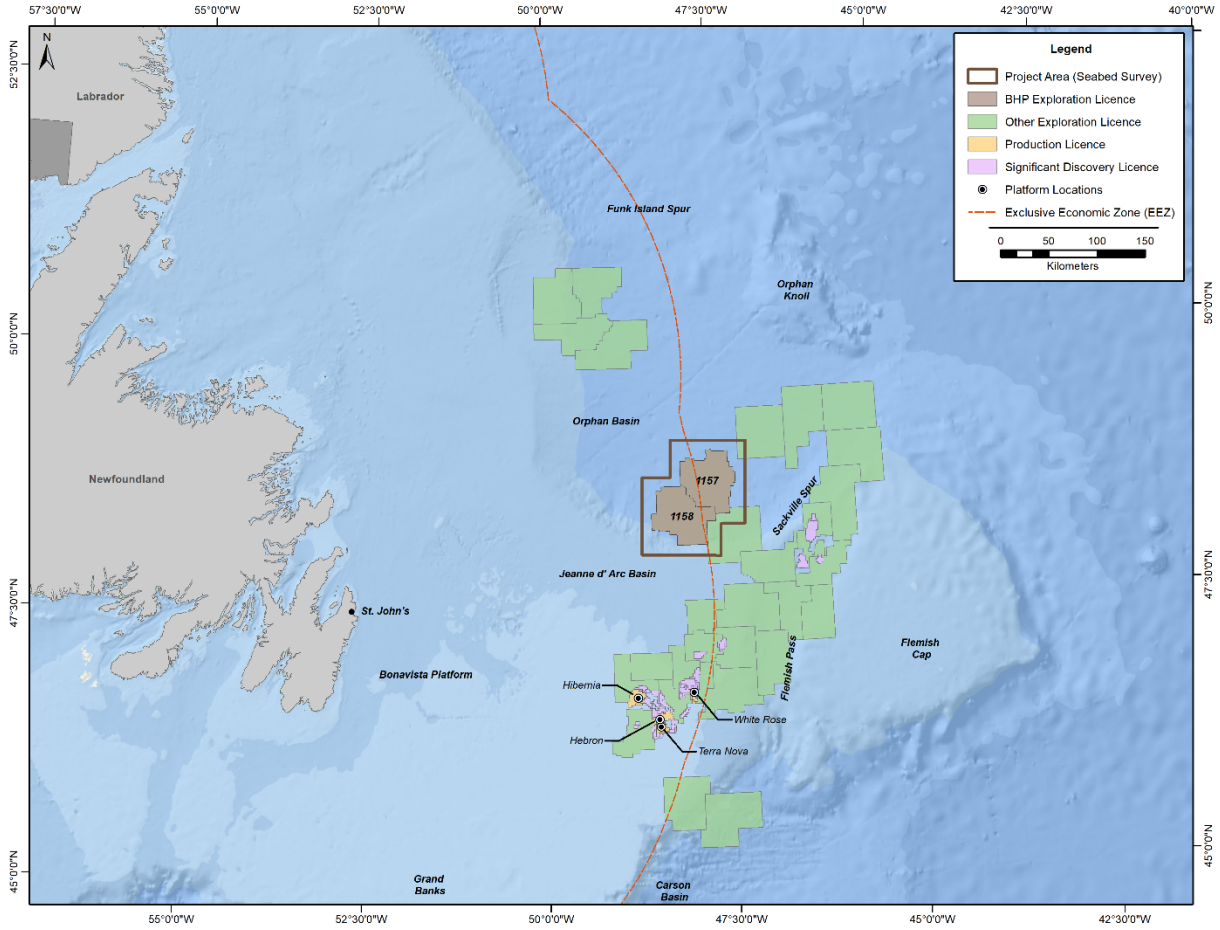

Figure 1-1 Project Location

Wells will be drilled by a mobile offshore drilling unit (MODU). The specific type of MODU used for the Project will be determined as Project planning continues but will be either a semi-submersible rig or a drillship. It is anticipated that the analysis of initial well results will be used to inform the execution strategy for subsequent wells. Depending on availability, the type of MODU may change during the temporal scope of the Project. This is referred to as a multiple phase approach for exploration drilling.

A fleet of Project support vessels (PSVs) and helicopters will provide logistics, stand-by, supply, and operational support and will be based out of existing, onshore facilities in Eastern NL. The scope of this EIS does not include onshore activities at these shore-based facilities.

2.1 Project Location

The Project is in offshore eastern Newfoundland in the Orphan Basin area. BHP is proposing to drill up to 20 exploration or appraisal wells within EL 1157 and EL 1158 (between one and ten wells in either, or both, ELs). The ELs cover an area of approximately 543,378 ha, and are located approximately 350 km from St. John's, NL (Figure 1-1). Water depths within EL 1157 and EL 1158 range between 1,175 and 2,575 m.

2.2 Project Components and Activities

The MODU and offshore exploration wells are the main physical components of the Project. The Project also includes logistics support for servicing and supplying offshore activity. Logistics-related components include PSVs and helicopters for the transportation of personnel and equipment, the heliport and a supply base in eastern Newfoundland.

The offshore exploration well components are the only new infrastructure that will require construction as part of the Project. Other Project components, including the MODU, PSVs, helicopters, and supply base are pre-existing and will be used by the Project on a temporary basis through contractual arrangements. The scope of this EIS therefore does not include onshore activities at these shore-based facilities.

2.2.1 Mobile Offshore Drilling Unit

The selection of the MODU generally depends on the nature of the physical environment of the well site (e.g., water depth, meteorological and physical oceanographic conditions), and logistical considerations (e.g., MODU availability). In deep waters, such as in the Orphan Basin, a semi-submersible drilling unit or drillship will be required. BHP has not yet selected the MODU that will be used to drill each well for the Project. It is likely that different MODUs may be used, in consideration of MODU availability over the life of the Project, including both a semi-submersible drilling unit and/or a drillship.

BHP will select a MODU based on regulatory compliance, water depths, meteorological and physical oceanographic conditions, technical capabilities of the MODU, price competitiveness, and mobility requirements. A Certificate of Fitness will be obtained for the MODU from an independent third-party Certifying Authority before commencement of drilling operations in accordance with the *Newfoundland Offshore Certificate of Fitness Regulations*.

Before drilling, a seabed survey will be carried out on the well site(s) to confirm if environmental (e.g., corals and sponges) or anthropogenic sensitivities (e.g., seabed cables) are present. These data will also be used to inform discussions on monitoring associated with drilling waste discharges. This survey(s) will be regulated under a separate EA according to C-NLOPB requirements and not within the scope of the EIS.

If a well is successful (i.e., hydrocarbons are discovered), vessels may be required to complete geophysical surveys (high resolution geophysical data acquisition) and geotechnical sampling (geotechnical coring). This is included in the scope of the Project. Large-scale two dimensional / three dimensional seismic surveys are not planned as part of the Project.

Throughout the duration of an offshore drilling program in the Canada-NL Offshore Area, other marine vessel traffic is restricted within a defined area surrounding the MODU as a safety precaution. As specified in the *Newfoundland Offshore Petroleum Drilling and Production Regulations*, this safety zone will be a 500 m radius of the MODU (approximately 1 km^2). The safety zone is monitored by a standby vessel, and Notices to Mariners and other measures are also used to continuously communicate the presence and nature of these drilling activities and associated safety zones to other vessels and marine operations in the area. These publications are not restricted to Canadian use and are accessible by members of the international community who may be navigating inside and outside the EEZ. Details of the safety zone will also be communicated during ongoing consultations with Indigenous and non-Indigenous fishers.

2.2.2 Offshore Exploration Wells

The Project includes drilling of up to 20 wells (exploration or appraisal) within the two ELs that comprise the Project Area over its 9-year duration (2019-2028). Specific well site locations are not currently defined and will be selected as Project planning and design activities move forward. Water depth, reservoir potential and geological properties are considerations in determining well location and design. As part of the operations authorization (OA) and approval to drill a well (ADW) applications, individual well designs will be designed and submitted for approval to the C-NLOPB.

It is anticipated that each well will be drilled in sections over a period of 35 to 115 days, where each section is gradually reduced in size. Once the sections are drilled, steel pipe or casing is inserted and cemented into place to line the wellbore. The casing is a series of pipes which give structure to the wellbore and preventing the formation from caving into the wellbore. The casing also helps to control formation fluids, pressure and manage drilling fluids.

2.2.3 Well Control and Blowout Prevention

Mechanical measures and barriers (e.g., steel casing, drilling fluids, blowout preventer (BOP), cement) will be implemented as part of the well design, and drilling and monitoring procedures, and are also used to control formation pressure. Formation pressures are managed to prevent a blowout that may occur when specific well control barriers have failed. A blowout is the uncontrolled flow of formation fluids that occurs when formation pressure exceeds the pressure applied to by the column of drilling fluid, followed by the failure of secondary well control measures to contain the formation pressure (e.g., BOP failure).

The BOP is a mechanical device designed to seal off the wellbore at the wellhead on the seafloor when required. The system is comprised of multiple ram types and annular preventers that are the closing and sealing components of the BOP. Rams are pistons that move horizontally across the top of the wellbore and create a seal around the drill string. Three types of rams that will be installed in the BOP include blind shear, casing shear, and pipe rams. Blind shear rams can be used to either to shear certain drill string components and form a wellbore seal or seal the wellbore when no pipe is present. Casing shear rams

fulfill the same purpose but are used to shear casing. Pipe rams seal around the drill pipe when closed. Annular preventers are large rubber elements installed above the ram preventers that can also be used to physically close off the wellbore around various sizes of pipe.

The BOP is capable of being activated from various locations on the MODU and is used immediately upon indication of a well control event (called a well kick). A kick is the entry of formation fluid into the wellbore during drilling that may lead to a blowout if not controlled. The BOP will be pressure tested on the MODU deck before installation on the well, and then again following installation on the well to test the wellhead connection with the BOP and operability on the seafloor. In addition to the deck and installation tests, the BOP and other pressure control equipment are tested regularly and recorded in accordance with the Drilling and Production Guidelines (C-NLOPB and Canada Nova Scotia Offshore Petroleum Board [CNSOPB] 2017).

When the BOP is installed, remotely operated vehicle (ROV) intervention capability for operating the BOP will also be tested by physically engaging the ROV control panels to test functionality. The BOP will only be removed once the well has been plugged and abandoned.

2.2.4 Vertical Seismic Profiling

Vertical seismic profiling (VSP) may be conducted to support correlation of previously collected seismic data to well data. It is often undertaken following completion of drilling to further characterize identified geological features and potential petroleum reserves. Specifically, this technique is used to obtain accurate time-to-depth ties to correlate seismic data to well depth.

VSP can be conducted in different ways including zero offset VSP and walk-away VSP (also called offset VSP) configurations. The zero offset VSP is undertaken by placing a string of receiver (geophones) down the well at pre-determined depths, with a seismic source (usually mid-sized airguns) suspended from the MODU (approximately 5 to 20 m below the water surface). Walk-away VSP involves placing a sound source on a vessel which then moves away while firing the sound source at pre-determined distances from the borehole receiver. The check-shots are recorded at multiple intervals down the well, and the resulting information assists in determining and reconciling drilling information with that obtained through seismic survey work. Between three and six seismic sound sources are typically used, with a volume of 150 to 250 cubic inches each. However, up to 12 sound sources may be used in a larger array. VSP surveys are typically short-term activities, usually lasting one to two days per well, with sound source firing often limited to just a few hours.

Relative to surface seismic activities, VSP surveys typically use smaller sound sources that are placed several meters below the water surface, are more localized and are shorter duration. Underwater sound from VSP was modelled in support of the Project EIS. VSP activities will be conducted in consideration of the Statement of Canadian Practice (SOCP) with respect to the Mitigation of Seismic Sound in the Marine Environment (DFO 2007).

2.2.5 Well Evaluation, Testing and Flaring

If exploration drilling indicates the presence of hydrocarbons in the target formations, the well will be evaluated and possibly tested. Well evaluation is an important component of exploration drilling to determine the viability of a prospect and the commercial potential of the reservoirs.

During drilling, the well is monitored and evaluated using a variety of techniques for well formation logging, mud logging, drilling parameters evaluation, and subsurface pressure evaluation. Well formation logging, which is typically an ongoing process during exploration drilling programs, identifies rock types encountered and possible zones where hydrocarbons are present.

If significant hydrocarbons are indicated during an exploration well, reservoir evaluation would likely be conducted during the drilling of a subsequent appraisal well to establish the viability and commercial potential of the geological formation.

Well flow testing is a regulatory requirement under the *Newfoundland Offshore Petroleum Drilling and Production Regulations*, before converting an EL to a Significant Discovery Licence. This reservoir deliverability evaluation method would likely occur post hydrocarbon discovery during the appraisal well drilling process, immediately thereafter, or possibly later by re-entering a suspended well.

If a well test is required and flaring must be undertaken, it will be subject to BHP's process for well test planning, which provide assurance that the least possible amount of flaring is carried out to obtain the needed data from the well test.

An alternative approach to flow testing with flaring is Interval Pressure Transient Testing (IPTT). In direct contrast to formation flow testing, where thousands of fluid barrels (bbls) are brought to surface in a controlled manner and flared, IPTT does not flow any fluid to surface, reducing the environmental impact. This alternative method offers a substantial reduction in safety risk by removing the exposure of personnel to pressurized surface equipment containing live hydrocarbons.

2.2.6 Well Decommissioning and Abandonment or Suspension

Offshore wells are typically decommissioned and abandoned when drilling and associated well evaluation is completed and approved by C-NLOPB. Approval may be included in the ADW or Approval to Alter the Condition of a Well when completing or suspending, respectively. In both cases, information demonstrating compliance with the *Newfoundland Offshore Petroleum Drilling and Production Regulations* (or subsequent amended regulations) will be provided to C-NLOPB and a *Notification to Abandon/Suspend* or a *Notification to Complete* will be provided before abandoning, suspending or completing a well.

Well decommissioning and abandonment activities involve isolation of the well bore by placing cement plugs, potentially in combination with mechanical devices, at various depths. Consideration will be given to removing the wellhead from the seafloor using mechanical cutters if appropriate (given water depth and fishing activity). Alternative approaches may be required and will be investigated and implemented in consultation with relevant regulatory authorities as necessary.

In some circumstances the well may be abandoned and suspended and re-entered later for additional data acquisition and evaluation before final abandonment. A similar cement plugging program would be implemented, isolating hydrocarbon-bearing intervals and is anticipated to take approximately two to three days per well. The casing / wellhead may be left in place for future use and the remaining infrastructure would be approximately 4 m in height and occupy a footprint of less than 1 m^2. The wellhead position would be reported to the Canadian Hydrographic Services such that nautical charts can be updated and published in the Navigational Warning (NAVWARN) and Notices to Mariners (NOTMAR) systems.

2.2.7 Supply and Servicing

PSVs and helicopters are used to transport personnel, equipment, and materials to and from MODUs during offshore drilling programs. It is expected that offshore PSV and aircraft (helicopter) services for the Project will be based in Eastern Newfoundland to support logistical requirements for offshore operations. Supply base activities will be conducted by a third-party contractor and are outside the scope of this EIS. Personnel will be transported to and from the MODU by PSV or helicopter, according to work schedules and rotations, workforce numbers, distances and other factors.

2.2.7.1 Project Support Vessel Operations

The MODU will be supported by a fleet of PSVs to re-supply the MODU with fuel, equipment, drilling mud, and other supplies during the drilling program, as well as removing waste. PSVs may also be used to transfer personnel if fog or sea state prevents helicopter operations. It is likely that two to three PSVs will be required, with one vessel continuously on stand-by at the MODU. It is anticipated that a single MODU operating at the site will require an average of three return transits per week by PSVs during the Project. Seasonally, ice management vessels may also be required.

Supporting vessels involved in Project activities will travel within established shipping routes where practical to reduce incremental marine disturbance. PSVs will essentially follow a straight-line approach between a MODU operating within an EL in the Project Area and an established port facility in eastern Newfoundland, a practice which is common in the oil and gas industry that has been active in this region for several decades. Vessels will follow applicable legislation and regulations and will be inspected by Transport Canada and approved for operation by the C-NLOPB before beginning Project-related work. They will have appropriate oil spill / pollution prevention and emergency response plans, and each will be compliant with International Convention for the Prevention of Pollution from Ships (MARPOL). Supplies will be loaded and unloaded onto PSVs using personnel and cranes for drilling materials and closed piping systems (e.g., pumps, hoses) for bulk powders, liquid supplies, and waste (e.g., drilling fluids). Marine gas oil, or diesel fuel, will be transferred to the MODU from shore via the PSVs as well. Fueling operations are anticipated to occur approximately once per week by a third-party contractor.

2.2.7.2 Aircraft Operations

Helicopters will be used for crew changes on a routine basis, and to support medical evacuation from the MODU and support search and rescue activities in the area, if required. Helicopter operations are anticipated to be run out of St. John's International Airport. It is estimated that there would be on average of seven transits per week to transfer crew and supplies to the MODU depending on weather conditions or other technical matters. Helicopter routes are anticipated to be direct from the St. John's airport to the Project Area. Flight distances are not expected to exceed 425 km, which is the distance between St. John's and the furthest boundary of the ELs. Standard altitude profiles are between 610 m and 2,743 m with, for separation purposes, an odd number altitude being flown on the eastbound flight and an even altitude being flown on the westbound flight. Flight times are expected to be up to approximately two to three hours to the ELs. Helicopters have not yet been contracted for the Project, however, helicopters typically used in the offshore areas generally have a maximum range of approximately 1,000 km without refuelling. Refuelling operations are expected to take place at St. John's International Airport as well as on the MODU, which will be equipped with refuelling equipment.

2.2.8 Emissions, Discharges, and Waste Management

Potential emissions and discharges associated with offshore exploration drilling programs include drilling mud and cuttings, sound, light and other atmospheric emissions (e.g., exhaust), liquid discharges, and non-hazardous waste materials associated with the offshore MODU, support vessels and aircraft. A summary of potential Project-related emissions and discharges is provided in Table 2.1.

Throughout the Project, efforts will be made to reduce emissions and discharges. Waste will be managed and disposed according to regulatory requirements and applicable guidelines. Depending on the nature of wastes generated, they will be managed and disposed directly offshore from the MODU and the PSVs or brought to shore for disposal. Offshore waste discharges and emissions associated with the Project (i.e., operational discharges and emissions from the MODU and PSVs) will be managed in accordance with relevant regulations and municipal bylaws as applicable, including the Offshore Waste Treatment Guidelines (OWTG) and the MARPOL, of which Canada has incorporated provisions under various sections of the *Canada Shipping Act* (2001). Waste not meeting legal conditions for discharge will not be discharged to the ocean and will be brought to shore for disposal. As part of the OA application process with the C-NLOPB, a Waste Management Plan will be prepared before drilling operations begin.

Table 2.1 Potential Project-Related Emissions and Discharges

Emission / Discharge	Source and Characterization	Management
Air Emission	Atmospheric emissions of criteria air contaminants and greenhouse gases would result from the following routine Project activities: • Fuel combustion from the MODU, support vessels and helicopters • Formation flow well testing (if required), including periods of flaring	Air emissions from the Project are required to adhere to the *Newfoundland and Labrador Air Pollution Control Regulations*, National Ambient Air Quality Objectives, Canadian Ambient Air Quality Standards, and applicable regulations under MARPOL. BHP will adhere to federal and provincial compliance and reporting requirements for emissions.

Table 2.1 Potential Project-Related Emissions and Discharges

Emission / Discharge	Source and Characterization	Management
Water-based Muds (WBMs)	WBMs are mainly comprised of either freshwater or seawater (approximately 75%) with other components such as bentonite (clay), barium sulphate (barite), and potassium chloride, and are primarily used for riserless sections of a well.	Excess WBM may be discharged to the marine environment as per the OWTG. The majority of WBMs discharged are classified under the Offshore Chemical Notification Scheme as substances that pose little or no risk to the environment (PLONOR).
Synthetic-based Muds (SBM)	SBMs may be used once the riser has been installed. SBM is a water-in-oil emulsion that contains non-aqueous (water insoluble) fluids manufactured through chemical processes.	SBM-associated drill cuttings will be discharged at the drill site, meeting regulatory performance targets detailed within the OWTG. The concentration of SBM on cuttings will be monitored on the MODU for compliance with the regulations. In accordance with the OWTG, no excess or spent SBM will be discharged to the sea. Spent or excess SBM that cannot be re-used during drilling operations will be brought back to shore for disposal.
Well treatment and testing fluids	Well testing may be required as part of the Project to gather information about the subsurface characteristics. Depending on well success, formation fluids, including hydrocarbons and associated water have the potential to be brought to surface during a well test.	Hydrocarbons, such as gas, oil or formation water that are brought to surface as part of well test activity will be flared for safe disposal. Flaring will be via one of two horizontal burner booms, to either a high efficiency burner head for liquids, or simple open-ended gas flare tips for gases to reduce fallout of un-combusted hydrocarbons. Flaring, if required, will be optimized to the amount necessary to characterize the well potential and as necessary for the safety of the operation.
Produced Water	Produced water includes formation water encountered in a hydrocarbon bearing reservoir that are brought to the surface during well evaluation and testing processes.	Small amounts of produced water may be flared. If volumes of produced water are large, some produced water may be brought onto the MODU for separation and treatment so that it can be discharged according to the OWTG.
Bilge and deck drainage water	Deck drainage is water on deck surfaces of the MODU from precipitation, sea spray or MODU activities such as MODU wash-down, or from fire control system or equipment testing. Bilge water is seawater that does not drain off the MODU and may seep or flow into parts of the MODU. Water may pass through pieces of equipment into other spaces of the MODU. Deck drainage and bilge water may be contaminated with hydrocarbons and other chemicals as it contacts equipment and machinery.	Deck drainage and bilge water will be discharged according to the OWTG which state that deck drainage and bilge water can only be discharged if the residual oil concentration of the water does not exceed 15 mg/L.

Table 2.1 Potential Project-Related Emissions and Discharges

Emission / Discharge	Source and Characterization	Management
Ballast water	Ballast water is used in MODU and PSVs to enhance stability and balance. Seawater is taken up or discharged when the cargo is loaded or unloaded, or when extra stability is needed to manage weather conditions. The water is typically stored in dedicated tanks on the vessel and does not usually become contaminated with hydrocarbons or chemicals. Depending on sailing history or operational practices of the vessel, ballast water may contain organisms and species from other areas.	Ballast water will be discharged according to International Maritime Organization *Ballast Water Management Regulations* and Transport Canada's *Ballast Water Control and Management Regulations.* The MODU will carry out ballast tank flushing before arriving in Canadian waters.
Grey and black water	Black and grey water will be generated from washing, bathing, laundry and galley facilities onboard the MODU and PSVs. Grey water will be generated from washing and laundry facilities, and black water includes sewage water generated from the accommodation areas.	Sewage (black water) will be macerated through sewage treatment plants onboard the MODU and vessels before discharge in accordance with MARPOL and OWTG. Grey water will be discharged at sea as far as practical from the nearest land.
Cooling water	Cooling water is seawater that is pumped onto the MODU and passed over or through equipment such as machinery engines as part of cooling processes. Cooling water may be required on the MODU; however, volumes are likely to be low. Water may be treated through biocides or electrolysis before use.	Cooling water will be discharged according to the OWTG which states that biocides used in cooling water are selected according to the Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands (OCSG). Cooling water is likely to be warmer than the receiving waters upon discharge but will be rapidly dispersed, reaching ambient temperatures.
BOP fluids	Regular program of function testing and pressure testing the BOP mechanism is required for safe well operations. BOP fluids are released directly to the ocean during BOP installation and removal, ranging between 335 and 552 bbl. There is also potential for fluid release during operation, testing, and non-routine retrieval or an emergency event. BOP fluid is a mix of 96% fresh water with 4% approved control fluid which are seawater soluble.	BOP fluids and other discharges from the subsea control equipment will be discharged according to OWTG and OCSG.
Putrescible solid waste	Includes food waste generated offshore.	Will be disposed according to OWTG and MARPOL requirements. Macerated food waste will not be discharged within 3 nautical miles from land.
Non-hazardous waste	Non-hazardous wastes, includes packaging material, scrap metal, and other recyclables.	Will be stored in designated areas on board the MODU. At scheduled intervals, waste will be transferred to the PSVs so that it can be transported to shore where it will be transferred to a third-party waste management contractor at an approved facility.

Table 2.1 Potential Project-Related Emissions and Discharges

Emission / Discharge	Source and Characterization	Management
Hazardous waste	Hazardous waste includes spent and excess chemicals, chemical containers, spent absorbents and oily rags, batteries, and biomedical waste.	Will be stored in dedicated and appropriate waste receptacles for transportation to shore where it will be transferred to a third-party waste management contractor at an approved facility. Transfer of hazardous wastes will be conducted according to the *Transportation of Dangerous Goods Act*. Applicable approvals for the transportation, handling and temporary storage, of these hazardous wastes will be obtained as required.
Sound emissions	Underwater sound will be generated by the MODU, PSVs, and the airgun used during VSP operations.	VSP activity will be planned and conducted in consideration of the SOCP with respect to the Mitigation of Seismic Sound in the Marine Environment (DFO 2007).
Light and thermal emissions	Light and thermal emissions will be generated by various sources from the Project. MODU and PSV navigation and deck artificial lighting will be operating 24 hours a day throughout drilling and vessel operations for maritime and crew safety. Flaring activity during well flow testing, if required, will generate light and thermal emissions on the MODU.	Lighting will be reduced to the extent that worker safety and safe operations is not compromised. Reduction of light may include avoiding use of unnecessary lighting, shading, and directing lights towards the deck. If BHP intends to flare, it will notify the C-NLOPB in accordance with "Measures to Protect and Monitor Seabirds in Petroleum-Related Activity in the Canada-NL Offshore Area".

2.3 Accidental Events

2.3.1 Potential Accidental Scenarios

BHP regularly evaluates potential risk events, and continually seeks to improve its preventative and response barriers to ensure a robust risk management strategy. Potential accidental event scenarios include:

- Well Blowout: A blowout could occur if both primary and secondary well control was lost. Potential causes of loss of primary well control could be unexpectedly high formation pressures, loss of drilling fluid hydrostatic overbalance due to human error, downhole losses, riser failure, MODU station keeping failure requiring emergency riser disconnect or poor cement job design, vessel collision requiring emergency riser disconnect, and accidental riser disconnect. Potential causes of loss of secondary well control could be equipment failure, human error, fire or explosion on the MODU.
- Batch Spill: Batch spills are accidental releases of various hydrocarbons (e.g., marine diesel) that occur once and include a bulk release with a finite amount (e.g., contents of a fuel tank or transfer hose). As an example, batch spills can occur as a result of a vessel collision or during bunkering operations on a MODU or PSV. Because batch spills cover a range of spill events the measures employed to prevent and, in the case of a spill, respond a release are broad ranging.
- SBM Spill: Spills of SBM could occur when transferring SBM to or from the PSV due to hose failure, station keeping failure and incorrect valve alignments. Spills of SBM could occur from the riser; these could be minor in nature (a few bbls) caused by failure of the slip joint packer, or a major spill (several

thousand bbls) caused by riser failure or LMRP unlatch (due to metocean conditions or MODU direct positioning failure or accidental activation).

A Safety Plan is required to be submitted for regulatory approval as part of the OA process and will provide additional information about accidental risks that could occur during Project operations, including risks with health and safety consequences (e.g., helicopter ditching). Contingency planning and emergency response is discussed in Section 2.3.3. Additional details to prevent potential accidental event scenarios is provided in Section 15.2 of the EIS.

2.3.2 Fate and Behaviour of Potential Spills

Oil spill trajectory and fate modelling was performed to support this EA in the Orphan Basin area (RPS Group 2019). A detailed discussion is provided in Section 15.3 of the EIS and key points are summarized here. Hypothetical releases were modelled at two locations in the Orphan Basin located more than 350 km east-northeast of St. John's, Newfoundland. Stochastic oil release modelling was conducted for continuous 30-day (capping stack scenario) and 120-day (relief well scenario) subsurface releases over a 160-day period for representative locations in EL 1157 (2,337 m water depth) and EL 1158 (2,047 m water depth). The modelling results were assessed against conservative ecological thresholds for oil surface thickness (10 µm), water column concentration (1.0 µg/L dissolved polycyclic aromatic hydrocarbons or 100 µg/L total hydrogen), and shoreline oiling (100 g/m^2).

For releases in EL 1157 and EL 1158 stochastic analyses indicated that the highest potential likelihood (>90%) for exceeding surface oil exposure and water column ecological thresholds occurred primarily to the east towards the Flemish Cap, up to 1,400 m from the release site. Released oil was forced to the east away from Canadian shorelines by prevailing winds and currents. Lower probabilities of surface oil and water column threshold exceedance occurred north and south of the release site and generally less than 25% of release potentially exceeded thresholds west of the Project Area. The probability of shoreline oiling from release scenarios was generally low (95) with maximum probability of 28% for a single shoreline grid cell. Predicted annual minimum time to shoreline threshold exceedance was 7 to 27 days, occurring along southeastern Newfoundland. Oil potentially reaching shorelines would likely be highly weathered oil that was discontinuous and patchy.

A surface oil thickness of >0.04 µm is the minimum concentration that would produce a barely visible sheen and is adopted in the trajectory modelling as a threshold for the possible closure of an area to fishing and possibly to other uses. The stochastic modelling results for a continuous 120-day unmitigated blowout from theoretical well sites in EL 1157 and EL 1158 indicate that there is a probability that surface oil exceeding the threshold could be present in some areas throughout much of the Regional Assessment Area (RAA). The modelling also indicates that the greatest probability is for surface oil to move generally eastward, away from Canadian EEZ waters and towards the Flemish Cap, Orphan Basin, and beyond.

Representative credible "worst-case" deterministic scenarios of a subsurface blowout at EL 1157 and EL 1158 are characterized by surface oil transported predominantly to the east and south. The footprints of the representative "worst-case" scenarios were centered to the east of the release sites. The area affected by surface oil thickness over the ecological threshold (10 µm) in the simulations ranged from

832,900 km² (modelled release: EL 1157, 4,052,506 bbl, 30 days) to 1,616,000 km² (EL 1157, 15,496,924 bbl, 120 days) (95th percentile).

The identified representative shoreline exposure cases were predicted to result in 1,241 to 1,597 km of contaminated shorelines. The releases at both sites resulted in similar lengths of shoreline oiling with the potential for contamination along the coasts of Newfoundland, mostly in excess of 500 g/m². The 30-day representative releases were predicted to contact the southern coasts of Newfoundland and the southern coast of the Avalon Peninsula. However, the 120-day representative releases were predicted to make contact with the northern coasts of Newfoundland and the eastern coasts of the Avalon Peninsula. As oil would take a week or more to reach the shoreline, it is predicted to be comprised of highly weathered oil that is patchy and discontinuous (RPS Group 2019).

The modelling results suggest that areas most likely to be affected by an unmitigated, subsurface, well blowout is Orphan Basin, Flemish Pass and the areas to the east. A detailed discussion of fate and behavior modelling is provided in Section 15.3 of the EIS. Model scenarios are based on unmitigated subsurface blowout scenarios. Emergency response and mitigations measures as detailed in Section 2.3.4 would be implemented in an actual event to limit the magnitude, duration, and extent of a spill. Shoreline protection measures would also reduce the potential effects on shorelines.

2.3.3 Spill Risk and Probabilities

There are three important aspects to determining “spill risk” associated with offshore oil exploration activities:

- Determining the likelihood or probability that a well blowout or other well release will occur
- Determining the potential oil spillage volumes that might occur and the probabilities that the spill will be a large-scale spill
- Determining the potential impacts of hypothetical spills

The results of the analyses show that the probability of a well blowout or other release is very low (i.e., blowouts and other spills from offshore production wells are quite rare). The analyses also show that if a spill were to occur, the chances are great that it would be a small volume of spillage rather than a very large event with high consequences. The available data were reviewed, and findings are based on historical research on offshore spills to determine the probabilities for spills and the potential spill volumes that might be involved.

The likelihood of incidents occurring depends on the number of wells and the duration of the exploration period. With more wells there are greater chances of having a spill. The two sites within the BHP Orphan Basin do not differ with respect to the probability of blowouts. They do differ with respect to potential blowout volumes due to a 1.2% difference in flowrates. For each, there is a 1 in 7,100 chance that there will be a blowout during exploration if there is one well. With 10 wells, the chance increases to 1 in 710. Across both sites with up to 20 wells, there is a 1 in 360 chance of a blowout. It is important to remember that if a blowout occurs, it is more likely to involve a relatively smaller volume than a very large volume, because of the multiple barriers capable of stopping a blowout.

Based on historical research on offshore spills there is a 1 in 5 chance of a batch spill for each well. This statistic is derived from the records of all batch spills, no matter the source, including those less than a liter. This means that with five or more wells, it can be expected that there is at least one batch spill, although this is not “guaranteed.” There is no difference between the sites. Batch spills also are generally relatively small as there is a limited amount of oil that is contained in the fuel tanks or other storage capacity.

2.3.4 Contingency Planning and Emergency Response

As detailed in Section 15.5 of the EIS, BHP prioritizes actions to prevent accidents occurring. However, in the unlikely event of a spill occurring a comprehensive set of emergency management procedures and equipment will be available to reduce harm to the environment.

BHP will have a suite of Emergency Response Plans (ERPs) including:

- ERP, this document will be supplementary and complimentary to the MODU and PSV Contractor ERPs.
- Oil Spill Response Plan (OSRP)
- Oiled Wildlife Response Plan (OWRP)
- Blowout Contingency Plan (Source Control Plan)

A multi-faceted approach will be taken in response to an uncontrolled hydrocarbon flow from the well. Many of these measures will be deployed simultaneously to provide a comprehensive response and ensure redundancy in control measures. This approach also provides a level of contingency so that additional measures will be available to be deployed as back-up if initial response measures are unsuccessful.

Efforts for well control response and well intervention (i.e., source control) strategies include:

- Direct BOP intervention
- Mobilization and installation of a capping stack
- Drilling of a relief well if required

BHP will have a source control plan that conforms to International Association of Oil and Gas Producers 594 Guidelines (industry best practice for these documents) and will be signed on to Atlantic Canada mutual aid agreements that facilitate the sharing of equipment, resources and personnel in the event of a blowout.

Oil spill response at an offshore facility falls under the jurisdiction of the C-NLOPB pursuant to Section 161 of the *Atlantic Accord Act*. The regulatory mandate of the C-NLOPB is to ensure the operator is taking all reasonable measures to prevent further spillage and to mitigate the effect and impacts of the spill. The Chief Conservation Officer has the authority to direct the operator or to take over management of the response effort directly, if reasonable measures are not being taken.

C-NLOPB is the designated lead agency in offshore spill incidents at the drilling site under memoranda of understanding. A variety of other federal and provincial agencies that may act in supporting roles include:

- Fisheries and Oceans Canada (DFO)
- Canadian Coast Guard
- Environment and Climate Change Canada (ECCC)

- Transport Canada
- Provincial government departments

The C-NLOPB is also named as the lead agency in offshore spill incidents under the Canadian Coast Guard National Emergency Response Plan. BHP is expected by the C-NLOPB to have a credible response capability including:

- Designated response personnel
- A training program for BHP personnel and BHP contractors
- Spill tracking and clean-up equipment at the offshore site

The C-NLOPB has expressed a series of 'expectations' or policies that pertain to drilling operations, in addition to specific requirements under formal guidelines, these include:

- An on-site oil spill response capability
- Access to third party oil spill personnel and equipment
- Mutual aid agreements with other Grand Banks operators

BHP's OSRP for the BHP Canada Exploration Drilling Project will cover the management, countermeasures, strategies, and training that will be used in the response to potential spills originating inside the safety zone of the Project.

BHP will employ a structured, systematic, and proportional management process, in the response to any uncontrolled release of hydrocarbons at any offshore site, in the unlikely event of a spill. Priorities in managing the response will be:

- Protection of personnel
- Protection of property (as it may affect human or environmental safety)
- Protection of the environment

Safely mitigating the effects of a spill in a way that results in the highest Net Environmental Benefit will be BHP's response priority in response to a spill. The measures implemented will be taken after consultation with regulators and will be safe, have little or no environmental impact, practical, and cost-effective.

2.4 Project Schedule

BHP proposes to commence exploration drilling with an initial well as early as 2021, pending applicable regulatory and corporate approvals, the identification of suitable drilling targets and other technical, logistical, and commercial considerations. Upon completion of these first well(s) and based on results, additional well site locations may be identified. It is currently anticipated that up to ten wells (exploration and possibly appraisal) may be drilled on either or both of the ELs, for a total of up to 20 wells being drilled during the term of the ELs (2019-2028). ELs issued by the C-NLOPB have a maximum nine-year term (consisting of two consecutive periods), when the interest owner is required to drill or spud and diligently pursue one exploratory well on or before the expiry date of Period I as a condition of obtaining tenure to Period II. Period I is six years commencing 15 January 2019 and Period II immediately follows Period I with an expiry date of 15 January 2028.

Planned exploration activities that comprise the Project may occur at various times of the year during any year between 2021 and 2028. Drilling activities may not be continuous and will be determined, in part, by MODU availability and previous wells' results. There may at times be up to two MODUs working in different parts of the Project Area simultaneously. It is expected that each well will require approximately 35 to 115 days for drilling, which will be followed by well decommissioning and abandonment or suspension. Wells designed for suspension and re-entry will be determined through further prospect evaluation. VSP operations are estimated to take approximately one to two days per well.

3.0 ALTERNATIVE MEANS OF CARRYING OUT THE PROJECT

As required under section 19(1)(g) of CEAA 2012, the EA of a designated project must consider alternative means of carrying out the project that are considered technically and economically feasible and include the environmental effects of such alternative means. The approach to review of alternative means is consistent with the CEA Agency (2015a) Operational Policy Statement for Addressing "Purpose of" and "Alternative Means" under CEAA 2012. An analysis of alternative means for the following Project components and activities is required by the EIS Guidelines (CEA Agency 2019) and requires the analysis of alternative means for the following Project components and activities:

- Drilling fluid selection (e.g., WBM or SBM)
- MODU selection
- Drilling waste management
- Water management and effluent discharge
- Alternative lighting options for the MODU (including flaring) to reduce attraction and associated mortality of birds

Each option for the alternative means is summarized in Table 3.1. The preferred alternative means form the basis for the Project to be assessed (i.e., assumed to be the base case that is assessed for environmental effects in the EIS). Specific drill fluids and other chemicals and materials have yet to be identified or selected for the Project. A drilling fluid and cementing contractor for the Project has not yet been selected, and the drilling fluid basis of design for the wells is under development. Therefore, potential alternatives have not yet been identified and BHP is unable to evaluate and select alternative chemicals as part the EA process.

Table 3.1 Summary of Alternatives Analysis

Options	Regulatory Acceptability	Technically Feasibility	Economic Feasibility	Potential Environmental Considerations	Preferred Option
Drilling Fluid					
WBM	YES Acceptable for use in accordance with regulatory requirements (i.e., OCSG)	YES Technically feasible for drilling initial hole sections Technically inferior in drilling deeper sections of well	YES Economically feasible for initial hole sections when drilling Economically inferior in deeper sections of well. Probability of increased non-productive time and cost associated with drilling deeper sections of well	Considered acceptable for drilling initial and deeper sections provided appropriate controls are in place and chemicals are selected in accordance with OCSG	✓ Use of WBM for drilling initial hole sections when drilling without riser installed

Table 3.1 Summary of Alternatives Analysis

Options	Regulatory Acceptability	Technically Feasibility	Economic Feasibility	Potential Environmental Considerations	Preferred Option
SBM	YES Acceptable for use in accordance with regulatory requirements (i.e., OCSG)	YES Technically feasible and superior for drilling deeper sections of well	YES Economically feasible for drilling deeper sections of well	Not considered acceptable for drilling initial sections. SBM cannot be used for riserless drilling where the cuttings are disposed directly on the seafloor (See Section 2.4.1.2) Considered acceptable for deeper sections provided appropriate controls are in place and chemicals are selected in accordance with OCSG	✓ Use of SBM for drilling deeper hole sections when riser installed
MODU					
Semi-submersible Drilling Unit	YES Acceptable for use following issuance of Certificate of Fitness	YES Suitable for working in deep-water environment of ELs.	YES Economically feasible for Project	MODU be can be used in an environmentally acceptable manner provided that appropriate approvals and mitigation measures are implemented Comparable environmental effects in terms of lighting, emissions, discharges and underwater sound	✓ Semi-submersibles may be used for the Project
Drillship	YES Acceptable for use following issuance of Certificate of Fitness	YES Suitable for working in deep-water environment of ELs. However less suited to harsh environment than semi	YES Economically feasible for Project. More prone to weather related downtime than a semi	MODU can be used in an environmentally acceptable manner provided that appropriate approvals and mitigation measures are implemented Comparable environmental effects in terms of lighting, emissions,	✓ Drillships may be used for the Project

Table 3.1 Summary of Alternatives Analysis

Options	Regulatory Acceptability	Technically Feasibility	Economic Feasibility	Potential Environmental Considerations	Preferred Option
				discharges and underwater sound	
Jack-up Rig	YES Acceptable for use following issuance of Certificate of Fitness	NO Not technically feasible considering the Project water depths	Not assessed as option is not technically feasible		✗ Jack-up rigs will not be used for the Project
Drilling Waste Management					
At-sea Disposal (WBM)	YES Acceptable for use in accordance with regulatory requirements (i.e., OWTG)	YES Only technically feasible option for WBM cuttings during the riserless section	YES Economically feasible for Project	Localized environmental effects on the seafloor within cuttings footprint	✓ At-sea disposal of WBM cuttings during riserless drilling
At-sea Disposal (SBM)	YES Acceptable for use in accordance with regulatory requirements (i.e., OWTG)	YES Technically feasible for Project	YES Economically feasible for Project	Localized environmental effects on the seafloor within cuttings footprint	✓ At-sea disposal of SBM cuttings following treatment
Reinjection (WBM)	YES Acceptable for use in accordance with regulatory requirements (i.e., OWTG)	NO During riserless drilling cuttings cannot be returned to MODU for collection and alternate disposal	Not further assessed as option is not technically feasible		✗ Not considered as an option as not technically feasible
Reinjection (SBM)	YES Acceptable for use in accordance with regulatory requirements (i.e., OWTG)	NO Not developed for deep-water applications	NO Economically inferior because of complexity and costs associated with specialized equipment	Reduced potential offshore environmental effects	✗ Considered not technically or economically feasible
Onshore Disposal (WBM)	YES Acceptable for use in accordance with regulatory requirements (i.e., OWTG)	NO During riserless drilling cuttings cannot be returned to MODU for collection and alternate disposal	Not further assessed as option is not technically feasible		✗ Not considered as an option as not technically feasible

Table 3.1 Summary of Alternatives Analysis

Options	Regulatory Acceptability	Technically Feasibility	Economic Feasibility	Potential Environmental Considerations	Preferred Option
Onshore Disposal (SBM)	YES Acceptable for use in accordance with regulatory requirements (i.e., OWTG)	YES Storage of drilling wastes on MODU before shipment by PSV to approved waste management facility for treatment and disposal	YES Economically inferior for cuttings because of increased transportation costs and operational delays	Reduced potential offshore environmental effects Increased potential onshore environmental effects associated with atmospheric emissions from transportation, and habitat alteration from onshore treatment and disposal	✓ Spent SBM is returned to shore for disposal or re-use ✗ SBM cuttings disposal considered economically inferior. Potential for increased onshore environmental effects
Water Management and Effluent Discharge Points					
At-sea Disposal	YES Acceptable for specific liquid wastes in accordance with regulatory requirements (i.e., OWTG, MARPOL)	YES Technically feasible for Project	YES Economically feasible for Project	Localized environmental effects that are considered acceptable provided appropriate treatment and disposal in accordance with regulatory requirements	✓ Discharge of bilge and deck drainage water, ballast water, grey and black water, and cooling water in accordance with regulatory requirements
Flaring (Well treatment and testing fluids, Produced Water)	YES Acceptable for specific liquid wastes in accordance with regulatory requirements	YES Technically feasible for Project	YES Economically feasible for Project	Localized environmental effects associated light and thermal emissions	✓ Well treatment and testing fluids will be flared for safe disposal. Small amounts of produced water may be flared

Table 3.1 Summary of Alternatives Analysis

Options	Regulatory Acceptability	Technically Feasibility	Economic Feasibility	Potential Environmental Considerations	Preferred Option
Onshore Disposal	YES Acceptable for specific liquid wastes in accordance with regulatory requirements (i.e., OWTG, MARPOL)	YES Technically feasible for Project	YES Economically feasible for Project	Reduced potential offshore environmental effects Increased potential onshore environmental effects associated with atmospheric emissions from transportation	✓ Liquid wastes not approved for discharge in OWTG transported onshore for treatment and disposal
Effluent Discharge Points	Options not considered as specific discharge points are fixed based on MODU design and cannot be re-configured. Confirmation that effluent discharge and water management systems comply with relevant legislation during application for Certificate of Fitness.				
Lighting					
Standard Lighting	YES Lighting required for navigation, safety, and regulatory compliance reasons	YES Technically feasible for Project	YES Economically feasible for Project	Potential localized effects on marine and migratory birds	✓ Standard lighting will be used for the Project
Spectral Modified Lighting	YES Lighting required for navigation, safety, and regulatory compliance reasons	NO Limited capabilities in extreme weather, lower energy efficiency, helicopter safety concerns	NO Not commercially viable	Potential reduced effects on marine and migratory birds	✗ Considered not technically or economically feasible
Flaring					
No Flaring	NO Not acceptable because of regulatory and safety requirements	Not further assessed as option does not have regulatory acceptability			✗ Not considered as option does not have regulatory acceptability
Interval Pressure Transient Testing	YES Acceptable in accordance with regulatory requirements	YES Technically inferior as may not fulfill C-NLOPB data requirements in all cases	YES Economically inferior with extended schedule associated with inferior data collection	No potential atmospheric effects on marine and migratory birds	✓ Conducted on case by case basis

Table 3.1 Summary of Alternatives Analysis

Options	Regulatory Acceptability	Technically Feasibility	Economic Feasibility	Potential Environmental Considerations	Preferred Option
Reduced Flaring (no flaring during night or inclement weather)	YES Acceptable in accordance with regulatory requirements	YES Technically inferior with potential compromised data from formation flow test	YES Economically inferior with potential schedule extension	Reduced potential atmospheric effects on marine and migratory birds	✗ Technically and economically inferior to other options
Flaring as required	YES Acceptable in accordance with regulatory requirements	YES Technically feasible for Project	YES Economically feasible for Project	Potential localized atmospheric effects on marine and migratory birds	✓ Conducted when Interval Pressure Transient Testing is not appropriate for data collection

As Project planning continues, BHP and its contractors will follow chemical management and selection processes to define the ways in which chemicals will be chosen and used. Chemical management processes will be defined before the start of drilling activity and will be conducted in accordance with applicable legislation as summarized in EIS Section 2.8.4.

4.0 CONSULTATION AND ENGAGEMENT

BHP recognizes the importance of proactive and systematic engagement with an emphasis on dialogue, inclusion, transparency, accountability and respect.

4.1 Government Departments and Agencies

For confirmation of specific regulatory requirements / processes and/or data requests, regulatory stakeholders are typically engaged. Key regulatory stakeholders for the Project are:

- C-NLOPB
- Government of Canada
  - CEA Agency
  - DFO
  - ECCC
  - Canadian Coast Guard
  - Natural Resources Canada
  - Department of National Defence
  - Transport Canada
- Government of NL
  - Municipal Affairs and Environment
  - Fisheries and Land Resources
  - Natural Resources

In the planning and developing of the EIS, to date, BHP has obtained relevant existing environment information and/or guidance in assessment methods and approach through consultation with multiple stakeholders, including the CEA Agency (now the Impact Assessment Agency of Canada), the C-NLOPB, DFO, ECCC (including the Canadian Wildlife Service [CWS]), Natural Resources Canada, Transport Canada, Department of National Defence, Health Canada, and the NL Department of Natural Resources. The review process of the Project Description and EIS guidelines also involved participation of these same government departments and agencies. Comments provided during these review processes and meetings were taken into consideration during the preparation of the EIS.

BHP is planning to host a meeting with regulatory agencies in the Spring 2020 after submission of the EIS to present an overview of the EIS and the results of spill modelling. BHP will also continue to consult with government departments and agencies throughout the EIS review process and during preparation of follow-up and monitoring programs.

4.2 Indigenous Groups

BHP recognizes the traditional rights of Indigenous peoples and their practices. For this EA, BHP understands that there are several Indigenous communities in Newfoundland-Labrador, Nova Scotia, Prince Edward Island, New Brunswick, and Quebec that have interests in the Project. There are several communities that hold commercial communal fishing licence for Northwest Atlantic Fisheries organization

(NAFO) Divisions that overlap the Project Area, although engagement to date suggests that fishing is not currently active in the Project Area under these licences. There are no documented food, social and ceremonial (FSC) licences within or near the Project Area. However, interactions between Project activities (routine or unplanned) and species harvested for commercial or FSC purposes outside the Project Area may potentially occur during species migration to traditional fishing grounds. There is also potential for the presence of species at risk (SAR) and/or species of cultural importance in the Project Area (e.g., Atlantic salmon).

The EIS Guidelines (Section 5.1) specify that BHP engage the following Indigenous groups:

Newfoundland and Labrador

- Labrador Inuit (Nunatsiavut Government)
- Labrador Innu (Innu Nation)
- NunatuKavut Community Council
- Qalipu Mi'kmaq First Nation Band
- Miawpukek First Nation

Nova Scotia

- Assembly of Nova Scotia Mi'kmaq Chiefs through the Kwilmu'kw Maw-klusuaqn Negotation Office, which represents the following 11 Mi'kmaq First Nations in Nova Scotia:
  - Acadia First Nation
  - Annapolis Valley First Nation
  - Bear River First Nation
  - Eskasoni First Nation
  - Glooscap First Nation
  - Membertou First Nation
  - Paqtnkek Mi'kmaw Nation
  - Pictou Landing First Nation
  - Potlotek First Nation
  - Wagmatcook First Nation
  - We'koqmaq First Nation
- Sipekne'katik First Nation
- Millbrook First Nation

Prince Edward Island

- L'Nuey (formerly Mi'kmaq Confederacy of Prince Edward Island), which represents the following Mi'kmaq First Nations:
  - Abegweit First Nation
  - Lennox Island First Nation

New Brunswick

- Mi'gmawe'l Tplu'taqnn Inc., which represents the following Mi'kmaq First Nation groups:
  - Fort Folly First Nation
  - Eel Ground First Nation
  - Pabineau First Nation
  - Esgenoôpetitj First Nation
  - Buctouche First Nation
  - Indian Island First Nation
  - Eel River Bar First Nation
  - Metepnagiag Mi'kmaq First Nation
- Elsipogtog First Nation
- Wolastoqey Nation in New Brunswick, which coordinates consultation with the following six Wolastokivik (Maliseet) First Nations:
  - Kingsclear First Nation
  - Madawaska Maliseet First Nation
  - Oromocto First Nation
  - St. Mary's First Nation
  - Tobique First Nation
  - Woodstock First Nation
- Peskotomuhkati Nation at Skutik (Passamaquoddy)

Quebec

- Mi'gmawei Mawiomi Secretariat, which represents the following Mi'gmaq First Nation groups:
  - Micmas of Gesgapegiag
  - La Nation Micmac de Gespeg
  - Listuguj Mi'gmaq Government
- Les Innus de Ekuanitshit
- Innu First Nation of Nutashkuan

Engagement with Indigenous groups was initiated via letter by BHP on March 28, 2019 to introduce the Project and inquire about potential interests and concerns. In July 2019, BHP followed up on the initial request with a second letter acknowledging and outlining the Indigenous interests and concerns that had been brought forward and invited Indigenous groups to attend a series of workshops in September 2019 to discuss interests and concerns.

Three workshops were held in September across the Atlantic Region in St. John's, Moncton, and Quebec City. The workshops provided an opportunity for mutual information exchange and dialogue regarding the following topics: introduction to company, Indigenous knowledge and social value, approach to the EIS, emergency preparedness and response, well control strategies, environmental monitoring, cumulative effects and ongoing communication with Indigenous groups.

BHP is aware that there are several other similar offshore exploration drilling EAs at various stages of environmental assessment under CEAA 2012. BHP understands the importance of recognizing and

learning from ongoing engagement with Indigenous groups and has joined with other operators to collaborate on current and future engagement to reduce burdens that may be caused by multiple engagement requests from multiple operators to Indigenous groups. BHP will coordinate opportunities for engagement with the exploratory drilling programs in the Flemish Pass and Orphan and Jeanne d'Arc Basins, including Husky Oil Operations, CNOOC Petroleum North America ULC (formerly Nexen Energy ULC), Suncor Energy, BP, Equinor (formerly Statoil), Chevron Canada, and ExxonMobil Canada.

Each of the identified Indigenous groups has and will continue to be notified by the Impact Assessment Agency of Canada about the steps in the EIS development process and of opportunities to review key documents. BHP remains available to meet with interested Indigenous groups to discuss details of their exploration drilling program, and concerns and interests they raise.

4.3 Fisheries Stakeholders

Early and ongoing consultation with the fishing industry is a key form of mitigation of potential effects of the Project on fisheries. The following is a list of initial fisheries stakeholders engaged, or to be engaged, for the Project:

- Fish, Food and Allied Workers-Unifor
- Association of Seafood Producers
- Ocean Choice International
- Atlantic Groundfish Council
- Canadian Association of Prawn Producers (CAPP)
- Mi'kmaq Alsumk Mowimskik Kaqoey Association

One Ocean, which acts as a liaison between the oil and gas and fishing industries, has developed a protocol that provides guidance on consultation approach.

4.4 Other Public Stakeholder Groups

Other public stakeholders include industry associations and non-governmental organizations. BHP will monitor activities and communications generated by these groups and participate in local industry events as appropriate, including supplier information sessions, seminars, and conferences. Engagement with public stakeholders will primarily be through BHP's external website, where pertinent Project information will be available.

4.5 Topics of Interest and Concerns

A summary of key issues and concerns raised by stakeholders and Indigenous groups during the EA process to date, and how these are being addressed, is provided in Table 4.1.

Table 4.1 Summary of Topics of Interest and Concerns

Commenter	Topics of Interest / Concern
Government and Agencies	Spill response and control capabilities: • Wells should be designed for worst case scenarios • There should be contingency in Project design • Capping stack and relief well timelines are a key area of interest *Action / Mitigation*: • BHP will implement multiple preventative and response barriers to manage risk of incidents occurring and mitigate potential consequences. See Section 15.1.3 of the EIS for information on BHP's approach to risk management, Section 15.5.2 of the EIS for specific information on well control and blowout prevention, and Section 15.5 of the EIS for a description of BHP's contingency planning and emergency response measures.
	Ongoing communication: • Important to contact DFO regarding timing and location of planned DFO research surveys • Maintain ongoing communications with NAFO Secretariat through DFO *Action / Mitigation*: • BHP will maintain ongoing communications with the NAFO Secretariat, through DFO as the Canadian representative, regarding planned Project activities, including timely communication of drilling locations, safety zone, and decommissioned well sites. • BHP will contact DFO about timing and locations of planned DFO research surveys.
Indigenous Groups	Atlantic Salmon (and other culturally important species): • Potential impacts of exploration drilling (both operations and potential accidents) on Atlantic salmon populations that may migrate and over-winter in the Project Area. These populations return to their natal rivers and streams where they could be harvested for traditional purposes (FSC). Some of these populations are listed under the *Species at Risk Act* (SARA), and in many cases, Indigenous communities do not harvest for FSC purposes, due to ecological concerns. • Other culturally important species of concern to Indigenous groups include American eel, swordfish, tuna, ground fish, lobster, crab, sea turtles, sharks and marine mammals. *Action / Mitigation*: • BHP recognizes the importance of salmon to Indigenous groups in the Atlantic region, as well as the uncertainty associated with the known presence and activities of Atlantic salmon in the Project Area. BHP, along with other oil and gas companies are required to provide funding to the Environmental Science Research Fund for studies related to environmental and social issues related to decision-making for oil and gas projects. The Environmental Science Research Fund has released an expression of interest for research in this area that involves Indigenous peoples.
	Potential Impacts to Indigenous Fisheries: • Impacts from operations and potential incidents or spills that may result in adverse environmental effects on traditional, commercial and commercial communal fisheries. For example – many concerns and questions were raised regarding behavioural impacts on Atlantic salmon and other species of operations - such as underwater noise, light, vibration and changes to water quality. *Action / Mitigation*: • BHP will continue to engage with Indigenous groups throughout the exploration drilling program and provide information related to operational activity, and the results of environmental monitoring. BHP will develop a communication protocol with Indigenous groups to provide regular updates during operations, and to inform Indigenous groups in the event of an emergency.

Table 4.1 Summary of Topics of Interest and Concerns

Commenter	Topics of Interest / Concern
	• While there are no active fisheries in the immediate Project Area, BHP will continue to work with Indigenous fishers to reduce potential effects on their ability to exercise their rights to fish.
	Cumulative Effects: • There is a perceived lack of a comprehensive approach to analyzing, understanding and addressing the potential for cumulative impacts of so many proposed projects in the region on the environment, and on Indigenous rights. It is anticipated that the current Regional Assessment underway in Atlantic Canada will address cumulative effects. Indigenous groups expressed interest in third-party, independent technical experts leading the Regional Assessment. *Action / Mitigation*: • BHP is advocating for and participating in the Regional Assessment where a more regional and multi-faceted approach is being taken to examining cumulative effects of multiple projects and interactions with other ocean users. BHP will apply applicable new learnings from the regional assessment to their exploration drilling project.
	Indigenous Knowledge: • The EIS and Project implementation should consider and integrate Indigenous traditional and ecological knowledge regarding aquatic, nearshore and offshore environments. • Indigenous groups expressed general disappointment with the work that has been done to date, as Indigenous Knowledge studies have typically been too narrowly focused and do not take into account the full regional history, current and ongoing changes within the communities, and potential future aspirations. There is a preference for more holistic inclusion of Indigenous Knowledge throughout the regulatory process. • Indigenous groups also recognize the complexity and sensitivity of gathering and applying or integrating Indigenous Knowledge in EIS and further, to operations – particularly in an area as geographically and culturally diverse as the Atlantic region. Many issues must be considered, for example, confidentiality and protection of information, where that information is managed and maintained, and by whom. *Action / Mitigation:* • BHP has endeavoured to gather Indigenous Knowledge, where appropriate and available, and recognizes the importance of considering Indigenous Knowledge in its operations. BHP is actively supporting an Atlantic-wide proposal to fund a number of regional Indigenous Knowledge studies through the Environmental Science Research Fund.
	Environmental Monitoring and Management: • In addition to concerns regarding potential impacts to fishing and fishing rights, Indigenous groups have concerns regarding effects of exploration drilling operations on the marine environment, including changes to water quality, fish and fish habitat, marine plants, migratory birds and marine mammals and increased contributions to atmospheric emissions. • Indigenous groups would like to see comprehensive monitoring and follow-up programs, including research and data collection related to impacts on Indigenous groups – e.g., fish and fish habitat, birds and marine mammals. Indigenous groups requested being involved with environmental monitoring; and, to be kept informed of results of environmental monitoring programs throughout the exploration drilling program, and in the event of an incident or spill that may result in adverse environmental effects. • Indigenous groups would also like to see more industry funding go towards environmental research that studies the ecosystems and habitats holistically, and tracks data and knowledge over time. Recommended partnerships included regional

Table 4.1 Summary of Topics of Interest and Concerns

Commenter	Topics of Interest / Concern
	universities, who may also be able to share raw data, video footage, and photographs with interested groups following research projects. *Actions / Mitigation Measures*: • Potential impacts to the environment are addressed through the EIS's analysis of valued components. • During operations, BHP will share the results of environmental monitoring with Indigenous groups through monthly operational updates. At the conclusion of exploration drilling, and once results are available, BHP will share final environmental monitoring results with Indigenous groups. • BHP will also explore partnerships with Indigenous groups, local universities including Memorial University, and other independent research groups to collaboratively further the environmental knowledge base in the region.
	Compensation: • A 'best practice approach' was discussed for compensation, and while all parties acknowledge the C-NLOPB guidelines for loss or damage to fishing gear and vessels, all parties also acknowledge the challenges of valuing the losses with spiritual, cultural or social importance. For example, commercial communal fisheries are different than "regular" commercial licences as ownership is often shared across the community and not transferable, and the profits often sustain employment, programs and services, and community infrastructure. • Indigenous groups also indicated that "perceived" impacts are important to consider following an incident. For example, if there is a community perception that fish are tainted following an oil spill, this can result in a lower market value and sales revenues for the commercial communal fisheries. • If a compensation plan is required, the parties involved should give additional thought to ensuring that remediation efforts reach the most marginalized people of the community. *Actions / Mitigation Measures*: • In addition to adopting the C-NLOPB guidelines, where Indigenous groups are involved BHP would take a case-by-case approach and seek to co-design a compensation negotiation process with the affected community in accordance with their institutions, decision making processes, and norms. The Company and community would then work through this process together to identify the appropriate compensation plan.
	Oil Spill Response: • A number of concerns have been expressed by Indigenous groups regarding oil spill response, including: - Concerns about oil reaching shoreline, impacting fisheries and traditional territories. - Companies need to demonstrate the accuracy of probability calculation and trajectories of oil spills. - Capping stacks – a capping stack located and maintained in Atlantic Canada. - How can Indigenous groups/communities be involved in emergency response? - Concerns expressed regarding contamination or fish taint from an oil spill and how this impacts not only consumption, but also perception and cultural norms. • BHP and Indigenous groups discussed emergency preparedness and oil spill response in detail in the workshops, including management practices, oil spill modelling, capping stacks and other technology, and the oil spill response Incident Command System. *Actions / Mitigation Measures*: • BHP is building upon the previous efforts of the oil and gas industry to create capacity and awareness of industry and company standards to prevent and respond to an emergency. BHP will advocate for Indigenous communities' participation in future oil

Table 4.1 Summary of Topics of Interest and Concerns

Commenter	Topics of Interest / Concern
	spill response planning and response exercises. BHP will develop an Indigenous Fisheries Communications Plan in consultation with Indigenous groups that includes a protocol for communicating with Indigenous groups during operations, and in the event of an emergency.
	Communication and Ongoing Involvement of Indigenous groups: • Indigenous groups would like to be actively informed of activities and outcomes during exploration and operations, and in the event of an incident or spill that may result in adverse environmental effects. In the event of an incident, information requested on a regular basis includes near misses with detail on what happened or how it was prevented, what the impacts were or could have been, and what measure are being taken to mitigate or prevent again. Written communications via email were noted to be sufficient, with follow up information on a public website also appropriate. • Indigenous groups referenced challenges with engagement fatigue, given the number of oil and gas operators as well as other industries requesting engagement. While a preferred method of direct engagement is workshop sessions, Indigenous groups request that companies collaborate on sessions. *Action / Mitigation*: • BHP will develop an Indigenous Fisheries Communication Plan in consultation with Indigenous groups, that takes the information referenced into account, to outline a process and content for regular operational updates during the drilling campaign, as well as outreach to Indigenous groups in the unlikely event of an emergency
Fisheries	Ongoing Communication: • Fisheries should be engaged through One Ocean early in the process • Logistic information should be provided to fisheries regarding schedule *Action / Mitigation*: • BHP will continue to engage commercial fisheries groups and relevant enterprises to share Project details and fisheries information, and to determine the need for a fisheries liaison officer during mobilization and demobilization of the MODU, with reference to the One Ocean Risk Management Matrix Guidelines (One Ocean n.d.). A Fisheries Communication Plan will be used to facilitate coordinated communication with fishers, including details about planned activities and the safety (exclusion) zone.
	Impacts to fisheries: • Concern regarding the MODU and PSV moving through fishing gear • Potential effects from spills and impact on tainted product *Action / Mitigation*: • BHP will continue to engage commercial fisheries groups and relevant enterprises to share Project details and fisheries information, and to determine the need for a fisheries liaison officer during mobilization and demobilization of the MODU, with reference to the One Ocean Risk Management Matrix Guidelines (One Ocean n.d.). A Fisheries Communication Plan will be used to facilitate coordinated communication with fishers, including details about planned activities and the safety (exclusion) zone. • Project-related damage to fishing gear will be compensated through an operator program in accordance with industry best practices in the NL offshore and relevant industry guidance material such as the Geophysical, Geological, Environmental, and Geotechnical Program Guidelines (C-NLOPB 2019), the Canadian East Coast Offshore Operators Non-attributable Fisheries Damage Compensation Program (CAPP 2007), and the Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activities (C-NLOPB and CNSOPB 2017) which apply when gear loss or damage occurs because of a spill or authorized discharge, emission or escape of petroleum.

5.0 ENVIRONMENTAL ASSESSMENT APPROACH

5.1 Scope of the Assessment

The scope of the Project was first defined in the Project Description submitted by BHP to the CEA Agency on 9 May 2019 and is further discussed in Chapter 2 of this EIS. BHP proposes to drill up to 20 exploration or appraisal wells within ELs 1157 and 1158. The potential environmental effects of routine Project activities that have been specifically identified and considered in this assessment, include:

- Presence and operation of a MODU (including drilling, associated safety zone, lights, sound, and geotechnical / geophysical surveys)
- VSP
- Discharges and emissions (e.g., drill muds and cuttings, liquid discharges)
- Well testing and flaring (including air emissions)
- Well decommissioning and abandonment or suspension
- Supply and servicing operations (including helicopter transportation and PSV operations)

Also identified and considered within the scope of the Project are non-routine events (i.e., accidental events or malfunctions) which includes:

- Blowouts (uncontrolled release of hydrocarbons during drilling)
- MODU and vessel batch spills and releases (e.g., hydraulic fluid, drilling mud, diesel).

Accidental releases, or “spills”, have the potential to occur in the offshore (e.g., during drilling) or nearshore (e.g., during PSV transit) environment.

5.2 Overview of Approach

The methods used to assess the effects of routine Project activities and accidental events, as well as the potential cumulative effects of the Project, are outlined below and in Chapter 4 of the EIS in consideration of the requirements of the CEAA 2012 and guidance issued by the CEA Agency. Previous offshore exploration project assessments within the Newfoundland and Nova Scotian offshore areas have been prepared using these methods and have been reviewed and approved by the CEA Agency or are currently under review.

These methods follow the guiding principles and specific requirements as set out in the Project-specific Guidelines, “Guidelines for the Preparation of an Environmental Impact Statement pursuant to the *Canadian Environmental Assessment Act, 2012*” BHP Exploration Drilling Project (EIS Guidelines), issued by the CEA Agency on 28 June 2019. The importance of EA as a planning and decision-making tool is emphasized in these guiding principles.

5.2.1 Identification and Selection of Valued Components

The approach to identifying and selecting valued components (VCs) for this Project was consistent with the requirements of CEAA 2012 and the Project-specific EIS Guidelines provided by the CEA Agency (2019). VC selection was also based on discussions with regulatory agencies, technical experts, key stakeholders, public and Indigenous groups as well as EA team experience with previous similar EAs.

The VCs selected for the EIS include the following:

- Marine Fish and Fish Habitat (including SAR)
- Marine and Migratory Birds (including SAR)
- Marine Mammals and Sea Turtles (including SAR)
- Special Areas
- Indigenous Peoples and Communities
- Commercial Fisheries and Other Ocean Uses

5.2.2 Spatial and Temporal Boundaries

Environmental effects are evaluated within spatial and temporal boundaries. Spatial boundaries are defined as the geographic extent of the measurable potential environmental, social, heritage and human effects of the Project (including project activities and components). The spatial boundaries include:

- **Project Area** (Figure 5-1): The Project Area is the boundary that encompasses the immediate area within which Project activities and components occur (EL 1157 and EL 1158) and incorporates an approximate 20 km buffer. Well locations have not been identified but will occur within the ELs in the Project Area. The Project Area is consistent across all VCs.
- **Local Assessment Area (LAA)**: The LAA is the maximum area within which environmental effects from routine 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 including effects thresholds, predictive modelling and professional judgement. The LAA is defined for each VC.
- **Regional Assessment Area (RAA)** (Figure 5-1): The RAA is the area that establishes the context for determination of significance of Project residual environmental effects from Project activities and components. It is also the area within which potential cumulative effects – the residual effects from the proposed Project in combination with those of past, present and reasonably foreseeable projects – are assessed. Although the RAA is intended to be much broader than the LAA, which focuses on the extent of potential effects associated with routine Project activities for each VC, it is possible that effects from larger scale unplanned events (e.g., blowout) could extend beyond the RAA. The RAA is consistent for all VCs, except for the Indigenous Peoples and Communities VC which has a larger RAA to encompass the various Indigenous communities which have the potential to be affected by Project-related activities.

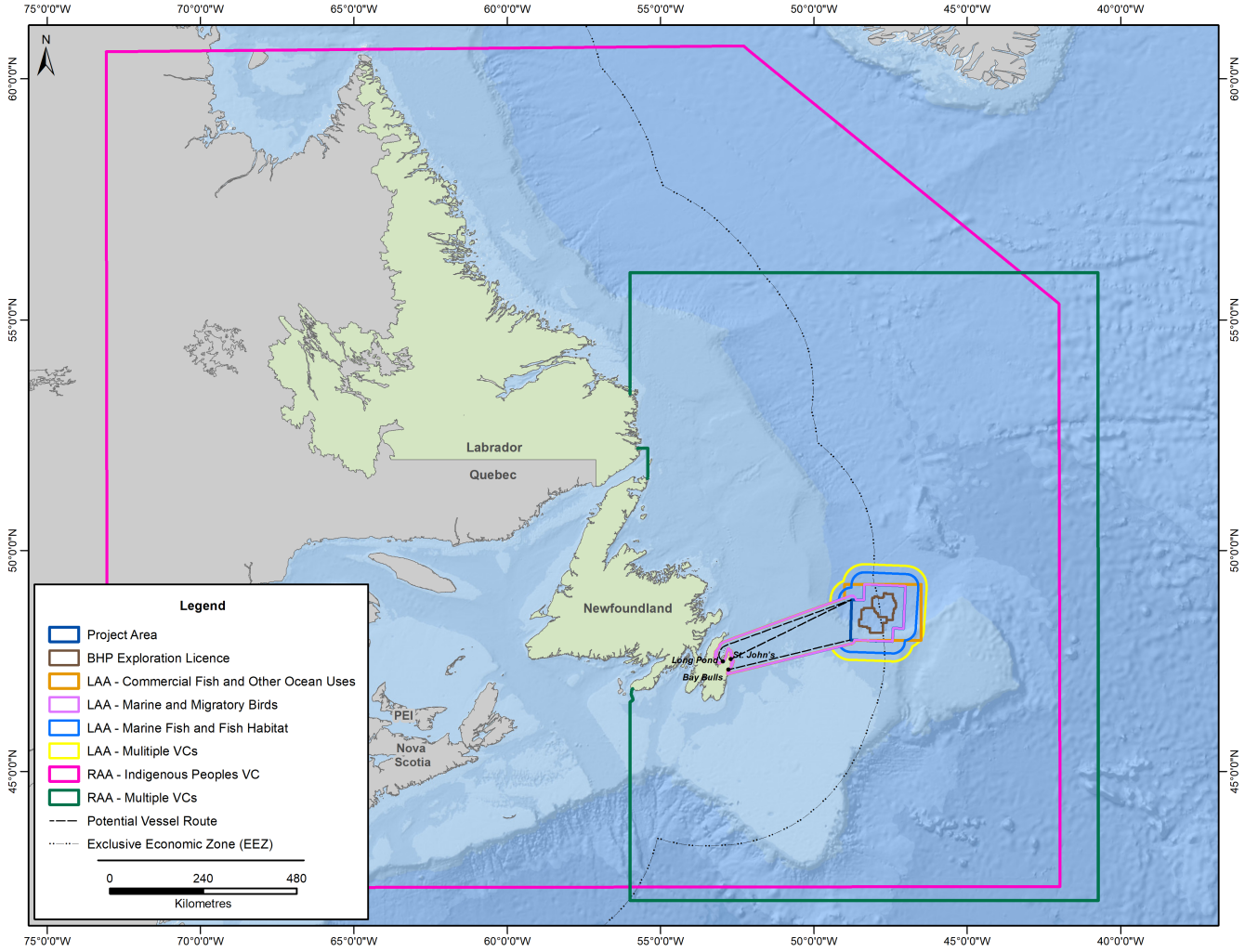

Figure 5-1 Project Area, Local Assessment Areas, and Regional Assessment Areas

The temporal boundaries identify when an environmental effect may occur. Temporal boundaries to be assessed for the Project are based on specific project phases or activities and include all Project phases, such as well drilling, testing and abandonment.

The temporal boundaries for the assessment are:

- BHP proposes to commence exploration drilling with an initial well as early as 2021. Upon completion of these first well(s) and based on results, additional well site locations may be identified. It is currently anticipated that up to ten wells (exploration and possibly appraisal) may be drilled on either or both of the ELs, for a total of up to 20 wells being drilled during the term of the ELs (2019-2028)
- Drilling is expected to occur between May – November, although this EIS assumes year-round drilling as a precaution; it is anticipated that each well will require 35 to 115 days for drilling, evaluation, abandonment and/or suspension
- Well testing (if required, dependent on drilling results) could also occur at any time during the temporal scope of this EIS
- Wells may be decommissioned and abandoned at any time within the temporal boundaries

In addition to temporal boundaries of Project phases and activities, key temporal characteristics associated with VCs, such as spawning, migration, and fishing seasons, are also considered for assessment. These are described and included in the assessment of VCs, as applicable.

6.0 SUMMARY OF ENVIRONMENTAL EFFECTS ASSESSMENT

The following sections provide a summary of the environmental effects assessment described in Chapter 8 to 13 of the EIS for routine Project-related activities, Chapter 14 of the EIS for the cumulative effects assessment, and Chapter 16 of the EIS for the effects of the environment on the Project. Chapter 15.6 of the EIS describes the effects assessment of accidental events. To reduce or eliminate potential adverse effects, the implementation of mitigation measures is fully integrated into the effects assessment. Mitigation measures are detailed in Table 7.1.

Project-specific modelling studies were conducted by BHP to understand the fate and behavior of discharges and emissions from the Project. The models are applicable to various VC's effects assessment for the Project and are summarized below.

Drill cuttings dispersion modelling on the seabed allows for the assessment of operational discharge of cutting and muds from the MODU by characterizing the release of drill cuttings associated with drilling activities during the Project. The water depths for the two sites modelled were similar with EL 1157 located in 2,338 m and EL 1158 in 2,047 m. At the modelled site for EL 1157 the discharged mud and cuttings (WBM and SBM) were deposited southwesterly in summer and southeasterly in fall. The drill cuttings deposition area was largely to the southeasterly for both the summer and fall scenarios for EL 1158. The differences between dispersion results for each EL were due to current patterns that are different at the modelled sites that are separated by a distance of 40 km. Modelled thicknesses above 6.5 mm were not predicted to occur at either site under either seasonal simulation, with the maximal depositional thickness of 5.45 and 4.75 mm predicted for EL 1157 and EL 1158, respectively. Dispersion sediment thicknesses of 1.5 mm or greater surrounding EL 1157 are predicted to reach a maximum extent up to 450 m from the discharge point and up to 580 m at EL 1158 and cover an area less than 0.12 km² at both sites. Variations in footprint shape and extent between seasonal simulations (summer and fall) can be attributed in part to the subsurface current regimes. Weaker subsurface currents in the summer simulations resulted in slightly more radial footprints, while fall simulations had more elongated footprints due to stronger subsurface current regimes.

Underwater sound modelling for drilling activity and support vessels was completed by JASCO to determine the potential zone of influence on protected marine mammals, sea turtles, and fish species from exposure levels of sound received into the marine environment. For all sources (i.e., VSP, vessels, and semi-submersible platform), the ranges to the acoustic thresholds defined in terms of peak pressure were never greater than 0.28 km, the distances to the peak pressure thresholds were all less than 0.06 km. For all the vessel and MODU sources, the peak pressure was well under the thresholds for temporary threshold shift and permanent threshold shift onset at less than 15 m from the source.

Spill trajectory modelling was conducted by RPS and considers the releases of crude oil from hypothetical blowouts and batch surface release scenarios (e.g., marine diesel from bunkering accidents). Results are described in Section 2.3.2.

6.1 Marine Fish and Fish Habitat

Marine fish and fish habitat has been selected as a VC in consideration of ecological (e.g., ecosystem functioning, food web linkages) and socio-economic importance (e.g., commercial, recreational and Indigenous fisheries), potential interactions with Project activities and components, regulatory considerations, and requirements in the EIS Guidelines.

Project activities and components occurring in the marine environment may influence the biological and physical components of the marine ecosystem. This includes the marine fish, marine plants, and the associated habitats upon which they depend. The Project Area and surrounding areas include shelf, slope, and abyssal marine habitats that support plankton and assemblages of fish and invertebrates.

6.1.1 Existing Environment

The Project Area and surrounding areas include the shelf and slope areas of the Northeast Grand Bank and the abyssal areas of the Orphan Basin. The shelf slope is an important transition area, supporting regionally important areas of biodiversity and marine productivity. The abyssal plain supports unique assemblages of deep-sea fishes as well as coral and sponge communities and other invertebrates. The physical characteristics of these areas influence the presence, abundance, and distribution of the marine organisms from primary producers (e.g., phytoplankton) to consumers (e.g., zooplankton, benthic invertebrates, and fish) (AMEC 2014) including species of commercial, cultural, and/or ecological value. This area is strongly influenced by the colder water from the Labrador Current, and therefore warmer water species that can occur on the southern Grand Banks dominated by the warmer Gulf Stream are largely excluded (Coté et al. 2019).

Key assemblages from the continental slope at water depths similar to that of the Project Area (264 m to 2,755 m) have been assessed from experimental trawl surveys (200 m to 2,335 m) and longline surveys (800 m to 3,100 m) (Snelgrove and Haedrich 1985; Murua and De Cárdenas 2005). The upper level and a portion of the middle continental slope are also within the range of Canadian RV surveys (197 m to 1,450 m). The upper slope assemblage is dominated by capelin and Acadian / deepwater redfish. The middle slope (700 m to 2,000 m) is dominated by flatfish (including American plaice, witch flounder, and Greenland halibut) and grenadiers (including roughhead, roundnose, abyssal, and carapine), with blue hake numbers increasing in the deeper portions. Limited information is available in the lower slope and abyssal depths (2,000 m+), but blue hake, grenadiers, and skate species are commonly recorded as well as anglerfish, dragonfish, and lanternfish.

Several coral groups occur within the RAA, including scleractinians (solitary stony corals), antipatharians (black wire corals), alcyonaceans (soft corals, including large and small gorgonians, and bamboo coral), and pennatulaceans (sea pens) (Wareham and Edinger 2007; Wareham 2009). There are approximately 40 known species of coral throughout eastern Canada (DFO 2018), most of which occur within the RAA (Wareham 2009; Murillo et al. 2011). With at least 34 species identified, the Flemish Cap supports the highest known deep-water coral species diversity within the RAA, along with 22 coral species observed on the Flemish Pass and Nose of the Grand Banks (Murillo et al. 2011).

Finfish are an abundant and diverse group that is well represented in the Project Area. Several fish species identified as at risk or of special conservation concern are known to occur, or likely to occur, in the LAA (Table 6.1). This includes species that are formally designated by the SARA or the Newfoundland and Labrador *Endangered Species Act* (NL ESA), or those identified as being of conservation concern by either Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or the International Union for Conservation of Nature (IUCN).

Table 6.1 Fish Species at Risk or of Conservation Concern with Potential to Occur within the LAA

Species		Status / Designation[A, B]				Relevant Population (Where Applicable)
Common Name	Scientific Name	NL ESA	SARA	COSEWIC	IUCN	
Acadian redfish	*Sebastes fasciatus*			T	E	Atlantic (COSEWIC); Global (IUCN)
Albacore tuna	*Thunnus alalunga*				NT	Global (IUCN)
American eel	*Anguilla rostrata*	V		T	E	Global (IUCN)
American plaice	*Hippoglossoides platessoides*			T		Newfoundland and Labrador (COSEWIC)
Atlantic bluefin tuna	*Thunnus thynnus*			E	E	Global (IUCN)
Atlantic cod	*Gadus morhua*			E	V	Newfoundland and Labrador (COSEWIC); Global (IUCN)
Atlantic halibut	*Hippoglossus hippoglossus*				E	Global (IUCN)
Atlantic salmon	*Salmo salar*			T		South Newfoundland
				SC		Quebec Eastern North Shore
				SC		Quebec Western North Shore
				E		Anticosti Island
				SC		Inner St. Lawrence
				SC		Gaspe-Southern Gulf of St. Lawrence
				E		Eastern Cape Breton
				E		Nova Scotia Southern Upland
				E		Outer Bay of Fundy Population
					LC	Global (IUCN)
Atlantic wolffish	*Anarhichas lupus*		SC	SC		
Barndoor skate	*Dipturus laevis*				E	Global (IUCN)
Basking shark	*Cetorhinus maximus*			SC	V	Atlantic (COSEWIC); Global (IUCN)
Bigeye tuna	*Thunnus obesus*				V	Global (IUCN)
Blue shark	*Prionace glauca*				NT	Atlantic (COSEWIC); Global (IUCN)
Common Lumpfish	*Cyclopterus lumpus*			T		Atlantic (COSEWIC)
Cusk	*Brosme brosme*			E		

Table 6.1 Fish Species at Risk or of Conservation Concern with Potential to Occur within the LAA

Species		Status / Designation[A, B]				Relevant Population (Where Applicable)
Common Name	Scientific Name	NL ESA	SARA	COSEWIC	IUCN	
Deepwater redfish	*Sebastes mentella*			T	LC	Northern (COSEWIC); Global (IUCN)
Greenland shark	*Somniosus microcephalus*				NT	Global (IUCN)
Haddock	*Melanogrammus aeglefinus*				V	Global (IUCN)
Little skate	*Leucoraja erinacea*				NT	Global (IUCN)
Northern wolffish	*Anarhichas denticulatus*		T	T		
Porbeagle	*Lamna nasus*			E	V	Global (IUCN)
Roundnose grenadier	*Coryphaenoides rupestris*			E	CE	Atlantic and Arctic (COSEWIC); Global (IUCN)
Shortfin mako	*Isurus oxyrinchus*			E	V	Atlantic (COSEWIC); Global (IUCN)
Smooth skate	*Malacoraja senta*			E	E	Funk Island Deep (COSEWIC); Global (IUCN)
Spiny dogfish	*Squalus acanthias*			SC	V	Atlantic (COSEWIC); Global (IUCN)
Spinytail skate	*Bathyraja spinicauda*				NT	Global (IUCN)
Spotted wolffish	Anarhichas minor		T	T		
Thorny skate	*Amblyraja radiata*			SC	V	Canada (COSEWIC); Global (IUCN)
White hake	*Urophycis tenuis*			T		Atlantic and Northern Gulf of St. Lawrence (COSEWIC)
White shark	*Carcharodon carcharias*		E	E	V	Atlantic (COSEWIC/SARA); Global (IUCN)
Winter skate	*Leucoraja ocellata*			E	E	Eastern Scotian Shelf – Newfoundland (COSEWIC); Global (IUCN)

[A] Least Concern (LC), Vulnerable (V), Near Threatened (NT), Special Concern (SC), Threatened (T), Endangered (E), Critically Endangered (CE)
[B] Multiple designations refer to multiple populations or sub-populations.
Data Sources: SARA/COSEWIC (www.sararegistry.gc.ca), IUCN (https://www.iucnredlist.org/), NL ESA (https://www.flr.gov.nl.ca/wildlife/endangeredspecies/index.html).

The waters off NL contain a variety of species commercially harvested or used for FSC purposes by Indigenous groups. Commercial communal licences have been issued within the RAA for capelin, groundfish, herring, mackerel, seal, shrimp, snow crab, tuna, and whelk. Species harvested for FSC include alewife (gaspereau), trout, Atlantic salmon, bass, American eel, shad, Arctic charr, blue shark, American lobster, and many others. Many species are harvested in freshwater, estuarine, or intertidal areas and are not present within the LAA, though they may be present in the potential PSV routes. However, two migratory fish species, the American eel and the Atlantic salmon, have been highlighted during Indigenous engagement as being of concern. These species are catadromous and anadromous, respectively, and may

migrate through the potential PSV routes and LAA. The American eel has been identified as key to Aboriginal right-based, Treaty rights-based, and commercial fisheries, particularly to the Mi'kmaq peoples (Denny and Kavanagh 2018). Atlantic salmon have traditionally been a staple food for Indigenous peoples, although today, due to a lack of abundance and concern for local populations, it is often reserved for special occasions (Denny and Fanning 2016).

6.1.2 Potential Interactions with the Environment

Potential interactions between planned offshore oil and gas exploration activities and pathways of potential effects on marine fish and fish habitat include (adapted from AMEC 2014):

- Destruction, contamination, or alteration of marine habitats and benthic organisms due to discharge and deposition of drill cuttings and/or fluids as well as the deployment and use of other Project equipment
- Contamination of fish / invertebrates and their habitats due to other discharges in the environment during planned oil and gas exploration drilling and other associated survey and support activities
- The attraction of marine fish to MODUs and PSVs, with increased potential for injury, mortality, contamination, and other interactions
- Temporary avoidance of areas by marine fish due to exposure to underwater sound or other disturbances, that may alter their presence and abundance as well as disturbing movements / migrations, feeding, or other activities
- Changes in the availability, distribution, or quality of food sources and/or habitats for fish and invertebrates as a result of planned activities and their associated environmental emissions
- Injury, mortality, or other disturbances to marine fish as a result of exposure to sound within the water column during VSP survey activity

As a result of these considerations, the assessment of Project-related effects on marine fish and fish habitat is focused on the following potential effects:

- Change in risk of mortality or physical injury
- Change in habitat availability, quality, and use

6.1.3 Potential Effects from Routine Operations

6.1.3.1 Change in Risk of Mortality, Injury or Health

A change in risk of mortality or physical injury for individual marine fishes and invertebrates may result from the presence and operation of a MODU, VSP surveys, and Project-related discharges. The presence and operation of a MODU will generate underwater sound that may affect the quality of the underwater acoustic environment for fish and invertebrate species. Based on sound modelling conducted for the Project, received sound pressure levels in the water column from the MODU sound sources will not exceed 150 dB re 1 µPa rms beyond 280 m from source. This received sound pressure level is considered a conservative value for the minimum received level that could evoke behavioural responses from fishes that can detect sound pressure. The deepest that a 150 dB re 1 µPa rms received level is predicted to occur is 100 m.

Based on available scientific literature, it is unlikely that exposure to MODU sound would result in either physical injury or mortality to fishes and invertebrates.

VSP operations will also temporarily generate increased sound levels and is expected to generate the highest levels of underwater sound associated with the Project. Based on sound modelling results, received sound pressure levels in the water column from the VSP sound sources will exceed 150 dB re 1 µPa rms as far as 30.6 km from the sound source (specific to VSP at Site B in August) along the 90° azimuth. It is unlikely that VSP sound levels received by mobile fishes would cause mortality or physical injury to them given their capability of moving away from the sound source once behaviour affecting levels are detected. A ramp-up period for the VSP source will be conducted during onset of the survey with the intention of warning nearby biota and allowing them to move away from the sound source before sound pressure levels are high enough to potentially cause injury. However, low-mobility fishes and sessile invertebrates occurring in the immediate area of a VSP source would be exposed numerous times to relatively consistent levels of sound during a VSP survey. A mitigating factor is that while all fishes and invertebrates are able to detect the particle motion component of underwater sound, only some fishes and no invertebrates can detect the sound pressure component of sound. Marine plankton, including ichthyoplankton, could also be affected physically by sound emitted during VSP activities. But current science suggests that this might happen only if the biota occur immediately adjacent to the sound source (i.e., a few metres) (Kostyuchenko 1973, Booman et al. 1996, Østby et al. 2003, in Boertmann and Mosbech 2011).

Artificial lighting emissions from the MODU may also increase predation and foraging opportunities for fish. Potential effects of artificial lighting from the MODU are generally localized from hundreds of meters to less than 1.5 km from the light source (Keenan et al. 2007; Simonsen 2013; Foss 2016). Lighting will be limited to the extent that worker safety and safe operations is not compromised. Reduction of light may include avoiding use of unnecessary lighting, shading, and directing lights towards the deck.

Drill cuttings and fluids dispersion modelling was performed for the Project across summer and fall seasonal scenarios to assess the footprint, spatial extent, and thickness of discharged drill cuttings. Dispersion sediment thicknesses of 1.5 mm or greater surrounding EL 1157 are predicted to reach a maximum extent up to 450 m from the discharge point and up to 580 m at EL 1158 and cover an area less than 0.12 km² at both ELs. There is potential for the burial effects or disturbance to corals and sponges present in EL 1157 and EL 1158 in the immediate area of the well sites. Sensitive benthic organisms (e.g., corals and sponges) within the localized area of sediment thicknesses above 1.5 mm may be affected by the deposition of drilling waste. As modelled thickness above 6.5 mm were not predicted to occur at either site, effects on benthic organisms would likely be low.

Aquatic invasive species may be transported through ballast water or on the hulls of ships and the MODU. The MODU or PSVs may also provide ‘stepping stone’ habitat that increases the range of colonizing invasive invertebrates that do not typically spread across large expanses of open water (Cordes et al. 2016). Introduction of invasive species may compete for food resources, potentially resulting in changes to fish health. With application of standard mitigation measures (e.g., *Ballast Water Regulations*; see Table 7.1) for prevention and mitigation of spread of invasive species, potential spread of invasive species is low.

6.1.3.2 Change in Habitat Availability, Quality and Use

A change in habitat quality and use for marine fishes and invertebrates may result from the operation and presence of the MODU, VSP surveys, Project-related discharges, well abandonment, and supply and servicing operations. The operation of the MODU will result in sound emissions into the water column and sound emissions into the seabed which result in substrate vibration. The principal potential effects on mobile fishes and invertebrates would be behavioural in nature. If exposure to sound emitted by MODU operations causes mobile fishes and invertebrates to move away from the vicinity of the sound source, then a change in habitat quality and use would occur. However, given the localized and temporary nature of the drilling activity, displacement of fish from habitats and population level disturbances are unlikely.

Habitat quality and use may also be affected from the artificial lights of the MODU as marine fish may aggregate towards or avoid the light source. Marine fish behaviours (e.g., feeding, schooling, predator avoidance, and migration) may be altered by sharp light contrasts created by over-water structures due to shading during the day and artificial lighting at night (Nightingale and Simenstad 2000, Hanson et al. 2003 in BP 2018). Behavioural responses to light is variable across species and within species depending on competing priorities (e.g., foraging, predator avoidance, schooling) and light detection sensitivities (Marchesan et al. 2005; Stoner et al. 2008). Potential effects of artificial lighting from the MODU are generally localized to 1.5 km from the light source (Keenan et al. 2007; Simonsen 2013; Foss 2016).

VSP surveys will temporarily generate high levels of underwater sound. Received sound pressure levels from VSP activities are expected to result in a short-term change in habitat quality and use for marine fish. Exposure of fishes to impulsive underwater sounds, such as those generated during VSP, has resulted in localized and temporary avoidance by a variety of fish species including salmonids, herring, and flatfish (Feist et al. 1996, McCauley et al. 2000a, 2000b in BP 2018). Other observed behavioural responses include a short duration “startle” response (flexion of body followed by a burst of faster swimming), and an “alarm” response with intense variable movements (Schwarz and Greer 1984, Feist et al. 1996, McCauley et al. 2000a, 2000b in BP 2018). Received SPLs from VSP activities are expected to result in a short-term change in habitat quality and use for marine fish. While mobile fishes could exhibit a variety of behavioural responses when exposed to sound from the VSP, the sound source is stationary and hours in duration.

Drilling mud and cuttings are the primary discharges resulting in changes in habitat quality and availability from physical or chemical changes in the water column and/or sediment. Drilling mud and cuttings discharges may result in a temporary increase in suspended particulate matter and turbidity in the water column. Drilling mud and cuttings discharges that settle on the seafloor may change habitat quality and availability from sediment alteration, and degradation of organic components that lead to oxygen depletion (Kjeilen-Eilertsen et al. 2004; Smit et al. 2008; Neff 2010; Ellis et al. 2012; DeBlois et al. 2014; Tait et al. 2016; DFO 2019). Significant benthic areas (SiBAs) for sea pens and large gorgonian corals have been designated along the southern slopes of the Project Area and overlaps with EL 1158. As noted above, drill cuttings dispersion modelling was performed for the Project which indicated the dispersion sediment thicknesses of 1.5 mm or greater was predicted to reach a maximum extent up to 450 to 580 m from the discharge point cover an area less than 0.12 km² at EL 1157 and EL 1158. However, benthic mortality rates as a result of these discharges are not predicted to result in irreversible changes to local populations due to the low magnitude and spatial extent of potential effects.

Well abandonment and decommissioning activities are predicted to result in a temporary, localized disturbance that may result in avoidance of the area and change in habitat availability for the duration of the activity. Depending on decommissioning strategy designed in consultation with the regulatory authorities, potential effects may be short to long-term in duration. Residual environmental effects associated with removal of well head infrastructure (if applicable), including underwater sound and light emissions, would be short-term in duration. Well abandonment, with the well head left in place, will likely provide hard substrate that is suitable for colonization by benthic communities (Cordes et al. 2016, Lacey and Hayes 2019). However, these long-term effects would be of localized nature and potentially positive.

Supply and servicing operations will increase vessel traffic within the Project Area and LAA and may therefore locally affect fish habitat quality and use around PSVs due to increased vessel sound. Although underwater sound generated by PSV traffic will introduce additional sound to the acoustic environment, this increase will be low given the relatively small increase in vessel traffic as a result of Project activities. Therefore, a change in habitat quality and availability from PSV traffic would represent a small incremental increase (two to three vessels over the life of the Project completing an average of three return transits per week between shore base and the MODU) over similar effects from existing levels of marine traffic in the RAA.

6.1.4 Potential Effects from Accidental Events

Accidental releases of oil or SBM in the marine environment can affect marine fish and fish habitat. The overall implications for marine fish and fish habitat depend on the nature, scale, and duration of an offshore spill. Hydrocarbon exposure to marine fish may result in change in risk of mortality or physical injury from direct and indirect effects. Hydrocarbon releases may also result in changes to fish habitat availability, quality, and use through potential effects on water and sediment quality, biogenic habitats (e.g., eelgrass beds, corals, and sponges), and associated avoidance of these areas by marine fish.

Accidental event scenarios with a subsurface blowout would have the greatest potential for causing environmental effects due to the potential quantities and spatial extents. In the event of a blowout scenario, there would be effects to the water column, surface waters, and sediments with changes to water and sediment quality from dissolved oil fractions, resulting in effects on fish and invertebrate species (e.g., injury, mortality, avoidance). Although hydrocarbon spills could result in adverse effects on marine fish and fish habitat, these residual effects are predicted to be reversible at the population level. The majority of fish species in the Orphan Basin spawn across a variety of large areas and over long time-scales, and therefore a spill is not predicted to encompass all of these areas or time scales within the RAA to such a degree that natural recruitment of juvenile organisms may not re-establish to affected areas. Population level effects from accidental events are considered unlikely given the low probabilities for large spill events to occur and the associated response measures that would be implemented to reduce the consequences of such an event. As described in Table 6.1, there are various fish SAR that are known to occur in the area. Species of cultural importance to Indigenous communities have also been identified through engagement, including the Atlantic salmon, American eel, swordfish, and tuna. These species would also have the potential to be adversely affected through pathways described above in the unlikely event of a subsurface blowout. It is expected that potential effects would be similar to those described above for species not of conservation concern, nor result in permanent alteration or irreversible loss of critical habitat as defined in a recovery plan or an action strategy.

6.2 Marine and Migratory Birds

Marine and migratory birds were chosen as a VC because of the group's role in pelagic and coastal ecosystems, the cultural and economic importance of subsistence and recreational hunts, predisposition to attraction to artificial lighting at night, the adverse effects of oil, regulatory considerations, and requirements in the EIS Guidelines. The Marine and Migratory Birds VC includes oceanic (i.e., beyond the continental shelf), neritic (continental shelf), and littoral zone (intertidal, splash, and spray zones) auks, fulmars, shearwaters, storm-petrels, gannets, skuas, terns, gulls, phalaropes, waterfowl, loons, grebes, and shorebirds (plovers, sandpipers) that are protected under the MBCA and additional marine-associated birds not protected under the MBCA but protected by the *Newfoundland and Labrador Wild Life Act* (i.e., cormorants).

6.2.1 Existing Environment

The marine waters off eastern Newfoundland provide a vast area of important breeding, migrating, and wintering habitat for marine-associated birds. The Orphan Basin and the Local Assessment Area (LAA) are part of a large marine ecosystem that is characterized by high biomass production due to the upwelling of nutrients by the Labrador Current along the continental shelf slope. As a result, the LAA is populated by large numbers of marine birds in every season of the year (Lock et al. 1994; Fifield et al. 2009). These bird populations are linked to distant areas through foraging trips by birds nesting in colonies along the Newfoundland coast, and through migratory connectivity to birds nesting at and fledging from nesting colonies in Newfoundland, northern Canada, Greenland, Iceland, northern Europe, and the south Atlantic. Nesting Leach's storm-petrels commute between the LAA and their nests in Newfoundland colonies to forage on deep-water prey. Non-breeding seabirds present in the LAA during summer include large numbers of great shearwaters and sooty shearwater that arrive in the LAA after nesting in the South Atlantic during the austral summer. In autumn dovekies, thick-billed murres, black-legged kittiwakes and northern fulmars arrive to overwinter in the LAA from breeding grounds in the Arctic and sub-Arctic lands surrounding the north Atlantic. Immature birds hatched in the same Arctic colonies, largely northern fulmars and black-legged kittiwakes, remain in the LAA during the summer after the adults have returned to the Arctic in spring. In late summer and fall, various species of shorebirds (plovers and sandpipers) depart Arctic nesting grounds to embark on trans-oceanic migratory flights from eastern North America to South America (Williams and Wiliams 1978; Richardson 1979), some of which may traverse the LAA.

Waterfowl nest in coastal Newfoundland in relatively small numbers but winter in large numbers (Lock et al. 1994). They are rarely observed beyond coastal waters. Some species of loons and grebes also winter in coastal Newfoundland waters. Some shorebird (plovers, turnstones, and sandpipers) species nesting in the Arctic make trans-oceanic flights during fall migration from eastern North America to South America (Williams and Williams 1978; Richardson 1979). As a result, small numbers are observed in offshore areas of the RAA.

SAR designated on provincial or federal lists that may occur in the LAA or the Project Area consist of: harlequin duck, Barrow's goldeneye, piping plover, red knot, buff-breasted sandpiper, red-necked phalarope, ivory gull, Ross's gull, and peregrine falcon. Six additional species are included on the IUCN Red List of Threatened Species: long-tailed duck, black-legged kittiwake, Leach's storm-petrel, Bermuda petrel, Zino's petrel, and Desertas petrel. The Project Area is on the periphery of some of these species'

distributions or migratory routes. However, they have been documented in the Project Area on rare occasion. Other shorebird and landbird SAR in NL are not likely to occur in the LAA or Project Area. A summary of SAR is provided in Table 6.2.

Table 6.2 Marine and Migratory Bird Species of Conservation Interest Likely to Occur in the RAA

Species	NL ESA Status	Federal Status		IUCN Red List
		SARA Listing	COSEWIC Assessment	
Harlequin duck (eastern pop.)	Vulnerable	Special Concern (Schedule 1)	Special Concern	None
Long-tailed duck	None	None	None	Vulnerable
Barrow's goldeneye (eastern pop.)	Vulnerable	Special Concern (Schedule 1)	Special Concern	None
Piping plover (*melodus* ssp.)	Endangered	Endangered (Schedule 1)	Endangered	Near threatened
Red knot (*rufa* ssp.)	Endangered	Endangered (Schedule 1)	Endangered	Near threatened
Buff-breasted sandpiper	None	Special Concern (Schedule 1)	Special Concern	Near threatened
Red-necked phalarope	None	Special Concern (Schedule 1)	Special Concern	None
Black-legged kittiwake	None	None	None	Vulnerable
Ivory gull	Endangered	Endangered (Schedule 1)	Endangered	Near threatened
Ross's gull	None	Threatened (Schedule 1)	Threatened	None
Peregrine falcon *anatum / tundrius*	Vulnerable	Special Concern (Schedule 1)	Special Concern	None
Leach's storm-petrel	None	None	None	Vulnerable
Bermuda petrel	None	None	None	Endangered
Desertas petrel	None	None	None	Vulnerable
Zino's petrel	None	None	None	Endangered

6.2.2 Potential Interactions with the Environment

Routine Project activities and components can interact with migratory birds and their associated habitat as a result of the attraction of nocturnally-active birds to artificial lighting on MODU and PSVs, operational discharges during well drilling and testing operations, underwater sound emissions from VSP operations, and interactions with PSVs and helicopter activities during supply and servicing.

Direct and indirect adverse effects on migratory birds could be caused by Project activities through the following effects pathways:

- Physical displacement because of vessel presence (e.g., disruption of foraging activities)
- Nocturnal disturbance (e.g., increased opportunities for predators, attraction to the MODU or PSVs and subsequent collision or stranding resulting in mortality) due to illumination levels from artificial lighting

during different weather conditions and seasons and during different project activities (e.g., drilling, formation flow testing with flaring)
- Exposure to spilled contaminants (e.g., fuel, oils) and operational discharges (e.g., drilling waste, deck drainage, gray water, black water)
- Attraction of predator species near the MODU or PSVs
- Collision risk with Project infrastructure (e.g., the MODU or PSVs)
- Physical or behavioural effects due to increased underwater sound from VSP surveys

In consideration of these potential pathways, the assessment of Project-related effects on marine and migratory birds focuses on the following potential effects:

- Change in risk of mortality or physical injury
- Change in habitat quality and use

6.2.3 Potential Effects from Routine Operations

6.2.3.1 Change in Risk of Mortality or Physical Injury

The presence and operation of a MODU and PSVs has the greatest potential to result in changes to risk of mortality or physical injury for marine and migratory birds. These species are known to concentrate around drilling and production platforms as a result of artificial lighting at night, food, and other visual cues. This attraction to platforms potentially makes marine and migratory birds vulnerable to increased risk of mortality due to physical strikes with structures, stranding on the MODU or PSVs, predation by other marine bird species, and incineration from flares (Wiese et al. 2001; Ronconi et al. 2015). Attraction to artificial lighting and related stranding in marine birds has been documented in more than 40 species representing most families of procellariform birds (i.e., fulmarine and gadfly petrels, shearwaters, and prions [*Procellariidae*], storm-petrels [*Hydrobatidae*], and diving-petrels [*Pelecanoididae*]) (Imber 1975; Reed et al. 1985; Telfer et al. 1987; Le Corre et al. 2002; Black 2005; Montevecchi 2006; Rodríguez and Rodríguez 2009; Miles et al. 2010; Rodríguez et al. 2015). Lighting will be limited to the extent that worker safety and safe operations is not compromised. Reduction of light may include avoiding use of unnecessary lighting, shading, and directing lights towards the deck. With the implementation of appropriate mitigation measures (see Table 7.1), the overall magnitude of the effect of the presence and operation of a drilling installation on marine and migratory birds is anticipated to be low. There may be a slight increase in mortality / injury levels due to collisions, disorientation, and potential predation, although, based on previous monitoring, the mortality rate is anticipated to be low as most stranded birds encountered on platforms and vessels are found alive and released successfully.

As well as direct (e.g., strikes) and indirect interactions with the MODU and PSVs, the Project has potential to result in a change in risk of mortality or physical injury for marine and migratory birds through exposure to residual hydrocarbons associated with drill muds, cuttings and other discharges. The treated discharge of some operational wastes may cause surface sheening, typically under calm conditions; however, the potential for sheen formation is very unlikely with proper treatment and management of operational discharges in accordance with the OWTG.

The Project can result in a change in risk of mortality or physical injury for marine and migratory birds through exposure to underwater sound caused by VSP operations, although the likelihood of such an exposure is limited by the short duration of VSP operations combined with the short duration of submersion by diving marine birds. No mortality or injuries of marine bird from the underwater sound energy from VSP surveys have been reported. To mitigate potential effects from VSP activities, air source operations will incorporate a ramp-up in consideration of the SOCP (DFO 2007). The gradual increase in emitted underwater sound levels will provide an opportunity for diving marine birds to move away from the sound source before associated underwater sound reaches levels that are potentially physically damaging to marine birds diving near the source. Above the water, atmospheric sound from the air source array is substantially reduced or muffled such that it is expected to have little or no effect on birds that have their heads above water or are in flight.

The Project will involve PSV and aircraft use (presence and movements), including supply and support traffic to, from and within the Project Area potentially at all times of year over the course of the Project. This traffic may affect seabirds through lighting, atmospheric and underwater sound. The various bird species that occupy the Project Area will not likely be affected by PSV activity or associated aircraft use, due to its transitory nature and thus, its short-term presence at any one location, and because it is generally consistent with the overall marine traffic that has occurred throughout the region for years, including that associated with existing oil production and exploratory drilling platforms in the RAA.

6.2.3.2 Change in Habitat Quality and Use

A change in habitat quality and use for marine and migratory birds could potentially occur as a result of Project activities, particularly due to the influence of artificial lighting, discharges and atmospheric and underwater sound associated with the MODU and PSVs. These changes in the marine habitat could potentially influence bird behaviour (most likely result in attraction).

Attraction of nocturnally-active marine and migratory birds to artificial lighting is discussed above (change in risk of mortality or injury). Daytime marine bird densities within 500 m of offshore platforms are often many times higher than before the installation of the platforms or some distance farther away from platforms, suggesting that the birds are attracted to foraging opportunities or to the shelter found downwind of platforms (Tasker et al. 1986; Baird 1990; Wiese and Montevecchi 1999).

The presence of offshore platforms can also provide new habitats for birds (Russell 2005). Structures may be used as roosting and resting habitat by gulls (Burke et al. 2012), as stopover locations for migrating landbirds who may forage around the platforms (Russell 2005; Bruinzeel and van Belle 2010), or even potentially as hunting grounds for predatory species such as large gull species and peregrine falcons in passage migration that take advantage of concentrations of birds around the structures (Russell 2005).

Some marine bird species, especially alcids, may be displaced from the area around the active MODU during drilling operations and along PSV supply routes through general avoidance responses. However, the effect of habitat displacement on marine-associated birds is likely to be minor due to its small footprint (Hedd et al. 2011; Ronconi et al. 2015).

Some localized and short-term behavioural effects (change in presence and abundance) are likely to occur, with some species displaced from the Project Area / LAA and others attracted by lighting which will reduce

the degree to which foraging opportunities are enhanced by the presence and operation of a drilling installation. The localized, transient, and short-term nature of these disturbances at one location and time during the Project considerably reduces the potential for adverse effects upon marine and migratory birds (individuals or populations). It is therefore unlikely that individuals will be attracted or displaced over extended areas or timeframes. The likely zone of influence of the Project for bird is conservatively set at 15 km diameter (EIS Section 9.1.4.1). This represents a small proportion of the feeding, breeding or migration area of species. Birds will not be displaced from key habitats or during important activities or be otherwise affected in a manner that causes detectable adverse effects to overall populations in the region.

Vessel traffic may interact with seabirds through lighting, atmospheric and underwater sound, and other associated environmental emissions and discharges. The various bird species that occupy the Project Area will not likely be affected by PSV activity due to its transitory nature and short-term presence at any one location, and because it is generally consistent with the overall marine traffic that has occurred throughout the region for years.

Helicopters may interact with the marine and migratory birds through aircraft overflights and potential disturbance of normal nesting, foraging or resting activities. The various bird species that occupy the Project Area and transit route will not likely be affected by helicopter activity due to its transitory nature and short-term presence at any one location, and because of mitigation measures (see Table 7.1) in place.

6.2.4 Potential Effects from Accidental Events

Accidental spill scenarios can result in a change in risk of mortality or physical injury and/or a change in habitat quality and use for marine and migratory birds. The extent of the potential effects will depend on how the spill trajectory and the VC overlap in space and time. An accidental release of hydrocarbons can result in the physical exposure of birds to oil in the affected area. There would be an increased risk of mortality for individual birds that encountered the sheen (particularly for diving birds and those that spend large amounts of time on the water), as well as potential sublethal toxicity effects (metabolic rate and chick growth) to species such as Leach's storm-petrel. Chicks and eggs are more susceptible to negative effects of exposure to oil (even at very low levels). The possible physical effects of oil exposure on birds include changes in thermoregulatory capability (hypothermia) and buoyancy (drowning) due to feather matting (Clark 1984; Montevecchi et al. 1999), as well as physiological effects of oil ingestion from excessive preening (Hartung 1995).

Although hydrocarbon spills could result in some mortality at the individual level, these residual adverse environmental effects are predicted to be reversible at the population level. However, these environmental effects could be significant if the consequences carried over more than one generation according to the significance threshold used in this environmental assessment or self-sustaining population objectives or recovery goals for listed species are jeopardized. This is considered unlikely given the low probability of a large spill event to occur and the response that would be in place to reduce the consequences of such an event.

As described in Table 6.2, marine and migratory bird SAR have the potential to occur in the area. These species would also have the potential to be adversely affected through pathways described above in the unlikely event of a subsurface blowout. It is expected that potential effects would be similar to those

described above for species not of conservation concern, nor result in permanent alteration or irreversible loss of critical habitat as defined in a recovery plan or an action strategy.

6.3 Marine Mammals and Sea Turtles

The marine mammals and sea turtles VC includes baleen whales, large toothed whales, delphinids, porpoises, seals, and sea turtles, and includes those species that are listed under Schedule 1 of SARA and considered at risk by COSEWIC. Marine mammals and sea turtles were selected as a VC because of their potential to interact with Project components and activities, as there is important habitat for these species in the offshore waters off Newfoundland, and because marine mammals are susceptible to effects from underwater sound. Marine mammals and sea turtles are also of cultural and recreational value to Indigenous groups and the general public.

6.3.1 Existing Environment

Thirty-two marine mammal species could potentially occur in the Project Area and RAA, including 26 cetacean species (whales, dolphins, and porpoises) and six seal species. Seven of the cetacean species are extralimital (i.e., outside their normal ranges); however, sightings / detections have been or could be made within the RAA. Most marine mammals use the area seasonally; the region likely offers important foraging habitat for many species. Four species of sea turtle could also occur within or near the Project Area. The potential time of occurrence and conservation status for marine mammal and sea turtle species that could occur within the Project Area are summarized in Tables 6.3 and 6.4, respectively.

While most cetaceans are sighted year-round in the RAA, they are more frequently sighted during June-September within the Project Area. Summer is an important season for cetaceans and sea turtles in Newfoundland waters. At this time, migratory species come to feed in the region before traveling to southerly latitudes for the winter. Pinnipeds are more common during winter and spring. Concentrations in certain areas at certain times may be an artifact of the survey effort that occurred in these locations. Similarly, low sightings in other areas may be attributable to low survey effort. Several Ecologically or Biologically Significant Areas (EBSAs) provide important ecological functions for marine mammals and sea turtles in the RAA, including important habitat for overwintering, refuge, and foraging.

Five species / populations of marine mammals and two species of sea turtles that could occur in the Project Area are listed under Schedule 1 of SARA: blue whale (Atlantic population); fin whale; North Atlantic right whale; northern bottlenose whale (Scotian Shelf population); Sowerby's beaked whale; leatherback sea turtle; and loggerhead sea turtle (Table 6.3 and 6.4).

Table 6.3 Marine Mammals that May Occur in the Project Area and Regional Assessment Area

Common Name	SARA Schedule 1 Status [A]	COSEWIC Designation [B, C]	Potential Timing of Presence	Sources
Mysticetes (Baleen Whales)				
Blue whale (Atlantic population)	Endangered	Endangered	Year-round (highest numbers from early spring through winter)	COSEWIC (2002a) ; Waring et al. (2011) ; Lesage et al. (2016)
Fin whale (Atlantic population)	Special Concern	Special Concern	Year-round	COSEWIC (2005); DFO (2017a); Hayes et al. (2018)
Sei whale (Atlantic population)	Not Listed	Endangered	Seasonal (summer)	COSEWIC (2003a); Hayes et al. (2017)
Humpback whale (Western North Atlantic population)	Not Listed (Special Concern on Schedule 3)	Not at Risk	Year-round (highest concentration from spring through winter)	Lawson and Gosselin (2009); Bettridge et al. (2015)
Common minke whale (North Atlantic subspecies)	Not Listed	Not at Risk	Year-round (highest concentration spring through fall)	Risch et al. (2014) ; Hayes et al. (2018)
North Atlantic right whale	Endangered	Endangered	Summer	COSEWIC (2013); Hayes et al. (2018)
Bowhead whale [D] (Eastern Canada-West Greenland population)	Not Listed	Special Concern	Unknown	Ledwell et al. (2007); COSEWIC (2009a); CBC (2014)
Odontocetes (Toothed Whales)				
Sperm whale	Not Listed	Not at Risk; Mid-priority Candidate	Year-round	Waring et al. (2015)
Pygmy sperm whale [D, E]	Not Listed	Not at Risk	Unknown	Hayes et al. (2017)
Northern bottlenose whale (1: Scotian Shelf population/ 2: Davis Strait-Baffin Bay-Labrador Sea population)	1. Endangered 2. Not Listed	1. Endangered 2. Special Concern	Year-round	COSEWIC (2011); DFO (2016)
Sowerby's beaked whale	Special Concern	Special Concern	Unknown	COSEWIC (2006a); DFO (2017b)
Cuvier's beaked whale [D, E]	Not Listed	Not at Risk; High-priority Candidate	Unknown	Waring et al. (2014)

Table 6.3 Marine Mammals that May Occur in the Project Area and Regional Assessment Area

Common Name	SARA Schedule 1 Status [A]	COSEWIC Designation [B, C]	Potential Timing of Presence	Sources
Killer whale (Northwest Atlantic/Eastern Arctic population)	Not Listed	Special Concern	Year-round	COSEWIC (2009b); Waring et al. (2015)
False killer whale [D]	Not Listed	Not Listed	Unknown	Waring et al. (2015)
Long-finned pilot whale	Not Listed	Not at Risk	Year-round	Fullard et al. (2000) ; Hayes et al. (2017)
White-beaked dolphin	Not Listed	Not at Risk	Year-round	Waring et al. (2007)
Atlantic white-sided dolphin	Not Listed	Not at Risk	Year-round	Hayes et al. (2018)
Common dolphin (short-beaked)	Not Listed	Not at Risk	Seasonal (summer through fall)	Hayes et al. (2018)
Risso's dolphin	Not Listed	Not at Risk	Year-round	Hayes et al. (2018)
Common bottlenose dolphin	Not Listed	Not at Risk	Seasonal (May to September)	Hayes et al. (2017)
Atlantic spotted dolphin	Not Listed	Not Listed	Unknown	Waring et al. (2014)
Spinner dolphin [D]	Not Listed	Not Listed	Unknown	Waring et al. (2014)
Striped dolphin	Not Listed	Not at Risk	Seasonal (summer)	Waring et al. (2014)
Harbour porpoise (Northwest Atlantic population)	Not Listed (Threatened on Schedule 2)	Special Concern	Year-round	COSEWIC (2006b)
Beluga whale [D] (St. Lawrence Estuary population)	Endangered	Endangered	Unknown	COSEWIC (2014)
Narwhal [D]	Not Listed	Special Concern	Unknown	COSEWIC (2004)
Phocids (Seals)				
Harbour seal (Atlantic and Eastern Arctic subspecies)	Not Listed	Not at Risk	Year-round	Hayes et al. (2018)
Harp seal	Not Listed	Not Listed; Low-priority Candidate	Year-round (highest concentrations in winter)	DFO (2012); AMEC (2014); Waring et al. (2014)

Table 6.3 Marine Mammals that May Occur in the Project Area and Regional Assessment Area

Common Name	SARA Schedule 1 Status [A]	COSEWIC Designation [B, C]	Potential Timing of Presence	Sources
Hooded seal	Not Listed	Not at Risk; Mid-priority Candidate	Seasonal (highest concentrations in winter)	Waring et al. (2007); Andersen et al. (2009, 2012, 2013, 2014)
Grey seal	Not Listed	Not at Risk	Year-round	Lesage and Hammill (2001); Hayes et al. (2018)
Ringed seal	Not Listed	Not at Risk	Year-round	SEM (2008)
Bearded seal	Not Listed	Data Deficient; Mid-priority Candidate	Year-round	SEM (2008)

Notes:

[A] SARA = Canadian *Species at Risk Act.*

[B] COSEWIC = Committee on the Status of Endangered Wildlife in Canada.

[C] None of these marine mammal or sea turtle species are currently listed under the Newfoundland and Labrador *Endangered Species Act* (NL ESA).

[D] These species are considered extralimital in the RAA and are not considered further.

[E] Although no confirmed visual detections have been made near the Project Area, sightings have been made within the RAA, and these species were detected acoustically near the Project Area during the ESRF acoustic study (Delarue et al. 2018).

Additional Sources: Husky Energy (2012), AMEC (2014), BP (2016).

Table 6.4 Sea Turtle Species that May Occur in the Project Area and Regional Assessment Area

Common Name	SARA Schedule 1 Status	COSEWIC Designation	Potential Timing of Presence	Sources
Leatherback sea turtle (Atlantic population)	Endangered	Endangered	Seasonal (spring through fall)	COSEWIC (2012a)
Loggerhead sea turtle	Endangered	Endangered	Seasonal (spring through fall)	Brazner and McMilan (2008); COSEWIC (2010)
Green sea turtle	Not Listed	Not Listed	Seasonal (summer and fall)	James et al. (2004)
Kemp's ridley sea turtle [A]	Not Listed	Not Listed	Seasonal	National Marine Fisheries Service (NMFS) et al. (2011)

Notes:
[A] This species is considered extralimital in the RAA.
Additional Sources: Husky Energy (2012), AMEC (2014), and BP (2016).

6.3.2 Potential Interactions with the Environment

Routine Project activities and components can interact with marine mammal and sea turtle species due to underwater sound produced by operation of the MODU, VSP survey, PSVs, and helicopter overflights. These potential sources of disturbance, as well as operational discharges, could result in direct or indirect (e.g., changes in habitat quality) effects on marine mammals and sea turtles. There is also the risk of mortality or physical injury as a result of vessel collisions. The Project could also change the availability, distribution, or quality of prey (see Section 6.1 on assessment of effects on prey species). The assessment of Project-related effects on marine mammals and sea turtles focuses on the following potential effects:

- Change in risk of mortality or physical injury
- Change in habitat quality and use

6.3.3 Potential Effects from Routine Operations

6.3.3.1 Change in Risk of Mortality or Physical Injury

There are two primary pathways from Project activities that may result in change in the risk of mortality or physical injury for marine mammals and sea turtles: ship strikes and underwater sound generated by Project activities. The PSVs transiting to and from the Project Area can collide with marine mammals or sea turtles, resulting in injury or mortality.

Underwater sound generated by VSP operations and other Project activities can cause temporary hearing changes in marine mammals or sea turtles (temporary threshold shift) and there is the possibility of permanent hearing damage (permanent threshold shift). There have been no reported cases of marine mammal or sea turtle mortalities that have been causally linked to sounds generated during oil and gas exploration activities. Based on the information provided in Section 10.3 of the EIS, and with the implementation of mitigation measures (see Table 7.1), it is unlikely that the operation of the MODU or VSP

surveys will result in injuries (permanent threshold shift) for marine mammals or sea turtles. To mitigate potential effects from VSP operations, a ramp-up procedure for the airgun array will be implemented in consideration of the SOCP (DFO 2007).

Mortality or injury of marine mammals and sea turtles can occur as a result of a vessel strike. Although there are no known marine mammal concentration areas along the PSV transit route, it is possible that groups of foraging marine mammals may be encountered, especially during summer months. Sea turtles are considered rare along the transit route as well as in the Project Area. PSVs will use existing shipping routes as practicable; where these do not exist, PSVs will follow a straight-line approach to and from the Project Area. PSVs will be required to reduce speed to a maximum of 7 knots when a marine mammal or sea turtle is observed or reported within 400 m of the PSV (except if not feasible for safety reasons). Vessels may also alter course if practicable to avoid collision with a marine mammal (or sea turtle). Overall, the risk of marine mammals and sea turtles incurring injury or mortality is considered quite low; the risk is lower for SAR given the rare occurrence of these species, except for fin whales (Schedule 1, special concern).

6.3.3.2 Change in Habitat Quality and Use

A change in habitat quality and use for marine mammals and sea turtles may occur from Project activities, particularly due to the underwater sound generated by the MODU, VSP, PSVs, and well abandonment. Marine mammals detect and produce sounds both passively and actively to communicate, locate prey and predators, navigate, and obtain information about their surroundings (Richardson et al. 1995; Nowacek et al. 2007; Tyack 2008; Shannon et al. 2016). It is uncertain how important underwater sound is to sea turtles, but it is likely less important than for marine mammals. Anthropogenic sound from vessel traffic and other offshore exploration activities can cause adverse effects on marine mammals and sea turtles. This assessment focuses on disturbance or the potential changes in behaviour and distribution of animals that could be of sufficient magnitude to be “biologically important”. Communication masking of marine mammals is also considered, where a sound of interest is obscured by interfering sounds at a similar frequency.

Changes in habitat quality and use due to the presence and operation of a MODU and VSP operations are mainly associated with sound emissions from the MODU, which can cause behavioural changes in marine mammals and sea turtles. Underwater sound, whether of anthropogenic or natural origin, may interfere with the abilities of marine mammals to communicate by masking sounds that are important to them. Some localized and short-term behavioural effects (change in presence and abundance) are likely to occur, with some species (see Table 6.3) potentially being displaced from the immediate area around the MODU and VSP airgun operation. The localized, transient, and short-term nature of these disturbances at one location and time during Project activities considerably reduces the potential for adverse effects on individual marine mammals and sea turtles and their populations. It is therefore unlikely that individuals will be displaced over extended areas or periods of time. The zone of influence of the Project at one time or location will likely be a small proportion of the feeding, breeding, or migration area of species. Marine mammals and sea turtles will not be displaced from important habitats or during important activities or be affected in a manner that causes adverse effects to overall populations in the region.

Discharges from Project PSVs and the MODU will be in accordance with the OWTG and MARPOL, as applicable. Discharges are expected to be temporary, localized, low toxicity, and subject to dilution in the open ocean.

The Project will involve PSV use including supply and support traffic to, from, and within the Project Area throughout the year during the Project life. In addition to PSV traffic, the Project will require helicopter use along the transit route from St. John's to the Project Area at various times of year. Sound generated from PSVs and to a lesser extent, helicopters, can cause changes to marine mammal and sea turtle habitat quality and use. Project-related PSV traffic represents a negligible contribution to the overall vessel traffic off eastern NL. PSVs will use existing shipping lanes as practicable; where these do not exist, PSVs will follow a straight-line approach to and from the Project Area. Whenever possible, vessels will maintain a steady course and constant speed. PSVs will be required to reduce speed to a maximum of 7 knots when a marine mammal or sea turtle is observed or reported within 400 m of the PSV (except if not feasible for safety reasons). Vessels may also alter course if practicable to avoid collision with a marine mammal (or sea turtle).

6.3.4 Potential Effects from Accidental Events

Accidental spill scenarios can result in a change in risk of mortality or physical injury and/or a change in habitat quality and use for marine mammals and sea turtles. The extent of potential effects will depend on how the spill trajectory and the VC overlap in both time and space (Frasier et al. 2020). Marine mammals and sea turtles may be exposed to oil via a combination of pathways (inhalation, ingestion, aspiration, and adsorption). Marine mammals and sea turtles that are closer to the site of the blowout are most likely to be exposed to a more constant flow and higher concentrations of recently released oil, as compared to species that are more prevalent in the nearshore.

The modelling results suggest that areas most likely to be affected by an unmitigated, subsurface, well blowout are Orphan Basin, Flemish Pass and the areas to the east. As a result, a blowout would have a greater potential to interact with marine mammals that inhabit these deeper waters including species like sperm whales, beaked whales, and delphinids. Fin whales also occur regularly in the Project Area. Harp and hooded seals are considered in the Project Area and adjacent deep-water basins. Sea turtles are expected to be rare in Orphan Basin, Flemish Pass and the areas to the east. While some marine mammals seem to avoid oil spills, other marine mammals have been observed swimming through, and feeding in, large slicks (see Helm et al. 2015; Wilkin et al. 2017). Sea turtles may be more susceptible to the effects of exposure to hydrocarbons than marine mammals because they do not respond with avoidance behaviour, exhibit indiscriminate feeding, and take large pre-dive inhalations (see Milton et al. 2003; Vander-Zanden et al. 2016). The magnitude and extent of potential effects would be reduced with the application of spill response measures; therefore, the risk of adverse effects on secure and at-risk marine mammals and sea turtles would be reduced.

There are nine marine mammal and two sea turtle Species at Risk that are known or expected to occur in the in the LAA and/or RAA. In the extremely unlikely event of a subsurface blowout to the marine environment, these species have the potential to be adversely affected, if the spill occurs when the Species at Risk is in the area. It is expected that potential effects would be similar to those described above for species not of conservation concern. The likelihood, however, of a subsurface blowout occurring is extremely low. In an actual event, emergency response measures would likely reduce the magnitude, duration and geographic extent of the spill, and therefore reduce the potential impacts on marine mammals and sea turtles.

6.4 Special Areas

The special areas VC addresses areas of the marine environment that have been identified for their biological, ecological, historical or socio-cultural importance. Special areas may be protected under federal, provincial, international and/or other legislations or agreements due to their special characteristics or sensitivity. Special areas have been selected as a VC due to their presence within and near the Project Area, and concerns regarding Project activities affecting these areas.

6.4.1 Existing Environment

The Project Area overlaps with the Northeast Newfoundland Slope Closure marine refuge, significant benthic areas (SiBA) identified for corals and sea pens, the Northeast Slope EBSA, the Slopes of the Flemish Cap and Grand Bank EBSA and proposed critical habitat for northern and spotted wolffish (Table 6.5). The LAA also overlaps with EBSAs, vulnerable marine ecosystems (VME), and NAFO fisheries closure areas identified mainly for corals and sponges. Along the PSV route and in coastal areas, the LAA overlaps with special areas identified for marine fish and fish habitat, marine and migratory birds, and marine mammals and sea turtles. As shown in Figure 6-1, special areas (e.g., VMEs, a NAFO closure and a Convention on Biological Diversity (CBD) EBSA) may overlap with the LAA but not the PSV route. Likewise, certain special areas such as coastal EBSAs and important bird areas (IBAs) may overlap with the PSV route only.

Table 6.5 Special Areas in the LAA

Special Area	Defining Features	Nearest Distance to Special Area (km)			
		EL 1157 / 1158	Project Area	LAA	Potential PSV Routes
East Avalon/Grand Banks Candidate National Marine Conservation Area	Detailed description not available. Overlaps Eastern Avalon EBSA, Witless Bay Ecological Reserve and Witless Bay Islands IBA. Assumed an important area for seabirds.	278	248	Overlap	Overlap
Northeast Newfoundland Slope Closure Marine Refuge	High biodiversity. High density of corals and sponges. Bottom contact fishing activities prohibited to protect corals and sponges.	Overlap	Overlap	Overlap	Overlap
SiBA - Sea Pens	DFO modelling shows high predicted presence probability of indicated species.	Overlap	Overlap	Overlap	Overlap
SiBA - Large Gorgonian Corals		Overlap	Overlap	Overlap	Overlap
Northeast Slope Canadian EBSA	Concentrations of corals. High aggregations of Greenland halibut and spotted wolffish (SAR) in spring. Aggregations of marine mammals (e.g., harp seals, hooded seals and pilot whales).	Overlap	Overlap	Overlap	Overlap

Table 6.5 Special Areas in the LAA

Special Area	Defining Features	Nearest Distance to Special Area (km)			
		EL 1157 / 1158	Project Area	LAA	Potential PSV Routes
Eastern Avalon Canadian EBSA	Seabird feeding areas. Cetaceans, leatherback turtles and seals feed in the area from spring to fall.	281	250	Overlap	Overlap
Baccalieu Island Canadian EBSA	Capelin spawning area. Aggregations of killer whales, shrimp, piscivores, spotted wolffish. Foraging area for seabird species: Atlantic puffin, black-legged kittiwake and razorbill.	259	237	Overlap	Overlap
Critical Habitat Northern Wolffish	Critical habitat has been identified in areas containing features (e.g., depth and sea bottom temperatures) that allow for the recovery and survival of these species.	17	Overlap	Overlap	Overlap
Critical Habitat Spotted Wolffish		12	Overlap	Overlap	Overlap
6B Snow Crab Stewardship Exclusion Zone	Crab fishing closure area.	281	255	Overlap	Overlap
Near Shore Snow Crab Stewardship Exclusion Zone		277	248	Overlap	Overlap
Witless Bay Seabird Ecological Reserve	North America’s largest Atlantic puffin colony. World’s second largest Leach's storm-petrel colony.	337	306	Overlap	Overlap
VMEs - Sponge	Concentrations of sponges and or corals.	62	35	Overlap	201
VMEs - Large Gorgonian Coral		63	35	Overlap	179
Sackville Spur (6) NAFO Fisheries Closure Area	High sponge and coral concentration area where bottom fishing activities are prohibited.	59	32	Overlap	204
Slopes of the Flemish Cap and Grand Bank UN CBD EBSA	Aggregations of corals and sponges, high diversity of marine taxa including SAR Greenland halibut fishery grounds.	Overlap	Overlap	Overlap	110

Table 6.5 Special Areas in the LAA

Special Area	Defining Features	Nearest Distance to Special Area (km)			
		EL 1157 / 1158	Project Area	LAA	Potential PSV Routes
Quidi Vidi Lake IBA	Daytime resting site for gulls (e.g., herring, great black-backed, Iceland, glaucous, common black-headed) late fall to early spring; reported locally rare ring-billed gull, mew gull and lesser black-backed gull; waterfowl (e.g., American black ducks, mallards and northern pintails) common in winter.	320	292	Overlap	Overlap
Witless Bay Islands IBA	Globally significant numbers of breeding seabirds, including more than half of eastern North American Atlantic puffin population and almost 10% of global Leach's storm-petrel population. Large numbers of nesting common murre, black-legged kittiwake and herring gull. Smaller numbers of nesting great black-backed gull, northern fulmar, thick-billed murre, razorbill and black guillemot. Important area for sea ducks (e.g., white-winged scoter, surf scoter, long-tailed duck and common eider during fall migration.	307	337	Overlap	Overlap
Distances are calculated in NAD83 UTM Zone 23N Projection					

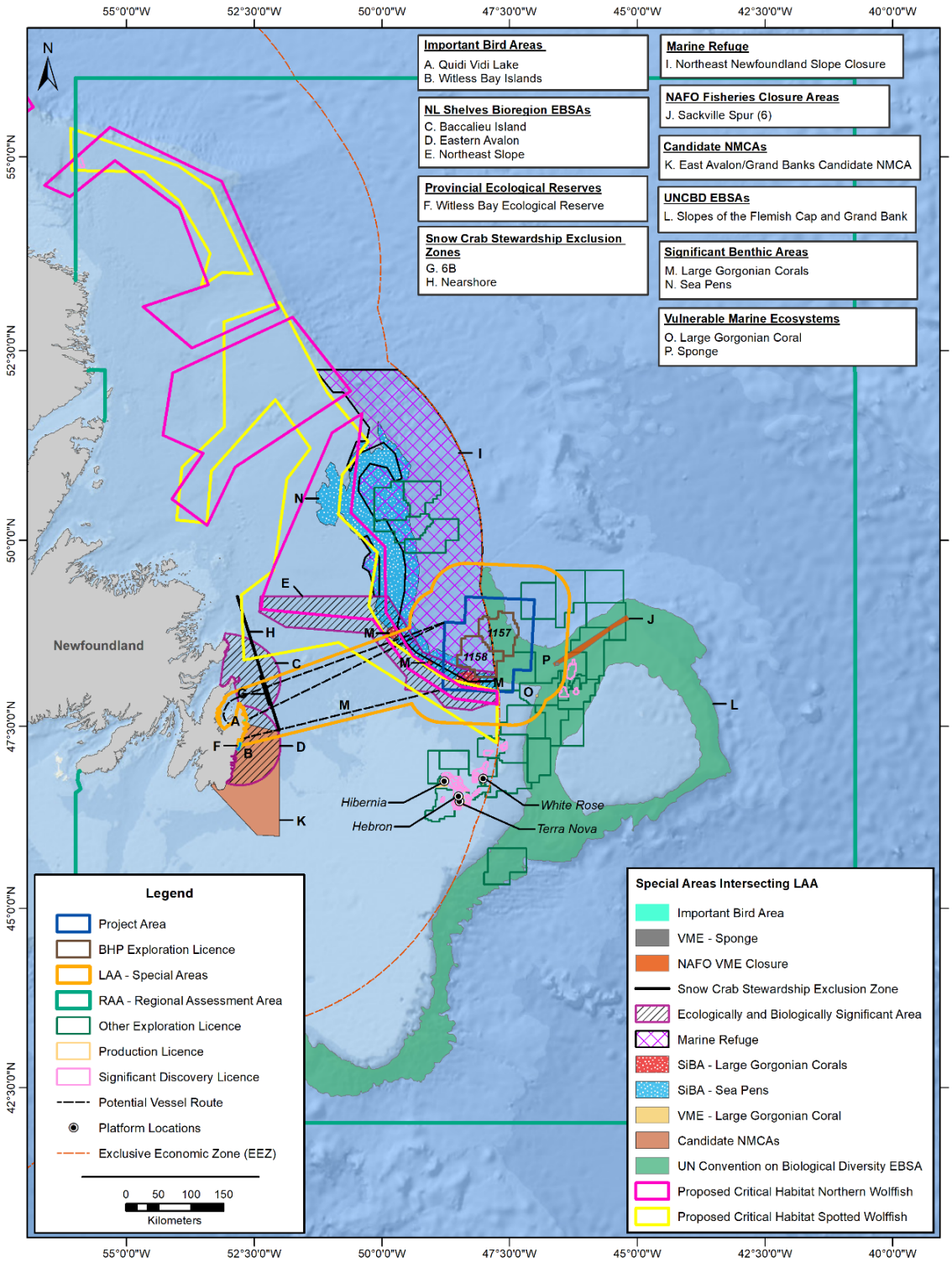

Figure 6-1 Special Areas in the LAA and RAA

6.4.2 Potential Interactions with the Environment

Routine Project-related activities can affect the ability of special areas to provide and maintain important ecological and biological functions for related species. As a result of these considerations, the assessment of Project-related effects on special areas is focused on the following potential effect:

- Change in habitat quality

6.4.3 Potential Effects from Routine Operations

A change in habitat quality within special areas could potentially occur due to Project activities affecting the marine environment. Underwater sound would be generated by the MODU through drilling operations and use of dynamic positioning to hold the MODU. This underwater sound can affect habitat quality of special areas within the Project Area, which may in turn affect the species that use these special areas. A change in habitat quality, primarily related to propagation of underwater sound from the MODU, could occur in special areas including the Northeast Newfoundland Slope Closure marine refuge, SiBAs, the Northeast Slope EBSA and the Slopes of the Flemish Cap and Grand Bank CBD EBSA, which are identified for benthic species and habitats, and proposed critical habitat for spotted and northern wolffish. However, a change in underwater sound in the area would be temporary, with the highest sound levels being close to the well site and not predicted to result in permanent or irreversible loss of habitat for fish or marine mammals. The short-term nature of drilling activity, and the irregular occurrence of drilling activity, would promote a short duration interaction with special areas.

Discharges, including drill muds and cuttings, that result from offshore exploration drilling operations can adversely alter sediment concentration and water quality in special areas that overlap with the Project Area. Discharges will be managed in accordance with the OWTG and associated standards and guidelines. In consideration of proximity to special areas identified for benthic habitat and lack of information of coral and sponge distributions in deeper areas of the Orphan Basin, BHP will conduct an imagery-based seabed survey at the well site(s) to confirm the absence of sensitive environmental features. The survey will be carried out before drilling and will consider the modelled spatial extent of the drill cuttings. If environmental or anthropogenic sensitivities are identified during the survey, BHP will notify the C-NLOPB immediately to discuss an appropriate course of action.

The potential effects of Project-related VSP surveys on special areas within the Project Area and LAA include effects of underwater sound on fish and marine mammals that may inhabit these special areas during the time of a survey. An increase in underwater sound levels from a VSP survey, and the potential for behavioural effects such as avoidance or masking, for marine species may also affect the overall quality and use of special areas by these species. VSP surveys could potentially occur within special areas identified for the presence of fish and marine mammals (i.e., the Northeast Slope EBSA) that overlap with the Project Area and LAA. VSP surveys could temporarily affect the habitat quality of the area and its ability to provide a suitable environment for species. It is unlikely that VSP surveys would cause mortality or physical injury given their capability of moving away from the sound source once behaviour affecting levels are detected. To mitigate potential effects, a ramp-up procedure for the airgun array will be implemented.

The potential effects of supply and servicing operations on special areas within the Project Area and LAA include those effects of underwater sound on fish, marine mammals, and sea turtles that may use these special areas. The PSV route overlaps with three EBSAs (i.e., Northeast Slope EBSA, Eastern Avalon EBSA and Baccalieu Island EBSA) that have been identified in part due to the presence of marine mammals and sea turtles including various seal, whale and turtle species. PSVs will use existing shipping routes as practicable; where these do not exist, PSVs will follow a straight-line approach to and from the Project Area. Overall, the risk of marine mammals and sea turtles incurring injury or mortality is considered low; therefore, potential adverse effects to special areas is similarly low.

6.4.4 Potential Effects from Accidental Events

Accidental spill scenarios can result in a change in habitat quality for special areas. The extent of the potential effects will depend on how the spill trajectory and the VC overlap in both space and in time. Special areas provide important habitat and may be comparatively more vulnerable to environmental effects, including effects from accidental events, than other areas. Adverse effects on special areas could degrade the ecological integrity of the special area so it is not capable of providing the same ecological function for which it was designated (e.g., protection of sensitive or commercially important species).

Given the potentially large amount of oil that could be associated with an unmitigated blowout event, and the possibility for a spill to extend to adjacent areas and resources, it represents the accidental event of greatest environmental concern. The extremely unlikely scenario of such a subsurface blowout can result in a change in habitat quality of special areas in the RAA. Although hydrocarbon spills could result in adverse effects on special areas, these residual effects would not be permanent or result in a change in habitat that would not be reversible at the population level for marine fish and fish habitat, marine and migratory birds and marine mammals and sea turtles. However, the environmental effects could be significant for migratory birds if the consequences carried over more than one generation according to the significance threshold used in this environmental assessment or self-sustaining population objectives or recovery goals for listed species are jeopardized. This is considered unlikely given the low probability of a large spill event to occur and the response that would be in place to reduce the consequences of such an event.

6.5 Commercial Fisheries and Other Ocean Uses

As the principal domestic economic activity within the RAA (other than petroleum production), commercial fisheries are considered as a VC for this assessment. They are also important socially and culturally to residents of the region. Fisheries in the RAA beyond the Canadian EEZ are also important for harvesters from other nations. Other ocean uses in the RAA – such as biological, geophysical and oceanographic research, commercial and recreational shipping, other petroleum exploration and production activities, subsea communications, and military operations – are also valued for commercial, cultural, and strategic reasons.

Commercial fishing activities (domestic and foreign) include travel to and from fishing grounds, deploying, baiting (in some cases), retrieving / hauling fixed or mobile gear, and locating targeted species on fishing grounds in economical quantities. Timely transits may also be essential for preserving the quality of the catch and/or reducing operating expenses. Fisheries research typically involves similar fishing methods

and components. Other marine shipping (e.g., cargo and passenger) may route through areas of planned Project activities; other petroleum industry exploration activities (e.g., seismic surveys) may occur in or near the Project Area and potential PSV traffic routes; and military exercises may overlap work areas. Artifacts and infrastructure (documented and undocumented) may be in areas of planned Project activity.

6.5.1 Existing Environment

The RAA fisheries include a variety of groundfish species such as redfish, Greenland halibut and Atlantic cod in directed and/or by-catch fisheries. They are harvested with fixed gear (e.g., gillnets) and mobile gear (e.g., otter trawls). Other important fisheries include shellfish, particularly snow crab (fixed gear pots) over much of the Grand Banks, and shrimp (mobile trawls) in northerly parts of the RAA. Harvesting large pelagic species, such as sharks and swordfish, and small pelagics, such as capelin and mackerel also occurs in some parts of the RAA.

Within the LAA and the Project Area, the geographic extent and type of fisheries are more limited, partially because of water depths and partly because of the presence of the Northeast Newfoundland Slope Closure, which overlaps much of the Project Area and all parts of EL 1157 and EL 1158 that fall within the Canadian EEZ. The terms of this closure prohibit the use of bottom-contact gear, the principal type historically employed within LAA and Project Area waters. Consequently, very little harvesting is expected to occur within either the Project Area or LAA, except for a band of activity (primarily for groundfish) in the southernmost parts.

Fisheries are typically more active along the potential PSV routes between the Avalon Peninsula and the Project Area. Vessels may transit through areas where domestic groundfish, snow crab and small pelagic fisheries take place, including both mobile and fixed gear harvesting. Lobster is harvested in some areas near shore, including within Conception Bay.

6.5.2 Potential Interactions with the Environment

Planned activities associated with the Project can interact with commercial fisheries either directly through effects on fishing activity itself (e.g., through temporary displacement from preferred fishing grounds, interference and reduced efficiency, or physical interactions, such as fishing gear damage), and/or indirectly from physical or behavioural effects on fish species (e.g., changes in commercial fish or prey health or quality, fish avoiding areas because of underwater sound, or changes in water quality). These effects can result in reduced harvesting success and/or increased operating expenses, resulting in economic loss. These interactions might also affect fisheries research, most of which involves fishing with commercial or modified gear. Project activities and installations can potentially restrict access to marine areas, and/or require route or timing modifications by other marine operators, including freighters, military operations, cruise liners, or other petroleum exploration ships.

As a result of these considerations, the assessment of Project-related effects on commercial fisheries and other ocean uses is focused on the following potential effect:

- A change in the availability of resources or in access to preferred or usual operating environments

6.5.3 Potential Effects from Routine Operations

Project interactions that might interfere with or prevent the normal operations of commercial fishing or other ocean activities include the closure of areas to fishing or to harvester and other vessel transit routes; damage to fishing gear or other equipment; reduced catch; and skewed fisheries science results. Physical contact with existing marine infrastructure or artifacts might damage them. Adverse effects on marine fish, including commercial species, are discussed in Section 6.1 (Marine Fish and Fish Habitat VC).

The presence and operation of a MODU requires the establishment of a safety (exclusion) zone around each MODU. This will prevent fish harvesting and vessel transits within the zone during operations and while Project equipment is in place (although all but a very small part of the two ELs are currently closed to bottom fishing gear). This could result in an overall simultaneous exclusion area of approximately 2 km² if two drill sites are active at the same time. This would represent approximately 0.013% of the Project Area and 0.008% of the LAA. Details of the locations and extent of safety zones will be communicated to the fishing industry and other maritime users via Navigational Warnings (NAVWARNs), Notice to Mariners (NOTMARs), the Fisheries Communication Plan and other means. The domestic fishing grounds that might be affected by safety exclusion zones would be small, based on the available record of past harvesting within the ELs. Also, the Northeast Newfoundland Slope fisheries closure area includes the majority of the joint EL area. The depths of the EL waters east of the closure, beyond the EEZ (average greater than 2,000 m), also limit the potential for harvesting in those areas.

The sound produced by the operating of drilling equipment and a dynamic positioning system can scare fish from the area during operations, though not to cause mortality (Section 6.1). However, the extent of fish displacement caused by noise (at much lower levels than seismic survey arrays, for instance, and producing primarily continuous rather than impulsive sounds) would be low in magnitude and short term.

As discussed in Section 6.1, underwater sound from a VSP array is not expected to cause physical injury to commercial species but could cause some fish species to avoid the area of disturbance within and near the safety zone. Based on sound modelling results, received sound pressure levels in the water column from the VSP sound sources will exceed 150 dB re 1 µPa rms as far as 30.6 km from the sound source (specific to VSP at Site B in August) along the 90° azimuth. It is unlikely, however, that VSP sound levels received by mobile fishes would cause mortality or physical injury and therefore resulting in a change to availability of harvesting resources. Given the very low levels of commercial harvesting within most of the Project Area, the localized nature of VSP surveys, the short duration of the surveys, and the relatively low sound levels expected at distance for the representative array and modeled sites and scenarios for this Project, VSP surveys are not expected to have a measurable effect on catch rates and therefore on commercial fishing success.

As discussed in Section 6.1, certain discharges have a potential to affect fish health and habitat in the surrounding area, and while they will not interact directly with fishing activities or other ocean operators, they could potentially affect the quality of commercial fish species. Discharges produced during MODU operations will be treated in accordance with MARPOL (International Maritime Organization 1973) and the OWTG (NEB et al. 2010), as applicable. Results from several environmental effects monitoring programs conducted for previous offshore drilling and production programs have concluded that effects on commercial species such as American plaice and snow crab were negligible (Buchanan et al. 2003; Hurley

BHP

and Ellis 2004; DeBlois et al. 2014). Results from a 2014 White Rose environmental effects monitoring program concluded similarly that there was no significant chemical body burden differences in American plaice or crab tissue collected within the White Rose field study areas and from reference areas, and the results of taste panels demonstrated that the two species were not tainted (Husky Energy 2017).

After the completion of drilling operations, each well (up to 20 during the life of the Project) will be decommissioned, and either abandoned or suspended (if future re-entry of the borehole is anticipated). Well decommissioning and abandonment or suspension may result in continued exclusion of other activities while abandonment activities take place within the safety zone with effects from sound changing fish distribution. A permanent risk to bottom fishing gear could occur if protruding infrastructure is left on the seabed and if in an area where bottom fishing might occur. Given the low level of fishing activity within and near potential drill sites, unless circumstances change (such as rescinding the Closure area, or enlarging the NAFO Footprint bottom fishing area), it is unlikely that subsea infrastructure that might remain would conflict with harvesting, based on regulatory restrictions and past harvesting data.

PSVs can interact with commercial fishing activity and other ocean use in overlapping areas through direct interference with fishing gear or at sea interactions with other shipping or marine activities. Relevant mitigation measures (see Table 7.1) for these activities include a Fisheries Communication Plan to facilitate coordinated communication with fishers (such as details about planned activities and the safety (exclusion) zone), adherence to the pre-established vessel traffic routes to and from the Project Area and ELs and use of proper lighting, Automatic Identification System, radar and other navigation and safety resources as needed. Radio communication systems will be in place and in working order for real-time contacts with other ships.

6.5.4 Potential Effects from Accidental Events

Accidental releases or spills of hydrocarbons (crude oil or marine diesel fuel) or SBMs can affect the availability of commercial fisheries resources by influencing the health of commercial fish or their habitat, by making preferred fishing grounds inaccessible, by damaging or fouling fishing gear or other equipment, or through negative effects on product markets (i.e., on sales). Other ocean uses could also be adversely affected by the closure of marine areas because of hydrocarbon slicks or clean-up operations. Closures might require marine operators to divert around an affected area, or to delay or relocate other activities and uses. Science studies might be similarly affected.

A well blowout can result in a change in availability of, or access to, resources (including fishing income) for commercial harvesters and other ocean operators, with the extent of that change depending in large part on how the spill trajectory overlaps with those uses, both geographically and temporally. Although avoidance would help to limit effects on commercial fisheries, these actions would have a negative effect on fishing income if closures affected available fishing grounds during fishing seasons, and if no alternative grounds were available, and/or if harvesting expenses increased. In shoreline areas, if contact occurred, and depending on the best practice for the situation, shoreline cleanup and rehabilitation operations would be implemented. If a spill resulted in an actual loss of income from commercial fishing, compensation would be accessible in compliance with the requirements of the Accord Acts as described in the Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activity (C-NLOPB and CNSOPB 2017).

6.6 Indigenous Peoples and Communities

Indigenous peoples and communities is included as a VC in recognition of the cultural, spiritual, social, and economic importance of marine life and fishing to Indigenous peoples, and in consideration of potential impacts of Project activities on asserted or established Aboriginal and treaty rights. This VC specifically considers how changes to the environment caused by the Project could affect: health and socio-economic conditions: physical and cultural heritage, including any structure, site or thing of historical, archaeological or paleontological importance; and current use of lands and resources for traditional purposes. This scope is consistent with the EIS Guidelines and section 5(1)(c) of CEAA 2012.

It is BHP's understanding that the lands and waters of eastern offshore NL where the Project components and activities will be located, are not within an area that the listed Indigenous groups (Section 4.2) have asserted or established Aboriginal or treaty rights protected by section 35 of the *Constitution Act, 1982* (section 35 rights). The Project is located approximately 450 km from the nearest Indigenous community, and there is no predicted Project interaction with any structure, site or thing of historical, archaeological or paleontological importance to Indigenous peoples. Therefore, this VC focuses on the potential effects of planned Project activities on health and socio-economic conditions, and, current use of lands and resources for traditional purposes. This includes direct effects on access to and availability of resources for commercial communal and FSC harvesting activities and potential indirect effects on socio-economic conditions that may subsequently occur.

6.6.1 Existing Environment

The EIS Guidelines identified 41 Indigenous groups with the potential to be affected by Project activities and therefore to be included within the scope of the environmental assessment (Section 7.4).

Traditional harvesting (including FSC fishing) is a way of life for many Indigenous communities and is an important component of Indigenous culture and sustenance, and a main aspect of community social and ceremonial activities. Although the location, species and methods of harvesting may have changed over time, Indigenous people continue to engage in traditional land and resource use practices harvesting a variety of species (e.g., fish, birds, marine mammals, wildlife, plants) for sustenance, medicine, spiritual and cultural practices, and for trade.

Of the 41 identified Indigenous groups, several hold commercial communal licences for species in areas that overlap with the Project Area and/or RAA, although it is not known if fishing under these licences currently takes place within the Project Area. Species harvested for commercial communal purposes within the RAA include capelin, groundfish, herring, mackerel, seal, shrimp, snow crab, tuna, and whelk. Within the LAA and the Project Area, the geographic extent and type of commercial fisheries in general is limited, partially because of water depths and partly because of the presence of the Northeast Newfoundland Slope Closure, which overlaps much of the Project Area and all parts of EL 1157 and EL 1158 that fall within the Canadian EEZ. The terms of this closure prohibit the use of bottom-contact gear, the principal type historically employed within the LAA and Project Area waters. Consequently, little harvesting is expected to occur within either the Project Area or LAA, except for an area of activity (primarily for groundfish) in the southernmost parts.

There are no documented FSC licences within the Project Area, however some species targeted in FSC fisheries in other parts of the RAA are anadromous and can potentially migrate through the Project Area. This includes American eel and Atlantic salmon, two migratory fish species harvested in proximity to Indigenous communities and highlighted during Indigenous engagement as being of specific concern due to potential interaction with Project activities.

Species commonly harvested by Indigenous communities include goose, ducks, loons, seagulls, murres, mergansers, and scoters. Murres have the potential to migrate through the RAA, particularly the thick-billed murre which is harvested off the coast of Labrador, north of Groswater Bay.

Indigenous groups harvest seals for FSC purposes. Six seal species occur in the Project Area: harp, hooded, grey, ringed, harbour and bearded seals, three of which are considered candidate species by the COSEWIC. Bearded and hooded seals are considered mid-priority candidate species, whereas the harp seal is a low-priority candidate species (COSEWIC 2019). The harp seal and hooded seal are expected to be common in the Project Area, while the bearded, ringed, harbour and grey seals are expected to be uncommon.

6.6.2 Potential Interactions with the Environment

The nearest Indigenous community is located on the Island of Newfoundland, approximately 450 km from the Project Area. Given these distances and the localized extent of routine Project activities, there are no pathways for effects from routine Project activities to changes in structures, sites or things of historical, archaeological, paleontological, or architectural significance, and none of these structures or sites have been identified within the Project Area or LAA.

Given the distance from the Project to Indigenous communities and the limited geographic extent of routine Project emissions and discharges, planned Project activities are also not predicted to directly affect the physical or social health and wellbeing of Indigenous communities. It is acknowledged that indirect effects on health and socio-economic conditions may result from Project-related effects on migratory species of interest to Indigenous peoples, as well as commercial communal or FSC fishing, hunting, or other harvesting activities.

Similar to commercial fisheries (Section 6.5), potential pathways of effects as a result of the Project on commercial communal fisheries include direct or indirect effects on fished species and/or effects on fishing activity from displacement from fishing areas, gear loss or damage, and/or availability of fisheries resources. To date, no Indigenous community has indicated that they actively fish in the Project Area or LAA, although this does not preclude future activities. The location of the Project Area lowers the likelihood / extent of future activities, as little commercial fishing occurs within either the Project Area or LAA, except for an area of activity (primarily for groundfish) in the southernmost parts.

FSC fishing and/or harvesting activities do not occur in the Project Area or LAA; however, routine Project activities could interact with fish, bird or mammal species that migrate through the Project area and are subsequently harvested or have the potential to be harvested by Indigenous groups from onshore / nearshore harvesting sites.

Based on these considerations, the following potential effects are the focus of the assessment of Project-related effects on Indigenous peoples and communities:

- Change in commercial communal fisheries
- Change in current use of lands and resources for traditional purposes

6.6.3 Potential Effects from Routine Operations

6.6.3.1 Change in Commercial Communal Fisheries

Some of the activities included in commercial communal fishing are travel to and from harvesting areas and deploying, setting, retrieving / hauling, and/or accessing gear in designated fishing grounds. The focus of this assessment is on Project interactions that might interrupt or prevent that process. Examples include having grounds closed to fishing, impediments to or from fishing grounds, lost or damaged fishing gear, or lost or reduced catch. Project activities that can adversely affect marine fish, including targeted fishery species, is discussed in Section 6.1 (Marine Fish and Fish Habitat VC). Many Indigenous communities rely on revenue generated from commercial communal fishing to fund community ventures, social programs and benefits; therefore, indirect socio-economic effects are also qualitatively considered in this assessment.

Drilling activities will require a 500-m radius safety zone around the MODU within which commercial communal fishing activities could be displaced. Given the bottom fishing closure within the Northeast Newfoundland Slope Closure and the extensive overlap of this area with the Project Area, the exclusion zone will be most relevant to pelagic fisheries. Due to the localized and temporary nature of the fishing exclusion and the limited amount of commercial fishing currently occurring within the Project Area and LAA, the residual effect on commercial communal fishing activities and fisheries resources is anticipated to be low in magnitude. BHP will require the Drilling Contractor to provide details of the safety zone to the Marine Communication and Traffic Services for broadcasting and publishing in the NAVWARN and NOTMAR systems. This information will also be communicated with Indigenous and non-Indigenous fishers during ongoing engagement, and through the implementation of the Indigenous Fisheries Communications Plan.

MODU underwater sound emissions can affect fish species, which may cause commercial fish species to avoid the area around the MODU, particularly during the start-up of drilling. Given the temporary and localized nature of this effect, it is not predicted to affect commercial communal fisheries to the extent that would result in a change in revenue for Indigenous communities or have adverse socio-economic effects. Swordfish and tuna are noted through Indigenous engagement activities as being of primary commercial communal importance and are known to occur in the RAA. Both the swordfish and tuna, which are not harvested in the Project Area, exhibit an avoidance behavior and have a large migration range; therefore, it is unlikely that large numbers of these species would interact or be adversely affected by the presence and operation of a MODU. Effects on prey species from routine Project activities are not predicted to occur such that it would affect foraging success of bluefin tuna or swordfish. Therefore, routine Project activities are not predicted to decrease the availability of swordfish or tuna as a resource for commercial communal fishing or result in associated adverse socio-economic impacts to the Indigenous communities.

As with the operation and presence of a MODU, VSP surveys create underwater sound that can interact with commercial communally-fished species. VSP operations are typically of short duration, taking

approximately one to two days to complete per well, over a one to three-week period (sounding just a few hours). As discussed in Section 6.1, physical and behavioural changes in commercial communal fish species and associated socio-economic effects resulting from VSP surveys are anticipated to be low.

Potential localized effects on water quality and/or sediment quality resulting from discharge of drilling waste and other discharges and emissions may occur and therefore could affect commercial communal fish species. The Project will adhere to the OCSG and the OWTG, which have been developed to protect the marine environment and will limit adverse effects on commercial fish species. As noted in Section 6.1, these effects are expected to be low in magnitude and localized to the Project Area.

A wellhead could interact with commercial communal fishing activity in the Project Area through a change in fish habitat (i.e., small structure above the seabed); however, given the bottom fishing closure within the Northeast Newfoundland Slope Closure and the extensive overlap of this area with the Project Area, this potential interaction is most relevant to pelagic fisheries. Due to the localized effects around the well site, and the water depths in the Project Area, changes to commercial communal fishing are anticipated to be low.

PSVs operating within the Project Area and LAA will increase vessel traffic and may therefore affect commercial communally-fished species and fishing activity in the vicinity of the vessels. The increase in vessel traffic can interfere with fishing gear and may restrict fishing vessel navigation. To reduce potential conflicts with commercial communal fisheries, PSVs will follow the most direct vessel traffic routes between the shorebase and the Project Area and adhere to standard navigation procedures. It is predicted that effects of helicopter transportation on fisheries will be negligible, given the lack of interaction with marine fish or fishing activities.

6.6.3.2 Change in Current Use of Lands and Resources for Traditional Purposes

Harvesting activities that collect resources to provide nourishment, or for use in traditional ceremonies, cultural practices, and social events are considered current use of lands and resources for traditional purposes. Although there are no known FSC fisheries in the Project Area, species such as marine fish, marine mammals, and migratory birds, that are traditionally harvested elsewhere have the potential to migrate through the Project Area. The focus of this assessment is, therefore, on routine Project activities that might interact with these migratory species, thereby potentially affecting the quality or availability of these resources upon which Indigenous communities may depend.

Underwater sound emissions from the MODU, particularly during the start-up phase of drilling, can affect fish by causing migratory species to avoid areas near the MODU (Section 6.1). This localized, temporary effect is not expected to affect migratory fish species to the extent that FSC fishers would experience change in availability of fisheries resources (through species mortality or dispersion of stocks) and would not indirectly result in associated social and cultural impacts to the Indigenous communities.

Indigenous groups harvest seals for FSC purposes. Section 6.3 describes the potential effects from the presence and operations of the MODU on marine mammals (including seals). Residual effects on marine mammals were predicted to be low in magnitude; therefore, potential impacts to harvested seal species are similarly predicted to be low in magnitude.

Traditional bird harvesting activities may be affected by the presence and operation of a MODU which could interact via the nocturnal attraction of birds to artificial lighting. The residual effects from the presence and operation of a MODU on marine and migratory birds are discussed in Section 6.2. With implementation of mitigation (see Table 7.1), such as following the Best Practices for Stranded Birds Encountered in Offshore Atlantic Canada, the magnitude of the effect of the presence and operation of a drilling installation on marine and migratory birds is anticipated to be low.

Migratory fish could experience startle and alarm responses from underwater sound levels associated with VSP surveys. However, based on the expectation that they would avoid underwater sound at lower levels than those at which injury or mortality may occur, received sound levels are unlikely to result in physical effects to most mobile fish species (Section 6.1) (BP 2016). Similarly, it is unlikely that VSP surveys will result in injuries (permanent threshold shift) for marine mammals or sea turtles with the implementation of mitigation measures (Section 6.3). Therefore, behavioural changes to FSC fish and marine mammal species resulting from VSP surveys and potential impacts to social and cultural values are also anticipated to be low.

Migratory birds, particularly diving birds, which are expected to hear a sound pulse if they are underwater at the time the pulse arrives, have the potential to be affected by sounds produced during VSP surveys. However, the ramp-up period for the seismic survey should deter birds from underwater feeding in these areas, reducing their potential for exposure to potentially harmful underwater sound waves. Therefore, residual effects from these surveys are anticipated to be negligible, as the activity will be localized and short-term (approximately one day per well) (Section 6.2).

Temporary and localized effects of the discharge of drilling waste and other discharges and emissions may result in change in water quality and/or sediment quality and therefore could potentially affect FSC species within a localized area. OCSG and OWTG have been developed to protect the marine environment and the Project will adhere to these guidelines. It is therefore unlikely that discharges and emissions will reduce the availability of species harvested for FSC purposes.

Flaring, during well testing can interact with migratory birds, as discussed in Section 6.2. Migratory birds can be attracted to artificial light, although the potential mortality resulting from such interactions is poorly understood. If flaring is required, it will be short in duration, totaling approximately 24 hours during a one to three-month window at the end of drilling operations, for a maximum of two wells. Associated bird attraction would be limited to within several kilometres of the MODU. With the implementation of mitigation (see Table 7.1), it is anticipated that the effects of formation flow testing with flaring (if conducted) on marine associated birds, will be negligible.

Well abandonment will occur underwater at sufficient depths to prevent interaction with species that may be harvested for traditional purposes, including marine fish, marine and migratory birds, and marine mammals.

Due to the operation of PSVs, there will be increased vessel traffic in the Project Area and LAA; therefore, areas around the PSVs may experience localized affects for marine species habitat quality associated with underwater sound, lights and discharges. Given the temporary and transitory nature of this vessel traffic, the requirement for PSVs to comply with applicable legislation and regulations including applicable

environmental protection measures, and the small incremental increase to existing levels of marine traffic and shipping activity throughout the RAA, the residual effects on species that may be harvested for traditional purposes are low.

6.6.4 Potential Effects from Accidental Events

An accidental spill can affect fisheries resources through direct and indirect effects on fished species therefore affecting fisheries success. Fishing activity may also be affected through displacement from traditional fishing areas, gear loss or damage, as well as reducing the marketability of commercial fish products and associated economic losses. These effects to fisheries resources and fishing activity have potential to result in changes to commercial communal fisheries and/or current use of lands and resources for traditional purposes, as well as associated effects on socio-economic conditions, well-being, and quality of life for the Indigenous communities. While the assessment is conservative (i.e., geographic and temporal overlap with resources of concern are assumed to occur in the case of an accidental event), the extent of potential effects depends on spill types and volumes, oceanographic conditions and how the spill trajectory and the VC overlap in both space and in time.

Given the larger spatial and temporal scale associated with a subsurface blowout, there is potential for effects on the availability of fisheries resources (e.g., effects on fisheries species), access to fisheries resources (e.g., fisheries closure), and/or fouling of fishing gear. These effects have the potential to result in a change in commercial communal and/or FSC fisheries, as well as socio-economic aspects in the Indigenous communities, lasting longer than the physical effects of the spill itself. Socio-economic conditions may result in affects to the quality of life of a community should Indigenous communities lose access to traditional use areas, sustain economic losses as a result of fisheries closures, and/or experience a reduced supply of harvesting resources.

The Project is not located in an area of high harvesting activity by Indigenous fishers, and in the event of a subsurface blowout, trajectory modelling shows released oil moving towards the east, away from Canadian shorelines due to the prevailing winds and currents. It is therefore unlikely that in the event of a subsurface blowout, oil will intersect with areas traditionally harvested for commercial communal and/or FSC fisheries. There is, however, potential for interaction with species of interest to Indigenous communities, as harvested species may migrate through a spill affected area before being harvested in a non-affected area, including marine fish, marine and migratory birds (e.g., murres), and marine mammals (e.g., seals).

Because of the widespread nature of a worst-case, unmitigated blowout incident, a significant effect (due to adverse effects on socio-economic conditions of affected Indigenous groups, such that there are associated, detectable, and sustained decreases in the quality of life of a community) is conservatively predicted for Indigenous people and communities in the event of a large scale subsurface blowout. A significant event of this type is considered highly unlikely because of prevention and response measure to be put in place. Emergency response would reduce the magnitude, duration, and extent of a spill. Shoreline protection measures would also reduce the potential effects on shorelines and coastal habitat for harvested species.

6.7 Cumulative Effects

As per section 19(1)(a) of CEAA 2012, in addition to assessing Project-specific environmental effects, the assessment of a designated project is required to consider "any cumulative environmental effects that are likely to result from the designated project [i.e., project related residual effects] in combination with other physical activities that have been or will be carried out".

Residual Project-related environmental effects were identified for the following VCs which could potentially contribute to cumulative effects:

- Marine Fish and Fish Habitat (including SAR)
- Marine and Migratory Birds (including SAR)
- Marine Mammals and Sea Turtles (including SAR)
- Special Areas
- Commercial Fisheries and Other Ocean Uses
- Indigenous Peoples and Communities

Given most of the accidental event scenarios (particularly larger-scale events with the greatest environmental consequences and opportunity to interact cumulatively with effects from other projects and activities) are considered unlikely to occur (see Section 15.4 of the EIS), accidental events are not assessed further in the cumulative effects assessment. The most likely accidental event which could occur are small operational spills from the MODU. Spill prevention and response procedures will be in place to reduce the risk of spills and associated environmental effects (refer to Section 15.5). Other offshore operators will also implement spill prevention and response measures. In the event that a small batch spill did occur from the Project, it would be unlikely to interact with the residual environmental effects of discharges from other exploration and/or production projects, fisheries, or other ocean uses in such a way that causes a cumulative environmental effect given the implementation of a 500-m radius safety (exclusion) zone surrounding the MODU and rapid dilution and/or evaporation of discharges.

In accordance with the Operational Policy Statement (CEA Agency 2015b), the cumulative effects assessment for this Project considers other physical activities that have been, are being, and are likely to be carried out. Other (non-Project) past, present, and future physical activities that are considered in the cumulative effects assessment because they have potential to result in residual environmental effects that may interact cumulatively with (i.e., overlap spatially and temporally with) the residual environmental effects of the Project within the RAA include:

- Hibernia Oilfield, including South Extension
- Terra Nova Oilfield and Extension Project
- White Rose Oilfield and Extension Project
- Hebron Oilfield
- Proposed Bay du Nord Development Project
- Offshore Petroleum Exploration – Drilling
- Offshore Petroleum Exploration – Geophysical and Other Exploration Activities
- Fishing Activity

- Other Ocean Uses (including Other Marine Vessel Traffic)
- Hunting

Residual environmental effects from the Project may combine with residual effects from one or more other physical activities potentially resulting in cumulative environmental effects on fish and fish habitat, marine and migratory birds, and marine mammals and sea turtles, including a cumulative change in risk of mortality or physical injury and/or a change in habitat quality.

Interactions from Project activities and other oil and gas exploration and production activities, shipping, and other ocean uses that are occurring in the RAA are predicted to cumulatively result in changes to fish, marine mammals and sea turtles, and marine and migratory birds mortality, injury, and health and changes in habitat quality and use that are adverse, but low in magnitude. Although the effects of the Project are predicted to be temporary and localized, mobile species (particularly those whose ranges cover a large extent of the RAA), may be sequentially exposed to the residual effects of the Project and the residual effects of other activities throughout their life cycle. Immobile species and species with very limited ranges in areas that are subject to residual effects from the Project and other activities may be exposed to the residual effects of the Project and the residual effects of these other activities simultaneously. However, the geographic extent is localized to the well site within the Project Area, reducing overall potential effects on these species and associated biogenic habitat. With the implementation of a safety (exclusion) zone during drilling operations, direct overlap of effects from other activities is unlikely to occur.

The following cumulative environmental effect mechanisms are applicable with respect to commercial fisheries and other ocean uses and Indigenous peoples and communities:

- Temporary displacement of commercial fishers from their customary fishing grounds due to establishment of a 500 m radius safety (exclusion) zone around the Project MODU, as well as the various safety (exclusion) zones associated with other exploration drilling projects and existing and proposed production projects (recognizing safety [exclusion] zones associated with exploration projects are short-term compared to longer term safety [exclusion] zones established for production projects)
- Restriction of fishing activities in fisheries closure areas (e.g., snow crab exclusion zones, marine refuges, NAFO VMEs)
- Increased competition with other displaced commercial fishers over remaining commercial fishing areas
- Risk of incidents of gear loss or damage caused by the Project in combination with other physical activities in the RAA
- Other general space-use conflicts (i.e., between safety (exclusion) zones, supply vessels, geophysical survey and support vessels, commercial fishing vessels, and the vessels of other ocean users [e.g., scientific research vessels, vessels engaged in military exercises, and cable-laying or cable repair vessels])

Standard practices for communication among marine users, including publishing in the NAVWARN and NOTMAR systems (as appropriate), is expected to mitigate potential conflicts with commercial and Indigenous fisheries. BHP (and several other operators conducting exploratory drilling) will also have an Indigenous Fisheries Communication Plan and a Fisheries Communication Plan which will provide a framework for regular operational updates to Indigenous groups and commercial fisheries as well as emergency notifications, if needed. It is assumed that other projects and activities in the RAA, including

future projects and activities, will be required to comply with various mitigation measures and regulations. BHP and other offshore petroleum operators in eastern Newfoundland's offshore area will promote effective communication between the petroleum and fishing industries and thus help mitigate potential cumulative effects on commercial and Indigenous fisheries.

Although there are no known FSC fisheries in the Project Area, the assessment of cumulative effects on current use of lands and resources considers cumulative effects on migratory fish, bird and marine mammal species that have the potential to migrate through the Project Area. Potential cumulative environmental effects on Indigenous peoples and communities may result in changes to current use of lands and resources for traditional purposes through environmental effects on marine fish, marine and migratory birds and marine mammals and sea turtles due to the generation of underwater sound and water quality effects associated with discharges. Cumulative adverse effects on marine species that could be considered important from a food, social or ceremonial perspective, are not predicted to cause a change in quantity, quality or availability of these resources that could result in a change in health and socio-economic conditions or a change in current use of lands and resources for traditional purposes.

6.8 Effects of the Environment on the Project

Careful consideration of the environment (e.g., winds, waves, currents, ice, precipitation, and seismicity) is required when planning, reviewing, and conducting offshore oil and gas production activities. Understanding these environmental characteristics enables offshore operations that are safe for workers, while also protecting the environment, equipment, and infrastructure. Key environmental conditions and phenomena relevant to potential effects of the environment on the Project include:

- Seismicity and geohazards: Potential offshore geohazards in and around the Project Area include, but are not necessarily limited to, submarine slides, shallow gas and dissociation of gas hydrates, and seismic events. The Project Area has been classified as having a relatively low to extremely low seismic hazard. A seismic event could disrupt Project activities, increase the risk of potential accidental events, and may also contribute to sediment and seafloor instability. Submarine landslides or tsunamis are estimated to be triggered by earthquakes of magnitude six or greater. The closest earthquake of such significance to the Project Area occurred in 1998 (magnitude of 6.2) at a location approximately 1,000 km east from ELs 1157 and 1158.
- Climatology, weather and oceanographic conditions: Adverse weather and oceanographic conditions (e.g., high winds, large waves, low visibility or freezing precipitation) may affect Project activities (e.g., the movement and positioning of the MODU, transportation and receipt of personnel, equipment and other materials, and drilling operations).
- Sea ice and icebergs: The Project Area is subject to seasonal intrusions of sea ice and icebergs. PSV navigation and delivery of personnel and supplies can be hindered by the presence of sea ice and icebergs. The primary risk from sea ice is at the ocean surface (e.g., vessel collision). The MODU will not operate in the presence of sea ice, unless the MODU is classed to do so. Given that the water depths in the ELs are in the range of approximately 1,175 to 2,575 m, there is no risk of iceberg scour to deep-water equipment in the Project Area.
- Climate change: Given that the temporal scope of the Project extends to 2028, it is unlikely that the physical environment in the Project Area will experience substantial climate change impacts beyond

what is presently found in recent trends and interannual variability. Climate change is therefore unlikely to have a direct and significant effect on the Project beyond the overall design and planning measures being undertaken to address the physical environmental parameters discussed above.

MODUs, PSVs, aircraft, and other equipment used for this Project will have the capacity to function within the environmental conditions that are known or likely to be encountered in the Project Area and will adhere to the applicable regulatory requirements for safety and environmental protection. Proper operational planning as well as Project compliance with applicable international standards and Canadian regulations for equipment design and use with respect to extreme weather and oceanographic conditions will help mitigate these risks. Given the relatively short time period associated with the drilling of each well, the probability of a major seismic event (and resulting landslides or tsunamis) occurring during the life of the Project is very low.

Engineering design, certification requirements, industry standards, operational procedures, and mitigation measures discussed in Section 16.2 of the EIS will reduce potential adverse effects to the Project. Based on the significance criteria defined above, and application of risk mitigation including adherence to the Newfoundland Offshore Certificate of Fitness Regulations, Newfoundland Offshore Petroleum Installations Regulations, and the Offshore Physical Environmental Guidelines, significant adverse residual effects of the environment on the Project are not likely to occur.

7.0 MITIGATION MEASURES AND COMMITMENTS

The implementation of mitigation measures is proposed to reduce or eliminate potential adverse effects. Many potential adverse environmental effects identified in this EIS can be managed effectively with standard operating procedures and standard mitigation measures. These mitigation measures have been routinely and successfully applied to similar oil and gas exploration programs off NL and elsewhere in eastern Canada. In some cases (e.g., fishing gear loss) compensation measures may be warranted. Each VC assessment describes how the mitigation measures will reduce or eliminate potential adverse effects on the VC. BHP will implement and adhere to relevant environmental mitigation requirements outlined in applicable legislation and regulations, including commitments made in this EIS, and eventually required as enforceable conditions of an EA approval. Table 7.1 provides a summary of standard mitigation and Project-specific commitments to be implemented.

Table 7.1 Summary of BHP Canada Exploration Drilling Program (2019-2028) EIS - Mitigation Measures

No.	Proponent Commitments	EIS Reference
General Mitigation Measures		
1	Contractors and subcontractors shall be required to demonstrate conformance with the HSE standard and performance requirements that have been established, by BHP.	Section 2.9.4
2	BHP will ensure a Certificate of Fitness from an independent third-party Certifying Authority for the MODU has been obtained prior to commencement of drilling operations in accordance with the C-NLOPB's *Offshore Certificate of Fitness Regulations*.	Section 2.9.4 Section 16.2
3	The observation, forecasting and reporting of physical environment data will be conducted in accordance with the Offshore Physical Environment Guidelines (NEB et al. 2008).	Section 2.9.4 Section 16.2
4	BHP and contractors working on the Project will regularly monitor weather forecasts to forewarn PSVs, helicopters, and the MODU of inclement weather or heavy fog before it poses a risk to their activities and operations. Extreme weather conditions that are outside the operating limits of PSVs or helicopters will be avoided if possible. Captains / Pilots will have the authority and obligation to suspend or modify operations in case of adverse weather or poor visibility that compromises the safety of PSV, helicopter, or MODU operations.	Section 2.9.4 Section 16.2
5	Icing conditions and accumulation rates on PSVs, helicopters, and the MODU will be monitored during fall and winter operations, particularly when gale-force winds may be combined with air temperatures below -2°C (Fisheries and Oceans Canada (DFO) 2012).	Section 2.9.4
6	In accordance with the Offshore Physical Environmental Guidelines (NEB et al. 2008), a Project-specific Ice Management Plan will be developed to include procedures related to ice detection, monitoring and assessment, as well as the physical management of icebergs, and will outline procedures for the implementation of disconnection and movement of the MODU due to presence of an iceberg. The Ice Management Plan will be submitted to the C-NLOPB for acceptance as part of the OA process.	Section 2.9.4 Section 16.2

Table 7.1 Summary of BHP Canada Exploration Drilling Program (2019-2028) EIS - Mitigation Measures

No.	Proponent Commitments	EIS Reference
7	The MODU and equipment will be designed to withstand potential environmental loads in accordance with the *Newfoundland Offshore Certificate of Fitness Regulations* and will be able to quickly and safely disconnect from the well as required to mitigate potential risks.	Section 2.9.4 Section 16.2
8	The Project will comply with Canadian regulations and international standards (where applicable) to mitigate risks associated with extreme weather and oceanographic conditions. These regulations and standards include considerations and requirements related to operations in various environmental conditions (e.g., average and extreme ambient temperatures, precipitation, ice accretion, wind, waves, tides, currents, sea ice, icebergs, and combinations thereof).	Section 2.9.4 Section 16.2
9	Safe work practices will be implemented to reduce exposure of personnel to lightning risk (e.g., restriction of access to external areas on the MODU or PSV during thunder and lightning events).	Section 2.9.4
10	BHP will require the Drilling Contractor to provide details of the safety zone to the Marine Communication and Traffic Services for broadcasting and publishing in the Navigational Warning (NAVWARN) and Notices to Mariners (NOTMAR) systems.	Section 2.9.4 Section 12.3 Section 13.3
11	Project-related damage to fishing gear will be compensated in accordance with industry best practices in the NL offshore and relevant industry guidance material such as the Geophysical, Geological, Environmental, and Geotechnical Program Guidelines (C-NLOPB 2019), the Canadian East Coast Offshore Operators Non-attributable Fisheries Damage Compensation Program (CAPP 2007), and the Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activities (C-NLOPB and CNSOPB 2017a), which apply when gear loss or damage occurs because of a spill or authorized discharge, emission or escape of petroleum.	Section 2.9.4 Section 12.3 Section 13.3
12	BHP will continue to engage commercial fisheries groups and relevant enterprises to share Project details and fisheries information, and to determine the need for a fisheries liaison officer during mobilization and demobilization of the MODU, with reference to the One Ocean Risk Management Matrix Guidelines (One Ocean n.d.). A Fisheries Communication Plan will be used to facilitate coordinated communication with fishers, including details about planned activities and the safety (exclusion) zone.	Section 12.3
13	BHP will continue to engage Indigenous communities to share Project details as applicable and facilitate coordination of information sharing. An Indigenous Fisheries Communication Plan will be used to facilitate coordinated communication with Indigenous fishers.	Section 13.3
14	BHP will maintain ongoing communications with the Northwest Atlantic Fisheries Organization (NAFO) Secretariat, through DFO as the Canadian representative, regarding planned Project activities, including timely communication of drilling locations, safety zone, and decommissioned well sites.	Section 12.3
15	BHP will contact DFO about timing and locations of planned DFO research surveys.	Section 12.3
16	BHP will contact and inform the Department of National Defence (DND) of planned marine Project Activities and identify a specific individual or office to serve as a Point of Contact for Maritime Forces Atlantic queries and concerns.	Section 12.3
17	If other petroleum exploration activities (e.g., another operator's seismic survey) are planned within the Project Area, or associated vessels are required to pass through the Project Area, communication protocols will be maintained with operators.	Section 12.3

Table 7.1 Summary of BHP Canada Exploration Drilling Program (2019-2028) EIS - Mitigation Measures

No.	Proponent Commitments	EIS Reference
18	In accordance with the Offshore Physical Environmental Guidelines (NEB et al. 2008), BHP will develop a Project-specific Ice Management Plan to include procedures related to ice detection, monitoring and assessment, as well as the physical management of icebergs, and will outline procedures for the implementation of disconnection and movement of the MODU due to presence of an iceberg. The Ice Management Plan will be submitted to the C-NLOPB for acceptance as part of the OA process.	Section 16.2
Presence and Operation of the MODU		
19	To maintain navigational safety during the Project, obstruction lights, navigation lights, and foghorns will be kept in working condition on board the MODU and PSVs. Radio communication systems will be in place and in working order for contacting other marine vessels as necessary.	Section 2.9.4 Section 12.3 Section 16.2
20	The MODU will be equipped with local communication equipment to enable radio communication between the PSVs and the MODU's bridge. Communication channels will also be put in place for internet access and enable communication between the MODU and shore.	Section 2.9.4
21	The MODU will be supported by a fleet of PSVs to re-supply fuel, equipment, and other supplies during the drilling program. A stand-by vessel, which has a Canadian Standby Certificate, will be in attendance at all times. The selection criteria for vessels engaged in Project activities will include year-round operation for the environmental conditions prevalent in the Project Area and larger RAA.	Section 16.2
22	In accordance with the *Newfoundland Offshore Petroleum Drilling and Production Regulations*, a safety (exclusion) zone (estimated to be a 500-m radius) will be established around the MODU within which non-Project related vessels are prohibited.	Section 2.9.4 Section 12.3 Section 13.3
23	Prior to drilling activity, BHP will conduct a comprehensive well-site specific geohazard review using high-quality reprocessed 3D seismic data for the geohazards assessment.	Section 2.9.4 Section 11.3 Section 12.3 Section 16.2
24	BHP will conduct a visual seabed survey in the vicinity of wells sites confirming the absence of shipwrecks, debris on the seafloor, unexploded ordnance and sensitive environmental features, such as habitat-forming corals or species at risk (SAR) to be used in conjunction with the geohazard assessment based on existing data. The survey will be developed in consultation with the C-NLOPB and DFO and will be carried out prior to drilling under a separate environmental approval by the C-NLOPB. If substantial environmental or anthropogenic sensitivities are identified during the survey, BHP will move the well site to avoid affecting them if it is feasible to do so. If it is not feasible, BHP will consult with the C-NLOPB and DFO to determine an appropriate course of action.	Section 2.9.4 Section 8.3 Section 11.3 Section 12.3
25	Lighting will be limited to the extent that worker safety and safe operations is not compromised. Measures may include avoiding use of unnecessary lighting, shading, and directing lights towards the deck.	Section 2.9.4 Section 8.3 Section 9.3 Section 11.3
26	PSV and MODU contractors will have a Maintenance Management System designed to direct the maintenance and efficient operation of the vessels and MODU, and all equipment.	Section 2.9.4

Table 7.1 Summary of BHP Canada Exploration Drilling Program (2019-2028) EIS - Mitigation Measures

No.	Proponent Commitments	EIS Reference
27	BHP, in consultation with Environment and Climate Change Canada (ECCC) Canadian Wildlife Services (CWS), will develop a protocol for systematic, daily searches for seabirds stranded on the MODU and PSVs, which will include the documentation of search effort. Seabirds found will be recovered, rehabilitated, released and documented in accordance with the methods in Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada (ECCC 2017a). BHP will provide training in these protocols and procedures. A Seabird Handling Permit will be obtained from ECCC-CWS annually. In accordance with ECCC requirements, an annual report and all occurrence data that summarizes stranded and/or seabird handling occurrences will be submitted to ECCC.	Section 9.3
28	BHP will monitor daily for the presence of marine birds from the drilling installation using a trained observer following Environment and Climate Change Canada's *Eastern Canada Seabirds at Sea Standardized Protocol for Pelagic Seabird Surveys from Moving and Stationary Platforms* and monitor for the presence of stranded birds and follow Environment and Climate Change Canada's *Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada.*	Section 9.3
29	Adequate food and potable water stores and water makers will necessarily be maintained on the MODU to accommodate weather-related delays in the transportation of supplies.	Section 16.2
Discharges		
30	Air emissions from the Project will adhere to applicable regulations and standards including the NL *Air Pollution Control Regulations*, National Ambient Air Quality Objectives, Canadian Ambient Air Quality Standards, regulations under the International Convention for the Prevention of Pollution from Ships (MARPOL) and the intent of the Global Gas Flaring Reduction Partnership.	Section 2.7 Section 2.9.4
31	Offshore waste discharges and emissions associated with the Project (i.e., operational discharges and emissions from the MODU and PSVs) will be managed in accordance with relevant regulations and municipal bylaws as applicable, including the Offshore Waste Treatment Guidelines [OWTG]) (NEB et al. 2010) and MARPOL, of which Canada has incorporated provisions under various sections of the *Canada Shipping Act*. Waste discharges not meeting legal requirements will not be discharged to the ocean and will be brought to shore for disposal. The development and implementation of a Project-specific environmental protection plan (EPP) and waste management plan (WMP) will be designed to prevent unauthorized waste discharges.	Section 2.7 Section 2.9.4 Section 8.3 Section 11.3
32	Selection of drilling chemicals will be in accordance with the Offshore Chemical Selection Guidelines (OCSG) for Drilling and Production Activities on Frontier Lands (NEB et al. 2009), which provides a framework for chemical selection to reduce potential for environmental effects. During planning of drilling activities, where feasible, lower toxicity drilling muds and biodegradable and environmentally friendly additives within muds and cements will be preferentially used. Where feasible the chemical components of the drilling fluids will be those that have been rated as being least hazardous under the Offshore Chemical Notification System scheme and Pose little or no risk to the environment by the Convention for the Protection of the Marine Environment of the North-East Atlantic.	Section 2.7 Section 2.9.4 Section 8.3 Section 11.3

Table 7.1 Summary of BHP Canada Exploration Drilling Program (2019-2028) EIS - Mitigation Measures

No.	Proponent Commitments	EIS Reference
33	Discharges of SBM and cuttings will be managed in accordance with the OWTG. SBM cuttings will only be discharged once the performance targets in OWTG of 6.9 g/100 g or less oil on wet solids can be satisfied. The concentration of synthetic oil on cuttings will be monitored on the MODU for compliance with the OWTG. In accordance with OWTG, no excess or spent SBM will be discharged to the sea. Spent or excess SBM that cannot be re-used during drilling operations will be brought back to shore for disposal.	Section 2.7 Section 2.9.4 Section 8.3 Section 11.3
34	If during testing the well starts to flow water, the test will cease. Any produced water that is retained in the surface separation equipment will be either brought to shore for disposal or routed through the MODU oil/water separator for disposal so that it can be discharged in line with the OWTG.	Section 2.7 Section 2.9.4
35	Deck drainage and bilge water will be discharged according to the OWTG which states that deck drainage and bilge water can only be discharged if the residual oil concentration of the water does not exceed 15 mg/L.	Section 2.7 Section 2.9.4
36	Ballast water will be discharged according to the International Maritime Organization *Ballast Water Management Regulations* and Transport Canada's *Ballast Water Control and Management Regulations.* The MODU will carry out ballast tank flushing prior to arriving in Canadian waters.	Section 2.7 Section 2.9.4 Section 8.3
37	Putrescible solid waste, specifically food waste generated offshore on the MODU and PSVs, will be disposed of according to OWTG and MARPOL requirements. Food waste will be macerated so that particles are less than 6 mm in diameter and then discharged. There will be no discharge of macerated food waste within 3 nautical miles from land.	Section 2.7 Section 2.9.4 Section 8.3 Section 11.3
38	Sewage will be macerated prior to discharge. In line with the OWTG and MARPOL requirements, sewage will be macerated so that particles are less than 6 mm in size prior to discharge.	Section 2.7 Section 2.9.4
39	Cooling water will be discharged in line with the OWTG which states that biocides used in cooling water are selected in line with a chemical management system developed in line with the OCSG.	Section 2.7 Section 2.9.4
40	Blowout preventer (BOP) fluids and other discharges from the subsea control equipment will be discharged according to OWTG and OCSG.	Section 2.7 Section 2.9.4
41	Liquid wastes, not approved for discharge in OWTG such as waste chemicals, cooking oils or lubricating oils, will be transported onshore for transfer to an approved disposal facility.	Section 2.7 Section 2.9.4
42	Waste generated offshore on the MODU and PSVs will be handled and disposed of in accordance with relevant regulations and municipal bylaws. Waste management plans and procedures will be developed and implemented to prevent unauthorized waste discharges and transfers.	Section 2.7 Section 2.9.4
43	Biomedical waste will be collected onboard by the medical professional and stored in special containers before being sent to land for incineration.	Section 2.7 Section 2.9.4
44	Transfer of hazardous wastes will be conducted according to the *Transportation of Dangerous Goods Act.* Applicable approvals for the transportation, handling and temporary storage, of these hazardous wastes will be obtained as required.	Section 2.7 Section 2.9.4 Section 8.3 Section 11.3
45	Information on the releases, wastes and discharges will be reported as part of a regular environmental reporting program in accordance with regulatory requirements as described in the OWTG.	Section 2.7 Section 2.9.4

Table 7.1 Summary of BHP Canada Exploration Drilling Program (2019-2028) EIS - Mitigation Measures

No.	Proponent Commitments	EIS Reference
46	As part of the OA application process with the C-NLOPB, a Waste Management Plan will be prepared before drilling operations.	Section 2.7
VSP Surveys		
47	VSP activity will be planned and conducted in consideration of the Statement of *Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment* (DFO 2007). A ramp-up procedure (i.e., gradually increasing seismic source elements over a period of approximately 30 minutes until the operating level is achieved) will be implemented before VSP activity begins.	Section 2.9.4 Section 8.3 Section 9.3 Section 10.3 Section 11.3
Well Evaluation and Testing		
48	If flaring is required, BHP will discuss flaring plans with the C-NLOPB including steps to reduce adverse effects on migratory birds. This may involve restricting flaring to the minimum required to characterize the wells' hydrocarbon potential and as necessary for the safety of the operation, minimizing flaring during periods of migratory bird vulnerability, and the use of a water curtain to deter birds from the general vicinity of the flare.	Section 9.3
49	If flaring is required, BHP will limit flaring to the length of time required to characterize the wells' hydrocarbon potential and as necessary for the safety of the operation.	Section 9.3
50	If flaring is required, flaring will be conducted as early as practicable during daylight hours to limit flaring that occurs during nighttime.	Section 9.3
51	C-NLOPB will be notified at least 30 days in advance of planned flaring to determine whether the flaring would occur during a period of migratory bird vulnerability and to determine how the Proponent plans to avoid adverse environmental effects on migratory birds.	Section 9.3
Supply and Servicing Operations		
52	PSVs will follow established shipping routes where they exist (i.e., in proximity to shore).	Section 2.9.4 Section 12.3 Section 13.3
53	In order to reduce the potential for vessel collisions during transiting activities outside the Project Area, PSVs will reduce speed to a maximum of 13 km/hour (7 knots) when marine mammals or sea turtles are observed or reported within 400 m of a PSV, except if not feasible for safety reasons.	Section 2.9.4 Section 10.3
54	If a vessel collision with a marine mammal or sea turtle occurs, BHP will contact the C-NLOPB, DFO's Canadian Coast Guard Regional Operations Centre, Indigenous groups, and other relevant authorities as soon as reasonably practicable but no later than 24 hours following the collision.	Section 2.9.4 Section 10.3
55	Lighting on PSVs will be limited to the extent that worker safety and safe operations is not compromised. Measures may include avoiding use of unnecessary lighting, shading, and directing lights towards the deck.	Section 2.9.4 Section 9.3 Section 11.3
56	The PSVs selected for this Project will be equipped for safe all-weather operations, including stability in rough sea conditions and inclement weather. In addition, measures to reduce superstructure icing hazards on PSVs will be implemented as necessary and may include (DFO 2012): • Reducing vessel speed in heavy seas • Placing gear below deck and covering deck machinery, if possible • Moving objects that may prevent water drainage from the deck	Section 2.9.4

Table 7.1 Summary of BHP Canada Exploration Drilling Program (2019-2028) EIS - Mitigation Measures

No.	Proponent Commitments	EIS Reference
	• Making the ship as watertight as possible • Manual removal of ice if required under severe icing conditions	
57	A PSV will remain on standby at the MODU at all times in the event that operational assistance or emergency response support is required. PSVs performing standby duties will have a Canadian Standby Certificate.	Section 2.9.4 Section 12.3
58	PSVs will undergo BHP's internal verification process as well as additional external inspections / audits inclusive of the C-NLOPB pre-authorization inspection process in preparation for the Project.	Section 2.9.4
59	The regional CWS office will be contacted for separation distances and altitudes between helicopters transiting to and from the MODU and migratory bird nesting colonies, as per CWS guidelines (Government of Canada 2018) and routes will comply with provincial Seabird Ecological Reserve Regulations, 2015 (no closer than 300 m). Specific details will be provided in the EPP.	Section 9.3 Section 11.3
60	PSV routes transiting to and from the MODU will be planned to avoid passing within 100 m of migratory bird nesting colonies during the nesting period and will comply with provincial Seabird Ecological Reserve Regulations, 2015 and federal guidelines to reduce disturbance to colonies (ECCC 2017b). Specific details will be provided in the EPP.	Section 9.3 Section 11.3
61	Searches for stranded birds and recovery, rehabilitation, release and documentation of birds will be conducted on PSVs as outlined above for the MODU.	Section 9.3 Section 11.3
Well Abandonment		
62	BHP plans to conduct a post-drilling visual survey of the seafloor using a remotely operated vehicle (ROV) after drilling activities to assess the visual extent of sediment dispersion and validate the modelling for the discharges of drill mud and cuttings.	Section 2.9.4 Section 8.3 Section 11.3 Section 12.3
63	Once wells have been drilled to True Vertical Depth and well evaluation programs completed (if applicable), the well will be plugged and abandoned in line with applicable BHP practices and C-NLOPB requirements. The final well abandonment program has not yet been finalized; however, these details will be confirmed to the C-NLOPB as planning for the Project continues.	Section 2.9.4 Section 8.3 Section 11.3 Section 12.3
Accidental Events		
64	Spill prevention measures are the most effective way to mitigate against potential effects from accidental events. BHP's strategy for contingency planning and spill response is described in Section 15.5. Mitigation of potential accidental events is incorporated as part of the regulatory processes (e.g., Operations Authorization [OA], Approval to Drill a Well), project-specific safety and response plans (e.g., safety plan, oil spill response plan, EPP), and well design (e.g., BOP).	Section 15.6.1 Section 15.6.2 Section 15.6.3 Section 15.6.4 Section 15.6.5 Section 15.6.6
65	The Project will operate under safety and contingency plans, including an oil spill response plan that will be submitted to the C-NLOPB before the start of any drilling activity as part of the OA process. The oil spill response plan will outline response methods and procedures, and response strategies based on severity of hydrocarbon spills. Potential responses considered in the event of an accidental release may include, but not be limited to, offshore containment and recovery, dispersants (surface application and/or subsurface injection), *in situ* burning, shoreline protection and clean-up, and oiled wildlife response. Further details on spill responses are provided in Section 15.5.	Section 15.6.1 Section 15.6.2 Section 15.6.3 Section 15.6.4 Section 15.6.5 Section 15.6.6

Table 7.1 Summary of BHP Canada Exploration Drilling Program (2019-2028) EIS - Mitigation Measures

No.	Proponent Commitments	EIS Reference
66	A Spill Impact Mitigation Assessment (SIMA) / Net Environment Benefit Assessment will be conducted as part of the OA Process as well. These assessments will be used to qualitatively evaluate the risks and trade-offs of feasible and effective response options, when compared to no action. An overall spill response strategy will be selected for the Project based on the SIMA process. If identified as a response option, chemical dispersant application would not occur without authorization from C-NLOPB.	Section 15.6.1 Section 15.6.2 Section 15.6.3 Section 15.6.4 Section 15.6.5 Section 15.6.6
67	Mechanical measures and barriers that are implemented as part of well design, and drilling and monitoring procedures for prevention of blow-outs are described in Section 2.3.4. This includes use of steel casings, drilling fluids, and BOPs for controlling formation pressures. The BOP includes a series of rams that are designed to seal off the wellbore at the wellhead on the seafloor when required. Furthermore, the BOP and other pressure control equipment are tested regularly and recorded in accordance with the Drilling and Production Guidelines (C-NLOPB and CNSOPB 2017b) and to BHP company standards.	Section 15.6.1 Section 15.6.2 Section 15.6.3 Section 15.6.4 Section 15.6.5 Section 15.6.6
68	Specific environmental effects monitoring and follow-up programs may be required in the unlikely event of a spill. These monitoring programs will be developed in consultation with applicable regulatory agencies.	Section 15.6.1 Section 15.6.2 Section 15.6.3 Section 15.6.4 Section 15.6.5 Section 15.6.6
69	Of particular relevance to marine and migratory birds are the commitments related to shoreline protection and clean-up, and oiled wildlife response (see Section 15.5.4). In the event that oil threatens or reaches the shoreline, shoreline protection measures, including deflection from sensitive areas, will be implemented as practical. SCAT teams will be mobilized to the affected areas to conduct shoreline surveys to document the type and degree of shoreline oiling and inform shoreline clean-up and remediation as applicable. SCAT teams will also be used to monitor and evaluate the effectiveness of the clean-up operations.	Section 15.6.2
70	BHP will develop an Oiled Wildlife Response Plan (OWRP) and, for incidents where wildlife is threatened, engage specialized expertise to implement the Plan, including the recovery and rehabilitation of wildlife species as needed (see Section 15.5.4 for BHP's oiled wildlife response approach).	Section 15.6.2 Section 15.6.3 Section 15.6.4
71	Implementation of a Fisheries Communication Plan, which would include procedures for informing fishers of an accidental event, appropriate responses, and the locations of closed areas. Emphasis would be on timely communication, thereby providing fishers with the opportunity to haul gear from affected areas, reducing the potential for gear fouling or bringing tainted fish to the marketplace.	Section 15.6.5
72	Communications to other ocean users through the media, direct industry-to-industry contacts, and the issuance of Notices to Fish Harvesters, NAVWARNS, and NOTMARs, which would include the locations of affected and/or restricted areas.	Section 15.6.5
73	Project-related damage to fishing gear will be compensated in accordance with industry best practices in the NL offshore and relevant industry guidance material such as the Geophysical, Geological, Environmental, and Geotechnical Program Guidelines (C-NLOPB 2019), the Canadian East Coast Offshore Operators Non-attributable Fisheries Damage Compensation Program (CAPP 2007), and the Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activities (C-NLOPB and CNSOPB 2017a) which apply when gear loss or damage occurs because of a spill or authorized discharge, emission or escape of petroleum.	Section 15.6.5

Table 7.1 Summary of BHP Canada Exploration Drilling Program (2019-2028) EIS - Mitigation Measures

No.	Proponent Commitments	EIS Reference
74	An Indigenous Fisheries Communication Plan will be used to facilitate coordinated communication with fishers, including procedures for informing Indigenous groups of an accidental event. Timely communication will be important, thereby providing fishers with the opportunity to haul out gear from the affected areas and reducing the potential for fouling of fishing gear. In the event of Project-related damage to fishing gear, fishers will be compensated in accordance with the *Compensation Guidelines with Respect to Damages Relating to Offshore Petroleum Activity* (C-NLOPB and CNSOPB 2017a).	Section 15.6.6

8.0 SIGNIFICANCE OF RESIDUAL EFFECTS

The residual environmental effects for routine operations for each VC is presented in Chapters 8 to13 of the EIS. Table 8.1 summarizes the residual effect findings for routine activities for each VC and indicates the significance of these effects. Chapter 15 of the EIS presents the residual environmental effects for accidental events for each VC. Table 8.2 summarizes the residual effect findings for accidental events for each VC and indicates the significance of these effects. Where an effect is predicted to be significant (refer to Chapters 8 to 13 of the EIS for significance criteria for each VC), the likelihood of that effect occurring is also presented.

Table 8.1 Summary of Residual Effects for Routine Operations

Valued Components	Area of Federal Jurisdiction (CEAA, 2012 s.5 "environmental effect")	Potential Effect	Project Activity	Mitigation Reference	Residual Effect Characterization					Ecological/Socio-Economic Context	Significance of Residual Effect	Likelihood of Significant Effect
					Magnitude	Geographic Extent	Duration	Frequency	Reversibility			
Marine Fish and Fish Habitat	s. 5(1)(a)(i)	Change in Risk of Mortality or Physical Injury	Presence and Operation of a MODU	Refer to Table 7.1	L	PA	MT	IR	R	D	N	N/A
			VSP		L	PA	ST	IR	R	D	N	N/A
			Discharges		L	PA	ST-LT	IR	R	D	N	N/A
		Change in Habitat Availability, Quality, and Use	Presence and Operation of a MODU		L	PA-LAA	MT	IR	R	D	N	N/A
			VSP		L	PA-LAA	ST	IR	R	D	N	N/A
			Discharges		L	PA	MT-LT	IR	R	D	N	N/A
			Well Decommissioning and Abandonment or Suspension		L	PA	ST-LT	IR	R	D	N	N/A
			Supply and Servicing Operations		L	LAA	MT	IR	R	D	N	N/A
Marine and Migratory Birds	s. 5(1)(a)(iii)	Change in Risk of Mortality or Physical Injury	Presence and Operation of a MODU	Refer to Table 7.1	L	LAA	ST	IR	R	D	N	N/A
			VSP		L	PA	ST	IR	R	D	N	N/A
			Discharges		L	PA	ST	IR	R	D	N	N/A
			Well Testing and Flaring		L	PA	ST	IR	R	D	N	N/A
			Well Decommissioning and Abandonment or Suspension		L	LAA	ST	IR	R	D	N	N/A
			Supply and Servicing Operations		L	LAA	ST	IR	R	D	N	N/A
		Change in Habitat Quality and Use	Presence and Operation of a MODU		L	LAA	ST	IR	R	D	N	N/A
			VSP		N	PA	ST	UL	R	D	N	N/A
			Discharges		L	PA	ST	IR	R	D	N	N/A
			Well Testing and Flaring		L	PA	ST	IR	R	D	N	N/A
			Well Decommissioning and Abandonment or Suspension		L	LAA	ST	IR	R	D	N	N/A
			Supply and Servicing Operations		L	LAA	ST	IR	R	D	N	N/A
Marine Mammals and Sea Turtles	s. 5(1)(a)(ii)	Change in Risk of Mortality or Physical Injury	Presence and Operation of a MODU	Refer to Table 7.1	L	PA	ST-MT	IR	R	D	N	N/A
			VSP		N-L	PA	ST-MT	IR	R	D	N	N/A
			Well Decommissioning and Abandonment or Suspension		N	PA	ST	IR	R	D	N	N/A
			Supply and Servicing Operations		N-L	LAA	ST-MT	IR	R	D	N	N/A
		Change in Habitat Quality and Use	Presence and Operation of a MODU		L	PA-LAA	ST-MT	IR	R	D	N	N/A
			VSP		L	PA	ST-MT	IR	R	D	N	N/A
			Discharges		N	PA	ST	IR	R	D	N	N/A
			Well Decommissioning and Abandonment or Suspension		N	PA	ST	IR	R	D	N	N/A
			Supply and Servicing Operations		L	LAA	ST-MT	IR	R	D	N	N/A

Table 8.1 Summary of Residual Effects for Routine Operations

Valued Components	Area of Federal Jurisdiction (CEAA, 2012 s.5 "environmental effect")	Potential Effect	Project Activity	Mitigation Reference	Residual Effect Characterization					Ecological/Socio-Economic Context	Significance of Residual Effect	Likelihood of Significant Effect
					Magnitude	Geographic Extent	Duration	Frequency	Reversibility			
Special Areas	s. 5(1)(b)(i)	Change in Habitat Quality	Presence and Operation of a MODU	Refer to Table 7.1	L-M	PA-LAA	ST-MT	IR	R	D	N	N/A
			VSP		L	PA-LAA	ST-MT	IR	R	D	N	N/A
			Discharges		L-M	PA	MT-LT	IR	R	D	N	N/A
			Well Decommissioning and Abandonment or Suspension		L	PA	ST	IR	R	D	N	N/A
			Supply and Servicing Operations		L	LAA	ST-MT	IR	R	D	N	N/A
Commercial Fisheries and Other Ocean Uses	s. 5(2)(b)(i)	Change in Availability of Resources or Operating Environment	Presence and Operation of a MODU	Refer to Table 7.1	L	PA	ST	IR	R	D	N	N/A
			VSP		L	PA	ST	IR	R	D	N	N/A
			Discharges		L	PA	ST	IR	R	D	N	N/A
			Well Decommissioning and Abandonment or Suspension		L	PA	ST-P	IR-C	R-I	D	N	N/A
			Supply and Servicing Operations		L	LAA	ST	IR	R	D	N	N/A
Indigenous Peoples and Communities	s.5(1)(c)(i) s.5(1)(c)(iii)	Change Commercial Communal Fisheries	Presence and Operation of a MODU	Refer to Table 7.1	L	PA	ST	IR	R	D	N	N/A
			VSP		N-L	PA	ST	IR	R	D	N	N/A
			Discharges		L	PA	MT	IR	R	D	N	N/A
			Well Decommissioning and Abandonment or Suspension		N-L	PA	ST-P	IR	I-R	D	N	N/A
			Supply and Servicing Operations		L	LAA	ST	IR	R	D	N	N/A
	s.5(1)(c)(i) s.5(1)(c)(iii)	Change in Current Use of Lands and Resources for Traditional Purposes	Presence and Operation of a MODU		L	PA	ST	IR	R	D	N	N/A
			VSP		L	PA	ST	IR	R	D	N	N/A
			Discharges		L	PA	MT	IR	R	D	N	N/A
			Well Testing and Flaring		L	PA	ST	IR	R	D	N	N/A
			Well Decommissioning and Abandonment or Suspension		N-L	PA	ST-LT	IR	R	D	N	N/A
			Supply and Servicing Operations		L	LAA	ST	IR	R	D	N	N/A
					Magnitude: N: Negligible L: Low M: Moderate H: High	**Geographic Extent:** PA: Project Area LAA: Local Assessment Area RAA: Regional Assessment Area	**Duration:** ST: Short-term MT: Medium-term LT: Long-term P: Permanent	**Frequency:** UL: Unlikely S: Single event IR: Irregular event R: Regular event C: Continuous	**Reversibility:** R: Reversible I: Irreversible	**Ecological/Socio-Economic Context:** D: Disturbed U: Undisturbed	**Significance:** S: Significant N: Not Significant	**Likelihood:** U: Unlikely L: Likely N/A: Not applicable

Table 8.1 Summary of Residual Effects for Routine Operations

Valued Components	Area of Federal Jurisdiction (CEAA, 2012 s.5 "environmental effect")	Potential Effect	Project Activity	Mitigation Reference	Residual Effect Characterization					Ecological/Socio-Economic Context	Significance of Residual Effect	Likelihood of Significant Effect
					Magnitude	Geographic Extent	Duration	Frequency	Reversibility			
Key/Note: VC specific definitions included for each VC in Chapters 8-13 of the EIS. **Environmental Effects under CEAA 2012:** 5(1) (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*, (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. 5(2) (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 any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.											

Table 8.2 Summary of Residual Effects for Accidental Events

Valued Components	Area of Federal Jurisdiction (CEAA, 2012 s.5 "environmental effect")	Potential Effect	Accidental Event Scenario	Mitigation Reference	Residual Effect Characterization					Ecological/Socio-Economic Context	Significance of Residual Effect	Likelihood of Significant Effect
					Magnitude	Geographic Extent	Duration	Frequency	Reversibility			
Marine Fish and Fish Habitat	s. 5(1)(a)(i)	Change in Risk of Mortality or Physical Injury / Change in Habitat Availability, Quality and Use	Well Blowout Incident	Refer to Table 7.1	M-H	RAA*	LT	S	R	D	N	N/A
			Marine Diesel Spill		L	LAA	ST	S	R	D	N	N/A
			SBM Spill		L	PA	ST-LT	S	R	D	N	N/A
Marine and Migratory Birds	s. 5(1)(a)(iii)	Change in Risk of Mortality or Physical Injury / Change in Habitat Quality and Use	Well Blowout Incident	Refer to Table 7.1	H	RAA*	ST-MT	S	R	D	S	U
			Marine Diesel Spill		L	LAA	ST	S	R	D	S	U
			SBM Spill		L	LAA	ST	S	R	D	N	N/A
Marine Mammals and Sea Turtles	s. 5(1)(a)(ii)	Change in Risk of Mortality or Physical Injury / Change in Habitat Quality and Use	Well Blowout Incident	Refer to Table 7.1	M	RAA	MT-LT	S	R	D	N	N/A
			Marine Diesel Spill		L	LAA	ST	S	R	D	N	N/A
			SBM Spill		L	LAA	ST	S	R	D	N	N/A
Special Areas	s. 5(1)(b)(i)	Change in Habitat Quality	Well Blowout Incident	Refer to Table 7.1	M-H	RAA	ST-MT	S	R	D	N	N/A
			Marine Diesel Spill		N/A	N/A	N/A	N/A	N/A	N/A	N	N/A
			SBM Spill		L	PA	ST-LT	S	R	D	N	N/A
Commercial Fisheries and Other Ocean Uses	s. 5(2)(b)(i)	Change in Availability of Resources or Operating Environment	Well Blowout Incident	Refer to Table 7.1	M-H	RAA	MT	S	R	D	N	N/A
			Marine Diesel Spill		L	LAA	ST	S	R	D	N	N/A
			SBM Spill		N	PA	ST	S	R	D	N	N/A
Indigenous Peoples and Communities	s.5(1)(c)(i) s.5(1)(c)(iii)	Change in Commercial Communal Fisheries / Change in Current Use of Lands and Resources for Traditional Purposes	Well Blowout Incident	Refer to Table 7.1	M-H	RAA	MT-LT	S	R	D	S	U
			Marine Diesel Spill		L	LAA	ST	S	R	D	N	N/A
			SBM Spill		N-L	PA	ST	S	R	D	N	N/A

Notes:
* In certain scenarios, effects may extend beyond the RAA.
See Table 8.1 for key.

The environmental effects assessment for each VC examines the degree and nature of change to, and resulting effects on, the existing environment that may occur as a result of planned Project activities. The characterization of range of magnitude (range of natural variability) considers the reasonable worst-case scenario and is therefore considered to provide a conservative indication of effects. Mitigation has been proposed to reduce or eliminate adverse environmental effects all components of the Project scope (Table 7.1). They include both general Project mitigation measures and best management practices as well as VC-specific mitigation measures. BHP will implement and adhere to relevant environmental mitigation requirements outlined in applicable legislation and regulations, including commitments made in the EIS, and eventually required as enforceable conditions of an EA approval. Environmental mitigation and compliance requirements will be implemented and adhered to by Project contractors and subcontractors as it applies to their specific work scopes. This will be enforced through relevant commercial and contractual arrangements with these providers or goods and services to the Project. With the implementation of these proposed mitigation measures, residual adverse environmental effects of routine Project activities and components are predicted to be not significant for all VCs.

In the unlikely event of a Project-related accidental event resulting in the large-scale release of oil into the marine environment, a significant adverse effect is predicted for marine and migratory birds and Indigenous peoples and communities under certain circumstances. The magnitude and extent of potential effects would be reduced with the application of spill response measures (see Section 15.5 of the EIS); therefore, the risk of adverse effects would be reduced.

In summary, BHP is committed to working closely with the local business community, governments, educational and training facilities, and various other stakeholders to effectively implement the Project Benefits Plan and achieve a positive outcome. Activities associated with the BHP exploration drilling program are expected to make a substantial positive contribution to the economy of Newfoundland and Labrador. Many potential adverse environmental effects identified in this EIS can be managed effectively with standard operating procedures and standard mitigation measures. These and/or other planning and management measures, in combination with BHP's own policies, principles, and environmental management plans and procedures, will allow the Project to be planned and completed in a manner that avoids or reduces potential environmental effects. Overall, with the implementation of mitigation, significant adverse residual environmental effects from the Project, including cumulative effects, are not likely to be significant.

9.0 FOLLOW-UP AND MONITORING PROGRAMS

As per CEAA 2012, a follow-up program is a program for "verifying the accuracy of the environmental assessment of a designated project" and "determining the effectiveness of any mitigation measures." Given offshore NL has a long history of oil and gas exploration and well-established oil production operations, most potential environmental interactions are well understood, and standard mitigation is well known. Proposed monitoring and follow-up programs are described below.

9.1 Marine Fish and Fish Habitat

BHP proposes to implement an imagery-based monitoring program to address the predicted residual effects of drilling mud and cuttings discharges on marine benthic environments in consideration of proximity to coral SiBAs. BHP will conduct a pre-drilling seabed survey at proposed drilling locations. Furthermore, BHP plans to conduct a post-drilling visual survey of the seafloor after drilling activities to assess the visual extent of sediment dispersion and validate the modelling for the discharges of drill mud and cuttings. The specific details of the follow-up program will be determined in consultation with the C-NLOPB and DFO and in consideration of pre-drill seabed survey results.

9.2 Marine and Migratory Birds

For the duration of the drilling program for each well:

- Systematic searches for stranded birds will be carried out daily on the MODU and PSVs, and this effort documented, by trained personnel according to search protocols designed specifically for each facility
- BHP will monitor daily for the presence of marine birds from the drilling installation using a trained observer following Environment and Climate Change Canada's *Eastern Canada Seabirds at Sea Standardized Protocol for Pelagic Seabird Surveys from Moving and Stationary Platforms* and monitor for the presence of stranded birds and follow Environment and Climate Change Canada's *Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada*
- Retrieval, rehabilitation, release and documentation of stranded birds will be conducted according to Procedures for Handling and Documenting Stranded Birds Encountered on Infrastructure Offshore Atlantic Canada (ECCC 2017a) and associated permit conditions under the MBCA authorizing the capture and handling of migratory birds
- Results of the monitoring program will be shared with regulators to help further improve the understanding of bird strandings and mortality in the NL offshore area

9.3 Marine Mammals and Sea Turtles

BHP will develop a marine mammal and sea turtle monitoring plan to be implemented during VSP surveys. The Plan will include Marine Mammal Observer requirements, shutdown, and ramp-up procedures and reporting requirements. A report of the observational program will be submitted annually to the C-NLOPB and DFO, including documentation of marine mammal and sea turtle sightings.

In the unlikely event of a Project vessel collision with a marine mammal or sea turtle, BHP will contact DFO through their 24-hour emergency contact number (1-888-895-3003).

9.4 Special Areas

BHP is proposing to implement a follow-up program to address uncertainty regarding residual effects of drill waste discharges on the marine benthic environment in consideration of the proximity of sensitive benthic areas to BHP's Project Area and concerns raised about potential effects on cold-water corals. BHP plans to conduct a visual survey of the seafloor following drilling activities to assess the visual extent of sediment dispersion and validate drill waste modelling predictions. Beyond the predrill and post-drill well site surveys to be conducted, environmental effects monitoring for recovery rates of infaunal organisms is typically not required for exploration drilling programs. The specific details of the follow-up program will be determined in consultation with the C-NLOPB and DFO in consideration of the pre-drill survey results.

9.5 Commercial Fisheries and Other Ocean Uses

The implementation of the Project's Fisheries Communication Plan will allow for ongoing feedback from fishing interests about the implementation and effectiveness of related mitigation measures, and about changes in fishing activities or science research relevant to the Project Area. Instances of suspected gear damage will be communicated to BHP and will be followed up through the gear compensation program as initiated by a claimant. Other follow-up communications described in the mitigation measures (e.g., contact with DFO, NAFO, Department of National Defence) will be undertaken regularly, as will the issuance of NAVWARNs and NOTMARs.

9.6 Indigenous Peoples and Communities

The implementation of the Project's Indigenous Fisheries Communication Plan will allow for ongoing feedback from Indigenous fishing interests about the implementation and effectiveness of related mitigation measures, and about changes in fishing activities or science research relevant to the Project Area. Instances of suspected gear damage will be communicated to BHP and will be followed up through the gear compensation program as initiated by a claimant.

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