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</tr>
<tr>
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*Revision History shown on next page*
### Revision History

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<td>Lara Smandych</td>
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<td>Greg Krauss</td>
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* An electronic copy will be stored in SharePoint

### Signatures for this revision

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</tbody>
</table>
**TABLE OF CONTENTS**

ACRONYMS .................................................................................................................. 5

1.0 INTRODUCTION ................................................................................................. 8

2.0 CONDITION IMPLEMENTATION ACTIVITIES .................................................. 12

   General Conditions ........................................................................................... 12
   Condition 2.1 .................................................................................................... 12
   Condition 2.2 .................................................................................................... 13
   Condition 2.3 .................................................................................................... 15
   Condition 2.4 .................................................................................................... 16
   Condition 2.5 .................................................................................................... 17
   Condition 2.6 .................................................................................................... 19

   Fish (Including Marine Mammals and Sea Turtles) and Fish Habitat ................ 20
   Condition 3.1 .................................................................................................... 20
   Condition 3.2 .................................................................................................... 24
   Condition 3.3 .................................................................................................... 26
   Condition 3.4 .................................................................................................... 27
   Condition 3.5 .................................................................................................... 28
   Condition 3.6 .................................................................................................... 29
   Condition 3.7 .................................................................................................... 30
   Condition 3.8 .................................................................................................... 32
   Condition 3.9 .................................................................................................... 34
   Condition 3.10 .................................................................................................. 35
   Condition 3.11 .................................................................................................. 36
   Condition 3.12 .................................................................................................. 37
   Condition 3.12.2 .............................................................................................. 38
   Condition 3.12.3 .............................................................................................. 40

   Migratory Birds ................................................................................................. 43
   Condition 4.1 .................................................................................................... 43
   Condition 4.2 .................................................................................................... 45
   Condition 4.3 .................................................................................................... 46
   Condition 4.4 .................................................................................................... 47

   Aboriginal and Commercial Fishing .................................................................. 50
   Condition 5.1 .................................................................................................... 50
   Condition 5.2 .................................................................................................... 52
   Condition 5.3 .................................................................................................... 53

   Accidents and Malfunctions ............................................................................. 54
   Condition 6.1 .................................................................................................... 54
   Condition 6.2 .................................................................................................... 59
   Condition 6.3 .................................................................................................... 60
   Condition 6.4 .................................................................................................... 61
ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
</tr>
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<tr>
<td>AFFF</td>
<td>Aqueous Film Forming Foam</td>
</tr>
<tr>
<td>AMAR</td>
<td>Autonomous Multichannel Acoustic Recorder</td>
</tr>
<tr>
<td>ANBFNC</td>
<td>Assembly of New Brunswick First Nations Chiefs</td>
</tr>
<tr>
<td>ANSMC</td>
<td>Assembly of Nova Scotia Mi'kmaq</td>
</tr>
<tr>
<td>BOP</td>
<td>Blowout Preventer</td>
</tr>
<tr>
<td>CEA Agency</td>
<td>Canadian Environmental Assessment Agency</td>
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<tr>
<td>CEAA 2012</td>
<td>Canadian Environmental Assessment Act, 2012</td>
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<td>CF</td>
<td>Control Framework</td>
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<td>CNSOPB</td>
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<tr>
<td>COSEWIC</td>
<td>Committee for the Status of Endangered Wildlife in Canada</td>
</tr>
<tr>
<td>CCG</td>
<td>Canadian Coast Guard</td>
</tr>
<tr>
<td>CWS</td>
<td>Canada Wildlife Service</td>
</tr>
<tr>
<td>dB</td>
<td>decibel</td>
</tr>
<tr>
<td>DFO</td>
<td>Fisheries and Oceans Canada</td>
</tr>
<tr>
<td>DND</td>
<td>Department of National Defence</td>
</tr>
<tr>
<td>DNV</td>
<td>Det Norske Veritas</td>
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<tr>
<td>DP</td>
<td>Dynamic Positioning</td>
</tr>
<tr>
<td>ECC</td>
<td>Environment and Climate Change Canada</td>
</tr>
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<td>Environment and Climate Change Canada's National Environmental Emergencies Centre</td>
</tr>
<tr>
<td>EA</td>
<td>Environmental Assessment</td>
</tr>
<tr>
<td>ECDIS</td>
<td>Electronic Chart Display &amp; Information System</td>
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<tr>
<td>ECRC</td>
<td>Eastern Canada Response Corporation</td>
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<td>EEM</td>
<td>Environmental Effects Monitoring</td>
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<tr>
<td>EIS</td>
<td>Environmental Impact Statement</td>
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<tr>
<td>El</td>
<td>Exploration Licences</td>
</tr>
<tr>
<td>EPP</td>
<td>Environmental Protection Plan</td>
</tr>
<tr>
<td>FAC</td>
<td>Fisheries Advisory Committee</td>
</tr>
<tr>
<td>FFT</td>
<td>Fast Fourier Transform</td>
</tr>
<tr>
<td>g</td>
<td>Gram</td>
</tr>
<tr>
<td>GHG</td>
<td>Greenhouse gas</td>
</tr>
<tr>
<td>H2S</td>
<td>Hydrogen sulfide</td>
</tr>
<tr>
<td>HSE</td>
<td>Health, Safety and Environment</td>
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</table>
HSSE&SP = Health, Safety, Security, Environment & Social Performance
Hz = hertz
IceMAX = Stena IceMAX
ICS = Incident Command System
IOPP = International Oil Pollution Prevention Certificates
JASCO = JASCO Applied Sciences
k = kilo
KMKNO = Kwilmu’kw Maw-klusuaqn Negotiation Office
LAA = Local Assessment Area
m = metre
m2 = square metre
MARPOL = International Convention for the Prevention of Pollution from Ships
MARS = Marine Animal Response Society
MCTS = Marine Communications and Traffic Services
mg/L = milligram per litre
mm = millimetre
MMO = Marine Mammal Observer
MSDS = Material Safety Data Sheet
NEB = National Energy Board
NEBA = Net Environmental Benefits Analysis
OA = Operations Authorization
OA-D = Operations Authorization-Drilling
OCSG = Offshore Chemical Selection Guidelines
OSM = Ocean Sound Meter
OSR = Oil Spill Response
OSRL = Oil Spill Response Limited
OSRO = Oil Spill Response Organization
OSRP = Oil Spill Response Plan
OSV = Offshore Support Vessels
OVID = Offshore Vessel Inspection Database
OWTG = Offshore Waste Treatment Guidelines
PAM = Passive Acoustic Monitoring
ROV = Remotely Operated Vehicle
SAR = Species at Risk
SARA = Species at Risk Act
SSC.......................... Sound Source Characterization
SCCP.......................... Source Control Contingency Plan / Well Containment Plan
SEL.......................... Sound Exposure Level
SME.......................... Subject Matter Experts
SOC.......................... Synthetic-on-Cuttings
SPL.......................... Sound Pressure Level
STA.......................... Spill Treating Agents
TOR.......................... Terms of Reference
TTS.......................... Temporary Threshold Shift
UXO.......................... Unexploded Ordnances
VSP.......................... Vertical Seismic Profiling
WAP.......................... Well Abandonment Plan
WAZ.......................... Wide Azimuth
WRP.......................... Wildlife Response Plan
1.0 INTRODUCTION

Shell Canada Limited (Shell) is conducting an exploration drilling project within the area of its offshore Exploration Licences (EL) 2423, 2424, 2425, 2426, 2429 and 2430 in the Nova Scotia Offshore Area. The Shelburne Basin Venture Exploration Drilling Project (the Project) consists of up to seven exploration wells to be drilled over a four year period from 2015 to 2019. The Project is divided into two separate drilling campaigns: the first drilling campaign consisted of drilling two (2) wells and the second drilling campaign could include up to five (5) additional wells.

In 2014, an Environmental Impact Statement (EIS) was prepared to fulfill the requirements of the Canadian Environmental Assessment Act, 2012 (CEAA 2012) as the Project’s proposed drilling programs involve activities that are designated by the Regulations Designating Physical Activities. On June 15, 2015, a Decision Statement was issued by the Canadian Minister of Environment, approving the EIS and concluding that, with the implementation of applicable mitigation measures, the Designated Project (the Project) is not likely to result in significant adverse environmental effects.

In accordance with subsection 53(2) of CEAA 2012, the Decision Statement established 40 conditions in relation to the environmental effects referred to in subsection 5(2) of CEAA 2012, with which Shell must comply. The conditions are grouped as per the following themes:

- General Conditions: Conditions 2.1 - 2.6
- Fish (Including Marine Mammals and Sea Turtles) and Fish Habitat: Conditions 3.1 - 3.12
- Migratory Birds: Conditions 4.1 - 4.4
- Aboriginal and Commercial Fishing: Conditions 5.1 - 5.3
- Accidents and Malfunctions: Conditions 6.1 - 6.11
- Implementation Schedule: Conditions 7.1 - 7.2
- Record Keeping: Conditions 8.1 - 8.2

The conditions cover a broad range of activities including the development and implementation of programs, plans and procedures (Appendix 1), conducting stakeholder engagement, implementing monitoring and mitigation measures, and document control. Each of the 40 conditions applies to all wells of both campaigns, unless otherwise specified. Each of the conditions are to be implemented either pre-drill, during drilling, post drilling or over all phases of well activity.

Shell commenced the drilling of the second well of the first campaign, Monterey Jack E-43A (Monterey Jack) on September 26, 2016. The well is located approximately 270 km south of Halifax in approximately 2,120 m of water (Figure 1). Drilling was completed...
and the well was abandoned in accordance with applicable regulations on January 21, 2017.
Figure 1: Location of Monterey Jack Well
Throughout each specified phase of drilling activity at Monterey Jack, Shell has implemented all applicable conditions of the Decision Statement, in consultation with the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB or the Board).

In accordance with Condition 2.4 of the Decision Statement;

*The Proponent shall, within 90 days after each well is suspended and/or abandoned, submit to the Board a report, including an executive summary of the report in both official languages. The Proponent shall document in the report:

2.4.1 implementation activities undertaken for each of the conditions;
2.4.2 how it met condition 2.1 in the implementation of the conditions set out in this Decision Statement;
2.4.3 for conditions set out in this Decision Statement for which consultation is a requirement, how it has considered any views and information received;
2.4.4 the results of the follow-up program requirements identified in conditions 3.12, and 4.4; and
2.4.5 any corrective actions taken by the Proponent, or proposed in relation to subsequent wells to be drilled as part of the Designated Project, should the predictions of environmental effects prove to be inaccurate or the mitigation measures prove not to be effective.*

Shell has prepared this document, *Shelburne Basin Venture Exploration Drilling Project Canadian Environmental Assessment Agency Closure Report for the Monterey Jack E-43A Well (Closure Report).* This Closure Report describes the activities undertaken to demonstrate Project compliance with each condition of the Decision Statement. This closure report will be submitted to the CNSOPB within 90 days of the abandonment of Monterey Jack.
2.0 CONDITION IMPLEMENTATION ACTIVITIES

General Conditions

Condition 2.1

The Proponent shall, throughout all phases of the Designated Project, ensure that its actions in meeting the conditions set out in this Decision Statement are informed by the best available information and knowledge, are based on validated methods and models, are undertaken by qualified individuals and apply the best available economically and technologically feasible mitigation strategies.

Implementation:

Shell, throughout all phases of the Project, has met all the conditions outlined in the Decision Statement. Shell has satisfied each condition with quality, fit for purpose, technically and economically feasible programs, procedures and plans and has demonstrated care and due diligence throughout the execution of the Project. All programs were adopted in consultation with the CNSOPB to meet the intent of the conditions. These efforts have resulted in the development and implementation of appropriate processes, procedures and programs.

Shell’s performance, commitment and standards are firmly grounded in the Health, Safety, Security, Environment & Social Performance (HSSE&SP) Control Framework (CF). The CF drives Shell’s commitments and standards in governing key aspects such as health and safety, environment and contractor management. The use of qualified and competent resources is mandated through Shell’s contract and procurement process, where contractors are required to demonstrate ‘equivalent to Shell’ health safety and environment management systems and are fully capable of managing the HSSE risks identified in the contract.

Shell followed a rigorous process in the procurement of external expertise and services in a fair, open, consistent and transparent manner, and in accordance with Section 45(1) of the Canada–Nova Scotia Offshore Petroleum Resources Accord Implementation Act (the Accord Act). Through this process, Shell was able to determine the capacity, capability and availability of external contractors to support the Project. As a result, Shell is confident in its selection of qualified, experienced contractors with the required expertise to support the delivery of activities, where required. Internally, Shell employs global expertise and subject matter experts (SME) such as senior environmental scientists, ecotoxicologists and technical health, safety and environment (HSE) advisors, who applied their professional judgement and expertise in designing programs, procedures and mitigation strategies to meet the conditions set out in the Decision Statement.
Condition 2.2

The Proponent shall, where consultation is a requirement of a condition set out in this Decision Statement:

2.2.1 provide written notice of the opportunity for the party or parties to present their views on the subject of the consultation;
2.2.2 provide sufficient information and a reasonable period of time to permit the party or parties to prepare their views; and
2.2.3 provide a full and impartial consideration of any views presented.

Implementation:

Shell started engagement with First Nations, Aboriginal organizations and fisheries stakeholders regarding the Project in 2012. Shell takes a “whole-of-project” approach to engagement by beginning engagement early, long before there are regulatory requirements, and continuing that engagement on an ongoing basis throughout the life of the Project.

During the timeframe of the Project’s Environmental Assessment (EA) process, twelve of thirteen First Nations in Nova Scotia were signatories to a Consultation Terms of Reference (TOR) that outlines the federal and provincial government (Crown) consultation requirements and the "appropriate manner in which to conduct consultation" on all projects. This includes notification, information sharing, dialogue to determine any potential adverse impacts to asserted and/or proven rights, as well as any accommodation measures that may be required, all conducted within reasonable timeframes. In addition to following Nova Scotia’s established process, Shell contacted the Kwilmu’kw Maw-klusuaqn Negotiation Office (KMKNO), the administrative office that coordinates all consultation for the Mi’kmaw in Nova Scotia, to confirm the consultation process, as well as the Sipekne’katik, Fort Folly, St. Mary’s and Woodstock First Nations to confirm their preference for consultation.

With respect to specific conditions where the proponent was delegated procedural aspects of consultation by the Crown, Shell provided written notice of the opportunities for consultation to all concerned parties by:

1. notifying the group in writing about the opportunity for consultation and asking how they would like the consultation to take place;
2. following the process that developed as a result of #1, which includes the provision of all pertinent information and a reasonable period of time for reflection and comment; and,
3. by fully and impartially considering any views presented by those concerned, and providing responses to any questions or comments.
Condition 2.3

The Proponent shall, where Aboriginal consultation is a requirement of a condition set out in this Decision Statement, first consult each Aboriginal group on the most appropriate manner in which to conduct the consultation.

Implementation:

Refer to response for Condition 2.2.
Condition 2.4

The Proponent shall, within 90 days after each well is suspended and/or abandoned, submit to the Board a report, including an executive summary of the report in both official languages. The Proponent shall document in the report:

2.4.1 implementation activities undertaken for each of the conditions;
2.4.2 how it met condition 2.1 in the implementation of the conditions set out in this Decision Statement;
2.4.3 for conditions set out in this Decision Statement for which consultation is a requirement, how it has considered any views and information received;
2.4.4 the results of the follow-up program requirements identified in conditions 3.12, and 4.4; and
2.4.5 any corrective actions taken by the Proponent, or proposed in relation to subsequent wells to be drilled as part of the Designated Project, should the predictions of environmental effects prove to be inaccurate or the mitigation measures prove not to be effective.

Implementation:

This Closure Report has been prepared to fulfill the requirements of Condition 2.4.
Condition 2.5

The Proponent shall make the report, the executive summary referred to in conditions 2.4, as well as the implementation schedule referred to in condition 7, available on its website when the report or schedule is submitted to the Board. The Proponent shall keep these documents available on its website for a minimum of five years after completion of the Designated Project, unless otherwise specified by the Board.

Implementation:

Prior to the commencement of the Project, Shell created a Project webpage on its Shell Canada website accessible at the following links:

http://www.shell.ca/shelburne


One of the purposes for creating the Project webpage was to post this Closure Report and executive summary (Condition 2.4), and the Project implementation schedules (Condition 7.1). Upon submission of this Closure Report and the executive summary to the Board, these documents will be uploaded and made available on the Project webpage.

In accordance with Condition 7.1, Shell developed an implementation schedule for the Monterey Jack well. This schedule indicates the notional commencement and completion dates for each activity relating to the conditions set out in the Decision Statement with sufficient detail to allow the Board to plan compliance verification activities. The Project webpage contains the most up to date implementation schedule available for the Monterey Jack well. The first implementation schedule was submitted to the Board on February 18, 2016, more than 30 days prior to the expected commencement of drilling of Monterey Jack, and was immediately posted to the Project webpage. The loss of riser/Lower Marine Riser Package (LMRP) incident at Cheshire on March 5, 2016 delayed the commencement of drilling of the Monterey Jack well until September 26, 2016. An updated implementation schedule was therefore submitted on August 7, 2016 to more accurately reflect the start of drilling. This implementation schedule was posted to the Project webpage. Each subsequent update of the implementation schedule submitted to the Board was also updated on the Project webpage. The final implementation schedule will be submitted to the CNSOPB upon completion of all condition compliance activities 90 days post abandonment of Monterey Jack. Once submitted to the Board, Shell will post the updated schedule on the Project webpage.
Shell will maintain the Closure Report, the executive summaries and the final implementation schedule on its company website for a minimum of 5 years (until 2022).
Condition 2.6

The Proponent shall notify the Board as soon as possible if the Designated Project is expected to be undertaken by another party due to a sale, a transfer or other circumstances that arise and would result in a new proponent taking over the Designated Project in whole or in part.

Implementation:

The Monterey Jack well was drilled and abandoned by Shell as part of the first drilling campaign of the Project. At this time, the Project is not expected to be undertaken by another party.

Shell will notify the CNSOPB as soon as possible if the remainder of the Project is expected to be undertaken by another party due to a sale, a transfer, or other circumstances that would arise, resulting in a new proponent taking over the Project in whole or in part.
Fish (Including Marine Mammals and Sea Turtles) and Fish Habitat

**Condition 3.1**

The Proponent shall treat all discharges from the drilling unit into the marine environment in compliance with the Offshore Waste Treatment Guidelines issued jointly by the National Energy Board, the Canada-Newfoundland and Labrador Offshore Petroleum Board and the Canada-Nova Scotia Offshore Petroleum Board, and in accordance with the requirements of the Fisheries Act, the Migratory Birds Convention Act, 1994 and any other applicable legislation.

**Implementation:**

All Project discharges from the drilling unit, the Stena IceMAX (IceMAX), into the marine environment are managed in compliance with the Offshore Waste Treatment Guidelines (OWTG), the Fisheries Act, and the Migratory Birds Convention Act, 1994. Discharges from the IceMAX are also compliant with the International Convention for the Prevention of Pollution from Ships (MARPOL).

As outlined by the OWTG, the Environmental Protection Plan (EPP) is the governing document with respect to the management of discharges to the natural environment. The EPP lists all applicable operational discharges associated with the Project, describes how these discharges are managed, and outlines the applicable discharge limits. The Project EPP is reviewed regularly and revised as needed to provide additional detail and clarification regarding Project discharges. Table 1 below includes a summary of all Project discharges listed within the EPP and includes any applicable discharge limits, a description of how each stream is managed, as well as a list of applicable legislation and guidelines that govern each discharge.

The Offshore Chemical Selection Guideline (OCSG) is the framework guideline for chemical selection for offshore activities under the jurisdiction of the CNSOPB, the C-NLOPB, and the National Energy Board (NEB). The purpose of the OCSG is to minimize the potential for environmental impacts from the discharge of chemicals used in offshore drilling and production operations by evaluating each chemical and selecting those of lower toxicity. Shell’s Chemical Selection and Review Process, written in accordance with the OCSG, ensures that all drilling chemicals used by Shell for the Project have been accepted for use and discharge in the offshore. Refer to Condition 3.2 for more information regarding Shell’s chemical review process.

Project discharges from the IceMAX to the marine environment are treated in compliance with the OWTG, as these discharges are outlined in, and managed as per, the Project EPP, and associated chemicals discharged have been assessed and deemed acceptable.
for use and discharge, in accordance with the OCSG. Since discharges are treated in compliance with the OWTG and the OCS, they are also considered compliant with the *Fisheries Act* and *Migratory Birds Conservation Act, 1994*. 
Table 1: Summary of Project Operational Discharges (as outlined within the Project EPP)

<table>
<thead>
<tr>
<th>Discharge Stream</th>
<th>OWTG Limit</th>
<th>Management (per OWTG)</th>
<th>Regulatory Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Emissions (sources: engines and onboard oil incinerator)</td>
<td>N/A</td>
<td>Greenhouse gas (GHG) emissions are reported to Environment and Climate Change Canada (ECCC) as required. Air emissions are reported annually. In 2015 and 2017 the Project did not reach the threshold for GHG reporting. 2016 emissions will be submitted June 2017 per ECCC requirements.</td>
<td>OWTG</td>
</tr>
<tr>
<td>Bilge Water</td>
<td>15 mg/L oil in water</td>
<td>The IceMAX employs a MARPOL compliant oil-water separator to treat bilge water from machinery spaces. This equipment is set to 15 mg/L and is equipped with a high oil-in-water alarm that will sound if this limit is exceeded.</td>
<td>MARPOL OWTG</td>
</tr>
<tr>
<td>Ballast Water</td>
<td>N/A</td>
<td>The IceMAX ballast water is contained in segregated tanks and therefore not contaminated with oil or chemicals. The IceMAX conducts all ballast water exchanges or saltwater tank flushing &gt;200 nm from shore.</td>
<td>OWTG</td>
</tr>
<tr>
<td>Deck Drainage</td>
<td>15 mg/L oil in water</td>
<td>Drainage from exposed decks:  - If the oil concentration of the deck drainage exceeds 15 mg/L, the drainage flows into a deck drain tank through remotely operated valves.  - If the oil concentration of the deck drainage is below 15 mg/L, then the deck drainage is discharged overboard. Drainage from the drill floor:  - Collected drainage is transferred through a dedicated MARPOL compliant oil water separator (OWS) which removes the oil from the drain water.  - Clean drainage (oil concentration &lt; 15 mg/L) is discharged overboard and oily drainage (&gt;15 mg/L) is returned to the recovered oil tank.</td>
<td>MARPOL OWTG</td>
</tr>
<tr>
<td>Sewage and Grey Water</td>
<td>Macerated to a particle size of &lt;6mm</td>
<td>All sewage and food wastes are reduced through maceration to an average particle size of 4 mm prior to discharge at sea. The majority of the sewage and grey water produced on the IceMAX is passed through a non-chlorinated system. Sewage that is chlorinated is</td>
<td>MARPOL OWTG</td>
</tr>
</tbody>
</table>
injected with a 15% solution on demand when the discharge pump is activated. The chlorine is substantially consumed during the disinfection process.

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling Water</td>
<td>There is no biocide added to the cooling water on board the IceMAX therefore it is considered an authorized discharge and not subject to discharge limit.</td>
<td>OWTG</td>
</tr>
<tr>
<td>Drilling Discharges</td>
<td>All substances that make up the drilling muds (water based mud, WBM, and synthetic based mud, SBM) are screened through Shell’s Chemical Selection and Review Process developed in consideration of the OCSG, for more information on this process (refer to Condition 3.2). No whole SBM was discharged during the drilling of the Monterey Jack well. Drill cuttings are treated on board the IceMAX in order produce a 48 hour mass weighted average of retained synthetic-on-cutting (SOC) not exceeding 6.9 g/100 g (refer to Condition 3.12.). The 48-hr mass average SOC discharge SOC is reported monthly to the CNSOPB.</td>
<td>OCSG OWTG</td>
</tr>
<tr>
<td>Blowout Preventer (BOP) Fluids</td>
<td>The BOP fluids used on the IceMAX are assessed under the OCSG as having low aquatic toxicity and are accepted for use and discharge in accordance with those guidelines. All operational and batch discharges of BOP fluid and hydrate seal glycol are described in the EPP and are accepted for use and discharge as per the OCSG. The volumes of BOP fluid and glycol discharged are reported monthly to the CNSOPB.</td>
<td>OCSG OWTG</td>
</tr>
<tr>
<td>Fire Suppression Chemicals</td>
<td>Fire monitors are tested monthly with seawater which is discharged without treatment. The active fire extinguishing agent, Aqueous Film Forming Foam (AFFF) is sampled annually and contained on board. If AFFF is anticipated to be released to the marine environment during testing or sampling, prior notification will be provided to the CNSOPB.</td>
<td>OWTG</td>
</tr>
</tbody>
</table>
Condition 3.2

The Proponent shall apply the Offshore Chemical Selection Guidelines for Drilling & Production Activities on Frontier Lands issued jointly by the National Energy Board, the Canada-Newfoundland and Labrador Offshore Petroleum Board and the Canada-Nova Scotia Offshore Petroleum Board to select lower toxicity chemicals that would be used and discharged into the marine environment, including drilling fluid constituents, and shall submit any necessary risk justification as per Step 10 of the Guidelines to the Board for acceptance prior to use.

Implementation:

In accordance with the OCSG, Shell has developed the Chemical Selection and Review Process (CSRIP) to assess all chemicals proposed for use and discharge into the marine environment as part of the Project. The CSRIP incorporates external regulatory guidance provided by CNSOPB via the OCSG as well as internal guidance via Shell’s internal chemical risk screening process, as required by Shell’s HSSE&SP CF. These two processes have been combined to provide complete characterization and risk evaluation of the proposed chemicals to enable the selection of lower toxicity chemicals for use and discharge into the marine environment.

As outlined in Shell’s CSRIP, review steps completed for each chemical are recorded in a spreadsheet. The spreadsheet captures the assessment of each chemical or chemical component in accordance with the process in Figure 6.1 of the OCSG. This review process was initiated by Shell in May 2015 and has continued throughout the Project. As new chemicals are considered for use or as new Material Safety Data Sheet (MSDS) versions and chemical formulations become available, the chemicals are assessed through the CSRIP to determine if they meet both CNSOPB (i.e. OCSG) and internal Shell criteria for acceptable use and discharge. If any chemical is found unacceptable for use and discharge through either the Shell or OCSG assessment processes, the next step is to determine if an alternative chemical exists that would provide the same technical performance. If a viable alternative chemical is identified, it is assessed using the same process to determine if it would be acceptable for use and discharge. If no viable alternative exists, per Step 10 of the OCSG process, Shell would submit a risk justification to the CNSOPB to outline the need for this chemical to be used, provide an assessment of any alternatives considered, and request approval to discharge the chemical despite its higher toxicity.

The scope of the OCSG includes the selection of “drilling and production chemicals intended for use and possible discharge into the offshore areas” (NEB et al. 2009); however Shell has chosen to assess all chemicals with potential for discharge offshore, not only drilling and production chemicals. To date over 100 chemicals have been assessed,
including contingency chemicals not currently in use. Two chemicals required submission of a risk justification to the CNSOPB and were approved. These chemicals were Bestolife 72732 and One-Trol HT. Bestolife 72732 is a pipe dope/thread compound used to protect against wear during make up and break-out of pipe joints, and to prevent leaking through the connection during operation. One-Trol HT is a fluid-loss reducer that was requested to be approved as a contingency chemical in the event that the approved, less toxic alternative was not effective at controlling fluid loss at higher temperatures.
Condition 3.3

The Proponent shall treat all discharges from support vessels into the marine environment in compliance with the International Convention for the Prevention of Pollution from Ships.

Implementation:

All Project offshore supply vessels (OSVs) are compliant with MARPOL. All mandatory vessel certificates were submitted to the CNSOPB as part of the drilling Authorization process prior to commencement of the Project, and are verified monthly by Shell to ensure they remain current. These certificates are maintained on board each OSV and include, but are not limited to, International Oil Pollution Prevention Certificates (IOPP), International Sewage Pollution Prevention Certificates and International Air Pollution Prevention Certificates. In order to receive these certificates, an inspector from the Classification Society inspects the equipment on board each OSV to ensure it is compliant with MARPOL requirements (e.g., that the oily water separator is functional, the engines perform to minimum emission standards, a biological sewage treatment system is in place, and no chlorinated systems are used). All waste on board the OSVs is segregated and managed in accordance with MARPOL and the vessels maintain Garbage Management Plans and log books and oil record books, all of which are verified monthly and through periodic EPP audit by Shell. The OSVs are also subject to annual inspection and sign-off by the Classification Society and Shell performs annual inspections per the Oil Companies International Marine Forum (OCIMF) Offshore Vessel Inspection Questionnaire (OVID inspection). The Offshore Vessel Inspection Database (OVID) questionnaire includes a detailed section on pollution prevention and environmental management written in accordance with MARPOL requirements.
Condition 3.4

The Proponent shall conduct a pre-drill survey at each well site to determine the presence of any military unexploded ordnance. If any such ordnance is detected, the Proponent shall consult the Board to determine an appropriate course of action prior to commencing drilling.

Implementation:

Shell completed a pre-drill survey on September 22, 2016 to determine the presence of military unexploded ordnances (UXOs) on the seabed at the Monterey Jack well location. The survey was conducted using a remotely operated vehicle (ROV) that scanned the seafloor across a 60 m by 60 m (3,600 m²) area on and around the Monterey Jack well site. There were no UXOs observed. The results of the survey were submitted to the CNSOPB on September 23, 2016.

In 2014, Shell completed an extensive seabed verification program which was comprised of a desktop review, consultation with government agencies and field work in order to determine the presence of UXOs within the Project Area and at the proposed Monterey Jack well location.

Within Shell’s EIS for the Project (Stantec, 2014), all known explosive disposal sites, sites of UXO risk (as per known historical Department of National Defence (DND) activities), and recorded shipwrecks and non-explosive ocean disposal sites in the vicinity of the Project Area were mapped. All known explosive disposal sites are located outside the Project Area. No shipwrecks are known to be located within 40 km of the Monterey Jack well location (Fugro 2014).

A seabed survey was completed for the Project in 2014 (Fugro 2014), which included the collection of multibeam data, piston cores and box core sediment samples at and around the proposed well location. At that time, Shell also collected high definition video and photos of the seabed within 2.5 km of wellsite location. No UXOs were identified on or around the proposed Monterey Jack well location. All reports were submitted and deemed acceptable by the CNSOPB.
Condition 3.5

The Proponent shall conduct a pre-drill survey to identify any aggregations of habitat-forming corals or sponges, or species at risk at each well site prior to drilling and report results to the Board within 48 hours of the completion of the survey.

Implementation:

On September 22, 2016, Shell conducted a pre-drill ROV survey of the seafloor at the proposed drill site for the Monterey Jack well to determine the presence of aggregations of habitat-forming corals or sponges, or species at risk prior to the commencement of drilling. The survey was completed in conjunction with the search for UXOs (refer to Condition 3.4). Shell contracted a marine scientist from Stantec Consulting Limited (Stantec) to review the live ROV video and provide an independent, qualified professional opinion on the benthic habitat results for the presence of habitat-forming coral or sponge aggregations and species at risk. Upon reviewing the ROV video, Stantec found that the typical benthic habitat at the proposed Monterey Jack well site was relatively bare and generally devoid of epifauna, with sparse solitary macrofauna scattered in the surveyed area, when present. The macrofauna found in the area are not species at risk listed under the Species at Risk Act (SARA) or assessed by the Committee for the Status of Endangered Wildlife in Canada (COSEWIC) to be species of conservation interest. These results were reported to the CNSOPB within 48 hours of the completion of the survey on September 24, 2016.

The findings of the Monterey Jack pre-drill survey were consistent with results obtained during the 2014 Seabed Survey (Fugro 2014). The seabed survey included a benthic habitat survey (comprised of box cores and drop camera video and photographs) in order to obtain information about baseline sediment chemical composition and diversity of the benthic environment surrounding the potential drilling location. The survey results indicated that the benthic habitat was generally sparse and devoid of epifauna. There were no aggregations or communities of corals, sponges, or other benthic epifauna observed. None of the species observed during the survey were considered species of conservation interest (i.e. listed as endangered, threatened, or special concern) by COSEWIC.
Condition 3.6

If aggregations of habitat-forming corals or sponges, or species at risk are confirmed, the Proponent shall move the drilling unit to avoid affecting them, unless in doing so would not be technically feasible. If not technically feasible, the Proponent shall consult with the Board prior to commencing drilling to determine an appropriate course of action to the Board’s satisfaction.

Implementation:

On September 22, 2016, Shell conducted a pre-drill ROV survey of the seafloor at the proposed Monterey Jack well location to determine the presence of aggregations of habitat-forming corals or sponges, or species at risk prior to drilling. No aggregations of habitat-forming corals or sponges, or species at risk were identified.

Refer to Condition 3.5 for further detail.
Condition 3.7

The Proponent shall apply the Statement of Canadian Practice with Respect to the Mitigation of Seismic Sound in the Marine Environment during vertical seismic profiling surveys.

Implementation:

In preparation for the vertical seismic profiling (VSP) survey to be conducted at the Monterey Jack well location, Shell and LGL Limited (LGL) prepared a Marine Mammal Observer (MMO) Program. The MMO Program describes the monitoring and mitigation measures to be implemented during the VSP survey in order to minimize the potential effects of seismic sound on marine mammals and sea turtles. Shell committed to the mitigation measures and monitoring requirements as outlined in the Statement of Canadian Practice with Respect to the Mitigation of Seismic Sound in the Marine Environment (the Statement). In many instances, the Program exceeded the minimum requirements outlined in the Statement by also including mitigations outlined within Shell’s EIS and EPP. The MMO Program document for Monterey Jack was submitted to the CNSOPB on November 2, 2016 and was deemed acceptable by the CNSOPB on November 30, 2016. The MMO Program was implemented during the VSP survey for the Monterey Jack well on January 14, 2017.

Mitigation and monitoring requirements outlined within the Statement, as well as additional measures from Shell’s Project EIS and EPP, were applied during the Monterey Jack VSP survey and are summarized below.

- Establishment of a safety zone:
  - A 500 m exclusion safety zone and 1000 m shutdown zone were established for the Project. Ramp up of the seismic source array was to be delayed if any marine mammal or sea turtle species was detected within the 500 m zone during the pre-ramp up watch. This seismic source would be shut down (and ramp up delayed) if any marine mammal or sea turtle species listed on Schedule 1 of SARA, as well as all other baleen whale and sea turtle species, was detected within the 1000 m zone.

- Marine mammal observation and detection measures:
  - Experienced and trained MMOs and a Passive Acoustic Monitoring (PAM) operator were responsible for implementing the Program on board the IceMAX throughout the VSP survey.
  - A visual watch of the safety zones was maintained during all daylight hours and the safety zones were monitoring acoustically during periods when the
safety zones could not be visually observed (i.e., at night, in fog) and during all pre-ramp up watches, which were 30 minutes in duration.

- Mitigation measures:
  o Ramp up: The array was gradually ramped up over a minimum of 20 minutes. The smallest source was activated first and others were gradually added at evenly spaced intervals, increasing the volume over a 20-minute period until all array were active.
  o Ramp up Delay: If MMOs detected any marine mammal or sea turtle either visually or acoustically within the 500 m exclusion safety zone during the 30-minute pre-ramp up watch, the ramp up procedure was to be delayed. If MMOs detected either visually or acoustically a marine mammal or sea turtle species listed on Schedule 1 of SARA, or other baleen whale, or other sea turtle within the 1000 m shutdown zone during the 30-minute pre-ramp up watch, the ramp up procedure was to be delayed. Ramp up could not commence until the marine mammal or sea turtle had left the zone or the MMO/PAM Operator had not detected the marine mammal or sea turtle for 30 minutes since the last sighting; 60 minutes if the species was a beaked whale.
  o Array Shutdowns: The seismic array would be shut down if a marine mammal or sea turtle species listed on Schedule 1 of SARA, or other baleen whale, or other sea turtle was detected visually (or acoustically during periods with limited visibility) within the 1000 m shutdown zone.
Condition 3.8

The Proponent shall submit a Marine Mammal Observer Program to the Board for acceptance at least 30 days prior to the commencement of any vertical seismic profiling activity that:

3.8.1 demonstrates that Marine Mammal Observers are trained to identify different species of marine mammals and sea turtles that may be present in the safety zone through either visual observation or cetacean detection technology, such as Passive Acoustic Monitoring, if used;

3.8.2 demonstrates that Marine Mammal Observers have the ability to view the entire safety zone; and

3.8.3 provides, if used during vertical seismic profiling, the specific Passive Acoustic Monitoring configuration.

Implementation:

In preparation for the Monterey Jack VSP survey, Shell and LGL prepared an MMO Program. The MMO Program describes the monitoring and mitigation measures to be implemented during the VSP survey in order to minimize potential effects of seismic sound on marine mammals and sea turtles. The MMO Program document for Monterey Jack was submitted to the CNSOPB on November 2, 2016 and was deemed acceptable by the CNSOPB on November 30, 2016. The MMO Program was implemented during the VSP survey for the Monterey Jack well on January 14, 2017 (Refer to Condition 3.7 for more detail).

Two experienced and trained MMOs from LGL and a PAM operator from JASCO Applied Sciences (JASCO) implemented the Program on board the IceMAX. Visual monitoring for marine mammals and sea turtles was conducted primarily from the bridge, which is approximately 40 m above sea level and spans most of the width of the IceMAX. The MMOs also had access to the IceMAX bridgewings and catwalk. The ability to view the safety zone was also aided by a live feed video camera positioned approximately 16.5 m above the water, focused on waters aft of the IceMAX. As a result, the MMOs maintained the ability to view the entire safety zone.

The PAM configuration used the Ocean Sound Meter (OSM) system. It was operated statically from the IceMAX to monitor for vocalizing marine mammals during periods of poor visibility and during the pre-ramp-up watch. The OSM system consists of a hydrophone, cable, laptop, interface module, and customized software for real-time viewing/listening of acoustic data. JASCO’s OSM system is designed to effectively monitor underwater sounds that range from 10 Hz to 64 kHz. Therefore, the OSM system is capable of detecting low-frequency baleen whale calls and high-frequency marine
mammal vocalizations at low to moderately high frequencies. The OSM was configured in ‘multi-FFT mode’ which allows the operator to see the full recorded spectrum at the optimal resolution for detecting marine mammals in each frequency band. The ‘Normalize Across Time’ feature helped to remove the noise of the IceMAX and give the PAM operator the best chance of visually detecting marine mammal calls on the display screen. The full range of automated detectors was also running to cue the operator to possible calls.
Condition 3.9

The Proponent shall record and report the results of the Marine Mammal Observer Program to the Board within 30 days of the completion of the vertical seismic profiling survey.

Implementation:

Shell implemented the MMO Program during the VSP survey for the Monterey Jack well on January 14, 2017. During visual monitoring, there was one sighting of a single marine mammal; a probable humpback whale at a distance of 800 m from the IceMAX when the seismic source was inactive. No marine mammals were detected acoustically using PAM within the safety zones for the duration of VSP activity.

The results of the MMO Program for Monterey Jack were compiled within a final report and submitted to the CNSOPB within 30 days of the completion of the survey on February 13, 2017. The report was accepted by the CNSOPB on March 24, 2017.
Condition 3.10

The Proponent shall implement measures to prevent or reduce the risks of collisions between support vessels and marine mammals and sea turtles, including:

3.10.1 establishing a speed limit of 10 knots for support vessels when operating outside existing shipping lanes in the project area, as well as when marine mammals or sea turtles are observed or reported in the vicinity of the vessel; and

3.10.2 requiring support vessels to use established shipping lanes, where they exist.

Implementation:

Shell defined the Project Area after review of early geologic work in the Shelburne Basin, particularly the 2013 Wide Azimuth (WAZ) 3D seismic data, to delineate the most prospective parts of the basin for inclusion in the Project (as outlined in Section 2.2 of the EIS). The final Project Area includes portions of five of Shell’s six ELs and covers 7870 km², 40% of the original leasehold. This Project Area has been included on both the paper charts and/or Electronic Chart Display & Information System (ECDIS) on all Project OSVs. The requirement to reduce speed to 10 knots within the Project Area is included in the Project Marine Bridging Document and EPP and is reviewed as part of the OSV crew project onboarding. In addition, the most up-to-date version of each document is available on board each OSV.

Shell audits the entire Project OSV fleet monthly and the ECDIS and paper charts are reviewed to confirm the Project Area is noted. As part of Shell’s continuous improvement efforts, each OSV was audited for compliance with the commitments listed in the EPP including review of the Project Area on the vessel charts and ECDIS, and verbal confirmation from the Master that the speed limit is adhered to. The OSVs typically travel at 10 - 11 knots and a maximum of 12 knots, as per the OSV Master’s Standing Orders. There were no designated MMOs on board the OSVs and any sightings were made by crew members. There were no noted observations of marine mammals or sea turtles in the vicinity of the OSVs during activity for Monterey Jack.

The OSVs follow an intended route (i.e. the most direct path to the IceMAX) where possible, which incorporates existing shipping lanes, where applicable. Depending on the weather forecast for each passage, the OSV may not be able to follow the route directly. Any deviation in route is noted in a Vessel Passage Plan prior to departure.
Condition 3.11

The Proponent shall promptly report any collisions with marine mammals or sea turtles to the Board, and to the Canadian Coast Guard Environmental Emergency Reporting Number.

Implementation:

There were no collisions with marine mammals or sea turtles during the drilling of the Monterey Jack well.

As documented within the EPP and Wildlife Response Plan (WRP), Shell would contact the CNSOPB, the Canadian Coast Guard (CCG), as well as the Marine Animal Response Society (MARS) to report any collisions with marine mammals or sea turtles during the Project.
Condition 3.12

The Proponent shall monitor effects on fish and fish habitat, including marine mammals and sea turtles, to verify the accuracy of the predictions made during the environmental assessment and to evaluate the effectiveness of mitigation measures identified under conditions 3.1 to 3.11, including:

3.12.1 measuring and reporting to the Board the concentration of synthetic-based drilling fluids retained on discharged drilling cuttings as described in the Offshore Waste Treatment Guidelines to verify that the discharge meets the limits set out in the Guidelines. Concentrations in excess of the limits shall be reported within 24 hours to the Board and treatment adjusted as necessary to prevent further exceedances.

Implementation:

Shell utilized the services of MI Swaco to manage cuttings processing on board the IceMAX and to monitor the concentration of synthetic-based drilling fluids retained on discharged drilling cuttings (synthetic-on-cuttings or SOC). The concentration of SOC is measured at least once every 12 hours, as described in the OWTG. These values are used to calculate a 24-hour and 48-hour mass-averaged SOC concentration for the total daily discharge. The OWTG states that the 48-hour mass weighted average of retained SOC discharged to sea should not exceed 6.9 g/100 g oil on wet solids (6.9% SOC). As stated in the OWTG, the best available technologies and practices for cuttings management and treatment are believed to be capable of achieving a concentration of 6.9 g/100 g or less oil on wet solids. Shell is able to achieve this target using the equipment on board the IceMAX. Shell provides a daily mud compliance report summarizing the readings to the CNSOPB to monitor compliance. If an exceedance occurs, the CNSOPB is notified within 24 hours. After an investigation into each exceedance, a follow-up e-mail is sent to the CNSOPB to explain the cause and the corrective action taken to prevent recurrence. The 48-hour mass averaged SOC concentration in g/100 g is also reported to the CNSOPB monthly with notes summarizing any exceedances that occurred in the previous month.

There were no SOC exceedances during the drilling of the Monterey Jack well.
Condition 3.12.2

The Proponent shall monitor effects on fish and fish habitat, including marine mammals and sea turtles, to verify the accuracy of the predictions made during the environmental assessment and to evaluate the effectiveness of mitigation measures identified under conditions 3.1 to 3.11, including:

3.12.2 collecting sediment deposition information during and after drilling activities to verify modeling predictions and reporting to the Board, within 90 days after a well is suspended and/or abandoned;

Implementation:

In 2014, as part to the EIS process, Shell contracted RPS Applied Science Associates Inc. (RPS–ASA; Vinhaterio and Horn 2014) to conduct model simulations of drilling discharges associated with the Project within the Project Area. The objective of the modelling was to evaluate seafloor deposition and suspended sediments in the water column resulting from the operational release of mud and cuttings anticipated during offshore drilling. The model and predictions were discussed within the Project EIS (Stantec 2014).

Upon receipt of the Decision Statement in June 2015, Shell consulted with the CNSOPB to determine the best approach for collecting sediment deposition information and verifying modelling predictions. Baseline benthic habitat data collected as part of the 2014 Seabed Survey (Fugro 2014) confirmed there is limited benthic habitat or species of significance to be potentially affected by sediment deposition resulting from drilling activities at Monterey Jack. The benthic habitat at and around the well location is generally sparse and devoid of epifauna. There were no aggregations or communities of corals or sponges and none of the species observed were considered species of conservation interest (i.e., listed as endangered, threatened, or special concern under SARA or by COSEWIC). Visual surveys using an ROV were therefore agreed on, in consultation with the CNSOPB, as an appropriate and technically feasible method for characterizing the operational deposition of drill muds and cuttings on the seafloor and to verify modelling predictions made in the Project EIS.

On October 10, 2016, Shell conducted a post-riserless survey of the seafloor with the ROV along eight radial transects out to 200 m from the wellhead to assess sediment deposition “during” drilling activities. There was evidence of deposition intermittently throughout each of the transects based upon the changes in colour and texture of the seafloor. Overall, the greatest display of mud and cutting deposition was observed within 75 m from the wellhead with a dusting of darker sand uniformly throughout the entire 200 m transect in most directions. Colour was often distinguished by tracks in the sand
from epifaunal movement on the seafloor. These observations support the modelling prediction of deposition occurring within 100 m from the wellhead; however, there was no indication that deposition among the transects is elongated towards the west as the model predicted for the fall scenario.

On January 16, 2017, a post-drill survey was completed out to 200 m from the wellhead. The results indicated cumulative deposition of drilling muds and cuttings were visually detected intermittently up to 200 m from the wellhead along all eight transects surveyed. The majority of muds and cuttings were observed within the first 50 m of the wellhead. This supports the modelling predictions that cumulative deposition occurred within at least 155 m of the wellhead, although the varying thickness of this deposit from the wellhead is not known. There were however no aggregations or communities of corals or sponges, and no species of conservation interest observed. These observations confirmed the limited potential effects sediment deposition may have on marine benthic habitat or species. There was no indication that deposition is elongated towards the west as the model predicted.

All survey results are found in the final report, Shelburne Basin Venture Exploration Drilling Project: Monterey Jack E-43A Sediment Deposition Survey Report (Appendix 2).
Condition 3.12.3

The Proponent shall monitor effects on fish and fish habitat, including marine mammals and sea turtles, to verify the accuracy of the predictions made during the environmental assessment and to evaluate the effectiveness of mitigation measures identified under conditions 3.1 to 3.11, including:

3.12.3 verifying predicted underwater noise levels with field measurements during the first phase of the drilling program. The Proponent shall provide to the Board a plan on how this will be conducted at least 30 days in advance of drilling, and the monitoring results within 90 days after a well is suspended and/or abandoned.

Implementation:

Shell prepared an Acoustic Monitoring Plan for the verification of underwater noise levels predicted within the Project EIS (the Acoustic Program). Shell submitted a draft Acoustics Plan to the CNSOPB on September 17, 2015 prior to selecting a contractor and finalizing the Acoustic Program. The Acoustic Plan was resubmitted to the CNSOPB on October 21, 2015 once the contractor was in place and the Acoustic Program refined. The Acoustic Program was to have been implemented during the drilling of the first well of the first campaign, the Cheshire well. In December 2015 due to poor weather and operational constraints, Shell was not successful at implementing the Program. Shell provided a letter to the CNSOPB on December 15, 2015, proposing to defer the Acoustic Program until the drilling of the Monterey Jack well. On January 5, 2016, Shell received email correspondence from the CNSOPB with an attached letter from the CEA Agency (dated December 23, 2015) confirming that both the Agency and the CNSOPB were supportive of this proposal with the expectation that Shell will comply with the Condition for either well. On January 26, 2016, Shell submitted a letter to the CNSOPB confirming the decision to delay the Acoustic Program to the Monterey Jack exploration well.

On March 15, 2016, Shell submitted an Acoustic Plan amendment to the CNSOPB. The modification of the Plan was in effort to account for some of the constraints encountered in December 2015. This amended Acoustic Plan was accepted by the CNSOPB on March 18, 2016.

The Sound Source Characterization (SSC) was performed during the drilling of the Monterey Jack well from October 31 - November 2, 2016 to verify predicted underwater noise levels within the Project EIS with field measurements. It was completed during the drilling of the 16 1/2” drill segment when there was a prolonged period of drilling activity to monitor and suitable weather conditions.
The SSC measured the underwater sound levels from the drilling operation, inclusive of OSVs which included:

i) mechanical and vibration sound associated with machinery located on the IceMAX and OSVs, including engines, gears, pumps, and generators;

ii) sound associated with vibration and the creation of low pressure points and bubbles (i.e., cavitation) by the thrusters from the dynamic positioning (DP) system that run to position the IceMAX and OSVs; and

iii) sound associated with the drill string and drill bit (drilling activity).

The EIS predicted that the noise emitted from the operating MODU will likely be in the range of 130–190 dB re 1 µPa (peak frequency 10–10 000 Hz), and the sound would be non-impulsive. The range for the OSVs was predicted to be within 170–180 dB re 1 µPa. These ranges were derived from several general reviews of anthropogenic sound sources. The EIS compared these predicted noise ranges to received sound levels used to assess risk of potential hearing impairment to marine mammals, sea turtles and fish found in literature. Based upon these values, the EIS predicted that there would likely be no direct auditory injury on fish, marine mammals, or sea turtles (Stantec 2014).

The SSC verified that the noise emitted by the Project drilling operations, inclusive of OSV traffic, falls within the range of 130–190 dB re 1 µPa predicted within the EIS. The noise emitted from drilling operations is therefore not likely to result in auditory injury to fish, marine mammals, or sea turtles.

- As per the SSC, broadband source levels based on the Leq measured sound levels for the static Beam and Stern Autonomous Multichannel Acoustic Recorders (AMAR), which included OSV noise, were 185.8 and 187.7 dB re 1 µPa, respectively. These source levels are within the 130–190 dB re 1 µPa range of the source levels predicted for the MODU in the EIS. The range of source levels for the OSVs predicted in the EIS is 170–180 dB re 1 µPa. Although it was not possible with the SSC measurement setup to measure the individual source levels of the OSVs, the source levels for the IceMAX and OSVs combined were less than the 190 dB re 1 µPa predicted in the EIS for the MODU. The frequency band that contributed most to the broadband level was 100–1000 Hz, which is associated with thruster noise from DP operation. The next largest contributor was the 10–100 Hz band where DP noise dominated and some mechanical noise from with power generation occurred.

- The SSC determined that the noise generated by the MODU during drilling activity was negligible compared to the noise generated by the DP thrusters and machinery from of the IceMAX and the OSVs.

- The hearing impairment criterion for temporary threshold shift (TTS) for cetaceans within the EIS was 224 dB re 1 µPa. Peak sound pressure levels (SPL) were
approximated by adding 10 dB to the measured 187.7 dB re 1 µPa. The peak source level of 197.7 dB re 1 µPa was well below the 224 dB 1 µPa criterion for TTS.

- The TTS was also examined based on the sound exposure level (SEL) that a mammal would be exposed to over an entire day. The EIS outlined that the onset of TTS on cetaceans from non-impulsive noise (e.g., vessel sound) can occur from an SEL of 195 dB re 1 µPa2·s. The mammal hearing group weighting functions were applied to the broadband SEL and distances to the 195 dB re 1 µPa2·s threshold were calculated. None of the ranges exceeded the 500 m radius safety zone defined in the EIS and monitored for marine mammals during VSP activities.

All Program results are found in the final report, Shelburne Basin Venture Exploration Drilling Project: Sound Source Characterization – 2016 Field Measurements of the Stena IceMAX. The final report will be submitted to the CNSOPB within 90 days of the Monterey Jack well being suspended and/or abandoned.
Migratory Birds

Condition 4.1

The Proponent shall carry out all phases of the Designated Project in a manner that protects and avoids harming, killing or disturbing migratory birds or destroying or taking their nests or eggs. In this regard, the Proponent shall take into account Environment Canada’s Avoidance Guidelines. The Proponent’s actions in applying the Avoidance Guidelines shall be in compliance with the Migratory Birds Convention Act, 1994 and with the Species at Risk Act.

Implementation:

Shell is committed to carrying out all phases of the Project in a manner that protects and avoids harming, killing or disturbing migratory birds or destroying or taking their nests or eggs. In this regard, Shell is implementing several mitigation measures and best management practices which are aligned with Environment Canada’s Avoidance Guidelines.

Of particular relevance to the Project are the Guidelines to Avoid Disturbance to Seabird and Waterbird Colonies in Canada (Environment Canada 2016). In order to avoid or minimize adverse effects on seabird and waterbird colonies, Shell has implemented protocols for helicopter and OSV traffic.

Helicopters transiting to and from the IceMAX have followed predetermined flight paths and flown at altitudes greater than 300 m and at a lateral distance of 2 km from any known active bird colonies. Helicopters also avoided flying over Sable Island (recognizing a 2 km buffer) and Roseway Basin. OSVs travelling to and from Halifax have followed established shipping lanes, where possible, and reduced speeds to 18.5 km/hour (10 knots) within the Project Area.

Air emissions and discharges from the IceMAX and OSVs are in adherence with the OWTG and MARPOL as applicable, thereby reducing adverse effects from waste discharges on birds at sea.

In October 2015 with the commencement of Project activities, Bird Handling Guidelines were provided to personnel on board the IceMAX and OSVs. These Guidelines included instructions on how to manage and document the capture, handling, transport and release of live and dead birds that may be encountered during the Project. These guidelines were reviewed with crew on board all of the OSVs and the IceMAX, including the Maersk Nexus which was added to the Project fleet in August 2016. Shell obtained annual permits from Environment and Climate Change Canada (Canada Wildlife Service
[CWS]) under the Migratory Birds Regulations made pursuant to the Migratory Birds Convention Act, 1994 to authorize the collection of dead migratory birds and the capture, transfer and release of live migratory birds. Refer to Condition 4.4 for more detail.
Condition 4.2

The Proponent shall notify the Board at least 30 days in advance of flaring to determine whether the flaring would occur during a period of migratory bird vulnerability and how it plans to prevent harm to migratory birds.

Implementation:

There was no well testing or flaring required in the drilling of the Monterey Jack well.
Condition 4.3

The Proponent shall implement measures to prevent harm to, or killing of migratory birds such as:

- 4.3.1 restricting flaring to the minimum required to characterize the well’s hydrocarbon potential and as necessary for the safety of the operation;
- 4.3.2 minimizing flaring during night time and during periods of bird vulnerability; and
- 4.3.3 operating a water-curtain barrier during flaring.

Implementation:

The proposed mitigation measures noted above to prevent harm to, or killing of migratory birds are not applicable to the drilling of the Monterey Jack well as there was no flaring required.
Condition 4.4

The Proponent shall monitor effects on migratory birds to verify the accuracy of the predictions made during the environmental assessment and to determine the effectiveness of the mitigation measures. The Proponent shall document and submit to the Board the results of any monitoring carried out under conditions 4.1, 4.2, and 4.3. The documentation shall demonstrate whether the mitigation measures have proven effective and if additional measures are required to comply with condition 4.1.

Implementation:

The EIS included an assessment of the significance of residual environmental effects of the Project on migratory birds and concluded that residual environmental effects during routine Project activities were predicted to be not significant. Follow-up and monitoring commitments were made to quantify and determine the nature, timing and extent of potential bird mortality caused by the Project.

A significant adverse residual environmental effect on marine birds was defined in the EIS as a Project-related environmental effect that:

- causes a decline in abundance or change in distribution of marine birds within the Local Assessment Area (LAA), such that natural recruitment may not re-establish the population(s) to its original level within one generation
- jeopardizes the achievement of self-sustaining population objectives or recovery goals for listed species, or
- results in permanent and irreversible loss of critical habitat as defined in a recovery plan or an action strategy for a listed species.

The EIS predicted a change in risk of mortality or physical injury to birds related to the presence and operation of the IceMAX and OSVs. In particular, artificial lighting on the IceMAX and OSVs, and short-duration flaring during emergencies or well testing were the primary mechanisms identified as resulting in predicted changes in risk of mortality or physical injury to birds.

Mitigation measures were proposed to reduce adverse environmental effects including reduction of lighting to the extent that worker safety was not compromised, and restrictions on flaring to events required to maintain safe operations. There was no well testing or flaring involved with the drilling of the Monterey Jack well.

An Environmental Effects Monitoring program (EEM) for migratory birds was developed to verify the accuracy of EIS effects predictions and consisted of routine checks for
stranded birds on the IceMAX and OSVs to document stranding events, injuries, and mortality of migratory birds. Prior to the commencement of drilling, Shell obtained a permit from CWS to authorize the collection of dead migratory birds and the capture, transfer and release of live migratory birds. Shell developed bird handling guidelines based upon the conditions of the CWS permit, to provide personnel on the IceMAX and OSVs with instructions on how to manage and document the capture, handling, transport and release of live and dead birds that may be encountered during the Project.

Designated crew members on the IceMAX and the OSVs received training and were tasked with undertaking daily walk-throughs to search all decks and easily-accessible open areas of their respective vessels for dead, stranded or injured birds. Monitoring occurred for the duration of drilling activity at Monterey Jack until demobilization was complete, from September 22, 2016 to February 13, 2017. All birds found on each vessel were documented, including photographs whenever possible. Photos of injured and dead birds were sent to Shell’s Environmental/Regulatory onshore focal for proper identification and/or discussions with CWS. Bird handling records were compiled regularly for each vessel by the Environmental/Regulatory onshore focal.

Between September 22, 2016 and February 13, 2017, a total of 72 birds were found stranded on the IceMAX or the OSVs. The vast majority of strandings (65 records) occurred on the IceMAX. Of the 72 birds, 45 were dead or died in care, and 25 were captured alive and released. Two birds were found injured on board and sent to a rehabilitation facility in Dartmouth, Nova Scotia; i) a peregrine falcon with grease in its feathers and an injured wing, and ii) an unidentified gull with an injured wing. The peregrine falcon was the only species at risk recorded and it is SARA-listed as special concern. The peregrine falcon was rehabilitated and released.

Bird strandings occurred over the fall and winter, with at least one occurring each month. The majority of bird handling records occurred in September (21 records) and October (42 records). These two months account for 88% of all strandings that occurred during the four month period of Project activity. During this time, blackpoll warblers (34 records) and leach’s storm petrel (21 records) were the dominant species found. Together they accounted for 76% of all strandings. Both of these species are migratory, and breed in parts of Canada, including Nova Scotia and Newfoundland. During the fall, these birds migrate south to warmer areas to spend the winter. The increased number of strandings in September and October is associated with this migratory period.
As indicated above, the EIS predicted potential interactions between migratory birds and the IceMAX/OSVs, primarily based on potential attraction to artificial lighting and flaring. No flaring occurred during the drilling of the Monterey Jack well, therefore mitigation proposed to reduce effects of flaring were not required to be implemented.

Based on the results of the monitoring program, it can be confirmed that while there were adverse environmental effects on migratory birds as a result of the Project, these environmental effects did not reach thresholds established for significant adverse effects. The EIS predictions for no significant adverse environmental effects on marine birds remain valid.

Refer to Section 7.4 (Marine Birds) of the EIS and the Migratory Bird Environmental Effects Monitoring Report for the Monterey Jack E-43A well (Appendix 3) for more information on predicted and measured effects.
Aboriginal and Commercial Fishing

Condition 5.1

The Proponent shall consult with Aboriginal and commercial fishers to minimize the potential for conflicts between the Designated Project and fishing activities, including by developing and implementing a Fisheries Communications Plan to address communications prior to and during drilling, testing and abandonment of each well. The plan shall include procedures to notify fishers a minimum of two weeks prior to starting each well and to communicate with fishers in the event of an accident or malfunction that may result in adverse environmental effects and requires measures to be taken in relation to conditions 6.9 or 6.10.

Implementation:

Condition 5.1 outlines the requirement for the development and implementation of a Fisheries Communications Plan, however Shell developed two Communications Plans for potentially impacted fishers in consultation with Aboriginal groups and fisheries stakeholders between May and October 2015: a Mi’kmaq/Maliseet Fisheries Communications Plan and a Fisheries Stakeholder Communications Plan. The draft Communications Plans were discussed at meetings and also distributed electronically for comment to the CNSOPB’s Fisheries Advisory Committee (FAC), the Kwilmu’kw Mawklusuaqn Negotiation Office (KMKNO) and the Assembly of Nova Scotia Mi’kmaq Chiefs (ANSMC), Sipekne’katik First Nation, Woodstock and St. Mary’s First Nations in New Brunswick, and the former Assembly of New Brunswick First Nations Chiefs (ANBFNC).

The Communications Plans outline communications protocols to be used for both exploration wells of the first campaign, and the steps to be taken by Shell to communicate with Aboriginal groups and fisheries stakeholders before, during and at the conclusion of drilling operations; and, in the unlikely event of an emergency. Since October 11, 2015, fisheries stakeholders have received weekly operational updates via e-mail, as well as more in-depth operational updates via the CNSOPB’s quarterly FAC meetings. First Nations receive bi-weekly updates, as per their request, and, a monthly update is provided to Chiefs of the ANSMC. In addition, Aboriginal groups regularly receive updates at face-to-face meetings, as required. The Aboriginal group’s distribution list includes those First Nations in Nova Scotia and New Brunswick who identified an interest in receiving regular Project updates. The fisheries stakeholder list includes all FAC members, Notice to Shipping, Notice to Mariners, as well as many unaffiliated fishers and fishery organizations.

In addition to protocols described in the Communications Plans, Shell developed a program to ensure that the Project’s stand-by vessel, the Scotian Sea, has personnel on
board who are trained and designated to observe and report all fishing activity on a daily basis, and act as a direct contact to fishing vessels in the area. This has also allowed Shell to collect daily fishing activity data for the areas where the Cheshire and Monterey Jack wells were located from October 2015 until January 2017.
Condition 5.2

The Proponent shall prepare a well abandonment plan and consult with Aboriginal and commercial fishers on the plan if it is proposed that a wellhead be abandoned on the seafloor. The Proponent shall submit the plan, including the result of any consultation, to the Board for acceptance at least 30 days prior to each well being abandoned.

Implementation:

Shell distributed the draft Cheshire Well Abandonment Plan (WAP) for consultation to Aboriginal groups and commercial fishers in August 2015, and requested feedback and comments by October 1, 2015. Prior to distribution, Shell discussed consultation process options with Aboriginal groups, and met with the FAC in September 2015 to discuss the content of the WAP and answer any questions. The KMKNO/ANSMC, Sipekne’katik First Nation, St. Mary’s and Woodstock First Nations, and the ANBFNC received copies of the WAP. Further to this, Shell extended the deadline for feedback to November 13, 2015, and discussed well abandonment with fisheries stakeholders who attended Shell’s South Shore Engagement Sessions in late November 2015. The results of consultation on the Cheshire WAP were provided to the CNSOPB for acceptance within the 30 days allotted prior to the commencement of abandonment operations on January 13, 2016. The CNSOPB deemed the condition acceptable for closure on January 14, 2016.

Shell distributed the draft Monterey Jack WAP for feedback and comment to Aboriginal groups and commercial fishers on October 4, 2016 with a deadline of October 28, 2016. The KMKNO/ANSMC, Sipekne’katik, Millbrook, St. Mary’s, Woodstock First Nations, and the Mi’gmawe’l Tplu’taqnn Incorporated received copies of the WAP. The results of consultation on the Monterey Jack WAP were provided to the CNSOPB for acceptance on November 30, 2016 within the 30 days allotted prior to the commencement of abandonment operations. The CNSOPB deemed the condition acceptable for closure on December 1, 2016.
Condition 5.3

The Proponent shall provide the details of its operation, including the safety zone during drilling and testing, to the Marine Communications and Traffic Services for broadcasting and publishing in the Notices to Shipping, and the location of the abandoned wellheads if left on the seafloor.

Implementation:

Shell provided notification of the IceMAX move to the Monterey Jack well location (from Cheshire well location) and the commencement of drilling, including details of proposed operations, the location of the wellhead, and the exclusion safety zone in an e-mail notification to fisheries stakeholders and Aboriginal groups on September 13 and 20, 2016. Marine Communications and Traffic Services (MCTS, which includes Notice to Shipping and Notice to Mariners) are both included in the distribution list of fisheries stakeholders and Aboriginal groups that have received weekly operational updates from Shell since October 2015. A notification of well abandonment, including the location of the abandoned wellhead, was provided to MCTS, Aboriginal groups and fisheries stakeholders on January 12, 17 and 23, 2017.
Accidents and Malfunctions

Condition 6.1

The Proponent shall take all reasonable measures to prevent accidents and malfunctions that may result in adverse environmental effects and shall implement emergency response procedures and contingency plans developed in relation to the Designated Project.

Implementation:

Incident prevention and response are of critical importance to project planning as well as Shell’s commitment to safe operations.

Shell’s operational focus is centered on prevention, with the goal to put in place appropriate barriers, to prevent a potential hazard from becoming an incident through minimizing the likelihood of an incident occurring. In the unlikely event that an incident does occur, the focus shifts to response and recovery whereby appropriate measures and controls are proactively developed and implemented to mitigate the consequences of an incident.

Prior to the commencement of Project operations, Shell, along with a third party certifying authority (Det Norske Veritas [DNV]) and the CNSOPB (designated as lead agency with regulatory oversight of drilling activities in the Nova Scotia offshore area), undertook a review of the assurance process. These assurance activities evaluate whether aspects of the Project are safe, fit-for-purpose and will protect the environment (i.e., all barriers are in place to prevent an incident and all response controls are in place in order to appropriately respond to an incident).

Shell developed and implemented the following response procedures and contingency plans prior to the commencement of operations, in order to support a timely and effective response to a potential incident:
Table 3: List of Project Contingency Plans

<table>
<thead>
<tr>
<th>Plan Name</th>
<th>Plan Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venture Emergency Response Plan (ERP)</td>
<td>Outlines and summarizes the framework, resources and reference materials needed by responders to facilitate a prompt, safe, efficient and properly managed response to all incidents regardless of size or complexity. This plan provides Shell employees and contractors with immediate advice and practical guidance through the Preparedness for and Response to Emergencies.</td>
</tr>
<tr>
<td>Medical Emergency Response Plan</td>
<td>Outlines the facilities and equipment available to provide support, and defines the organization and procedures for responding to a medical emergency during the Project. Provides operational guidance and a framework for the management of medical emergencies and is one component of the ERP.</td>
</tr>
<tr>
<td>IceMAX H₂S Contingency Plan</td>
<td>Outlines escape and working arrangement scenarios to ensure Project personnel are prepared and protected in the remote chance H₂S is encountered at surface during drilling operations on the IceMAX.</td>
</tr>
<tr>
<td>Oil Spill Response Plan (OSRP)</td>
<td>Provides guidance regarding response management, capabilities and resources in the unlikely event of an oil spill release during the Project.</td>
</tr>
<tr>
<td>Wildlife Response Plan (WRP)</td>
<td>Developed to enable timely, coordinated, and effective protection, rescue, humane treatment, and rehabilitation of wildlife resources to minimize potential impacts that may result from a spill incident associated with the Project. The Plan includes general planning considerations and measures, protocols for wildlife recovery and care, specific response strategies, and key resources to guide spill response operations in providing protective measures for birds, marine mammals, turtles, and terrestrial animals.</td>
</tr>
<tr>
<td>Dispersant Preparedness and Operations Plan</td>
<td>Provides the organization, procedures, forms and guidance to prepare for and apply approved dispersants / Spill Treating Agents (STAs) to offshore surface oil slicks in order to minimize potential environmental effects and provide net environmental benefit in the unlikely event of an oil spill. This baseline plan is designed for use during an emergency and will be adjusted and updated regularly to align with incident priorities and objectives developed during incident response.</td>
</tr>
<tr>
<td><strong>Net Environmental Benefits Analysis (NEBA)</strong></td>
<td>Developed to compare the environmental benefits of potential response methods and to develop a response strategy that will reduce the impact of an oil spill on the environment.</td>
</tr>
<tr>
<td><strong>Source Control Contingency Plan / Well Containment Plan (SCCP)</strong></td>
<td>Developed to coordinate and organize an effective and efficient response to a low-probability/high consequence well control incident while managing risks. Details the technical procedures and operations involved with subsea source control in the event of a well control incident.</td>
</tr>
<tr>
<td><strong>Capping Procedure</strong></td>
<td>Developed as a guidance document to cover the mobilization, deployment and subsea installation of a capping stack in response to a well control incident.</td>
</tr>
<tr>
<td><strong>Subsea Dispersant Plan</strong></td>
<td>Provides specific and general guidance in planning subsea dispersant operations. The primary objective of the Subsea Dispersant Plan is to guide the subsea dispersant injection portion of the process for responding to and managing a subsea well blowout.</td>
</tr>
<tr>
<td><strong>Relief Well Contingency Plan</strong></td>
<td>Describes how a Relief Well would be executed in the highly unlikely event that multiple barriers of a well fail to maintain pressure control, while permeable hydrocarbon bearing zones capable of flowing are exposed, resulting in uncontrolled flow of hydrocarbons at the seabed.</td>
</tr>
</tbody>
</table>
In addition to the contingency plans listed above, Shell developed and implemented an EPP for the Project to describe the procedures, practices, resources and monitoring necessary to manage hazards and protect the environment. Shell also developed and implemented a Waste Management Plan (WMP) to detail the management processes and procedures for wastes that are generated in association with the Project and to establish protocols to handle, transport and dispose of all waste associated with the Project in an environmentally sound manner.

Project response procedures and contingency plans were reviewed and approved internally by Shell, and reviewed and accepted externally by the CNSOPB as part of the Operations Authorization-Drilling (OA-D) process for the Project. A third party verification of Oil Spill Response Organization (OSRO) response capacity was also conducted prior to the commencement of operations, which determined that the response capacity of Eastern Canada Response Corporation (ECRC) and Oil Spill Response Limited (OSRL) was appropriate to respond to an incident during the Project.

Project response procedures and contingency plans were implemented for potential use during the Project as follows:

- Plans were distributed and made readily available to all Project personnel to ensure awareness of the plans and their overall content.
- Plans were provided to the following groups and agencies for their awareness and use during an incident:
  - local First Nations;
  - the CNSOPB (the OSRP, WRP, NEBA, SCCP and EPP are posted on the CNSOPB’s website);
  - other regulatory agencies (e.g., Environment and Climate Change Canada’s National Environmental Emergencies Centre (ECCC-NEEC), DFO, CCG);
  - response organizations (ECRC, Joint Rescue Coordination Centre (JRCC), OSRL).
- Prior to drilling out the 14” casing shoe in each exploratory well until the end of drilling activities on each well, Shell conducts weekly assessments of capping stack vessel availability and monthly assessments of relief well rig availability for assurance of operational readiness for capping stack and relief well rig deployment. These assessments were submitted to the CNSOPB weekly and monthly, respectively.
- Regular reviews and updates of Project plans were conducted, as required, as part of Shell’s focus on continual improvement.
Prior to the commencement of drilling operations in 2015, Shell conducted emergency response exercises to assure that the response capabilities outlined in the procedures and contingency plans were understood and could be mobilized and deployed, as required. These include the April 23, 2015 Shell Americas Response Team Tier III (Tier III) Oil Spill Response Exercise and the October 2015 table top emergency response communications exercises.

Shell has a comprehensive oil spill response (OSR) training program to assure that the necessary competency and response capabilities outlined in Shell’s response procedures and contingency plans are ready to be implemented, as required. From September 2015 to December 2016, all crews on all OSVs completed multiple live on water Offshore Oil Spill Preparedness training sessions delivered by ECRC. The goal of each oil spill response training session is to safely develop OSV crew competency and expertise to understand and operate Tier I or Tier II Response Equipment, as per their vessel emergency response role and technical capability. The principal objective is to have each vessel crew able to safely and independently: set-up, deploy, operate and recover each piece of equipment assigned to their vessel in realistic offshore conditions, and to validate and operationalize the Oil Spill Response Plan (OSRP). Operational and procedural challenges and recommendations were also captured and incorporated into training materials, after action reviews, training summaries and Job Safety Analyses (JSAs) for wider distribution and sharing of best practices/lessons learned. In 2016, Aerial Observation of Marine Oil Spills training for flight crews was also added to the training program. This course included discussion on oil properties, fate and effects of oil, and oil spill assessment.
Condition 6.2

The Proponent shall prepare an Oil Spill Response Plan and a Well Containment Plan in accordance with the Board’s requirements and submit the Plan to the Board for acceptance at least 90 days prior to drilling.

Implementation:

Prior to the commencement of the Project and the drilling of the two wells of the first drilling campaign, an application for an OA-D was required from the CNSOPB. As part of the OA-D application process, Shell prepared an OSRP, as well as a Well Containment Plan (also referred to as the Source Control Contingency Plan [SCCP]) for the Project, which were submitted to the CNSOPB for their review and acceptance.

The OSRP was provided in first draft to the CNSOPB, CCG and ECCC-NEEC on April 7, 2015 prior to the April 23, 2015 Shell Tier III Oil Spill Response Exercise. After extensive review by the CNSOPB and subject-matter-expert peer review, the final version of the OSRP was submitted to the CNSOPB on September 22, 2015 and subsequently accepted by the CNSOPB on September 30, 2015. The final update and submission of the OSRP to the CNSOPB was on December 14, 2016 during the drilling of the Monterey Jack well. It was accepted by the CNSOPB January 11, 2017.

The SCCP was initially submitted to the CNSOPB on July 13, 2015. The final version of the plan was submitted on September 22, 2015 and subsequently accepted by the CNSOPB on September 30, 2015. The final update and submission of the SCCP was submitted to the CNSOPB on December 14, 2016 during the drilling of the Monterey Jack well. It was accepted by the CNSOPB on January 13, 2017.
Condition 6.3

The Oil Spill Response Plan shall include:

6.3.1 procedures to respond to an oil spill (e.g. oil spill containment, oil recovery);
6.3.2 measures for wildlife response, protection, and rehabilitation (e.g., collection and cleaning of marine mammals, birds, and sea turtles) and measures for shoreline protection and clean-up; and
6.3.3 procedures to notify the Board and other relevant regulatory agencies of the occurrence of any oil spill to water in accordance with applicable reporting requirements.

Implementation:

The OSRP is one component of Shell’s overall program for managing oil spill response, under the umbrella of the Emergency Response Plan (ERP). The OSRP provides guidance regarding response management, capabilities and resources in the unlikely event of an oil spill release during the Project. Additionally, the OSRP supplies Shell’s Incident Command Organization, Response Teams and Halifax Incident Management Team (IMT) with tactical and strategic response guidance, procedures and information that may be required during an oil spill response operation. The OSRP also outlines the overall process and procedures required to respond to an oil spill, and provides references to external and supporting materials (plans, processes, procedures) to be utilized during a response.

As described in Section 7 of the OSRP, a WRP has been developed and implemented to allow for timely, coordinated, and effective protection, rescue, and rehabilitation of wildlife resources to minimize any negative impacts that may result from a spill associated with the Project. The WRP is an independent document which outlines the measures to avoid and mitigate impacts on wildlife, as well as for rescue and rehabilitation of affected or injured wildlife should such measures be required. Further, Section 8.3 of the OSRP outlines the EEM program to be implemented in the event of an incident, which would provide appropriate identification and characterization of threats and potential impacts on marine resources as well as shoreline areas.

In the event of a spill, Shell will follow all required notification and reporting obligations necessitated by the incident. Section 4.3 of the OSRP describes the process to be followed for external notifications to the CNSOPB, as well as other agencies and authorities in the event of a spill in accordance with the CNSOPB Incident Reporting and Investigation Guidelines.
Condition 6.4

*The Proponent shall conduct an exercise of the Oil Spill Response Plan prior to the commencement of drilling and adjust the plan to the satisfaction of the Board to address any deficiencies identified during the exercise.*

Implementation:

Shell successfully completed a Tier III Emergency Oil Spill Response exercise on April 23, 2015 prior to the commencement of drilling of the Cheshire well. The draft OSRP was updated based on findings from the exercise and was submitted to the CNSOPB and other government agencies, including DFO and the CCG, for review. The OSRP was accepted by the CNSOPB on September 30, 2015. The OSRP was updated on December 14, 2016 during the drilling of the Monterey Jack well to account for changes to the OSVs supporting the Project and contact information.

Refer to Condition 6.1 for further detail.
Condition 6.5

The Proponent shall review the Oil Spill Response Plan and update it as required following completion of each well.

Implementation:

Shell reviews its contingency plans, including the OSRP, on an ongoing basis. Specifically, the final update to the OSRP was submitted to the CNSOPB on December 14, 2016 during the drilling of the Monterey Jack well to account for changes to the OSVs supporting the Project and contact information. The updates were accepted by the CNSOPB on January 11, 2017.
Condition 6.6

The Well Containment Plan shall include:

6.6.1  A Relief Well Contingency Plan; and
6.6.2  Well Capping Plan describing the plan to mobilize and deploy a capping stack, if required.

Implementation:

The Well Containment Plan (also referred to as the SCCP) details the technical procedures and operations involved with subsea source control in the event of a well control incident.

As part of the SCCP, a Relief Well Contingency Plan was developed for the Project. It describes how a relief well would be executed in the highly unlikely event that multiple barriers of a well fail to maintain pressure control while permeable hydrocarbon bearing zones capable of flowing are exposed, resulting in uncontrolled flow of hydrocarbons at the seabed.

As a supporting plan to the SCCP, Shell developed and implemented a Well Capping Plan (Capping Procedure) for the Project to outline the initiation, mobilization and deployment of the primary capping stack and back-up capping stack, if required. Additionally, prior to drilling out the 14” casing shoe in each exploratory well until the end of drilling activities on each well, Shell conducts weekly assessments of capping stack vessel availability and monthly assessments of relief well rig availability to inform Shell, as well as the CNSOPB, of operational readiness for capping stack and relief well rig deployment, if required.

These plans were submitted to the CNSOPB for review and acceptance as part of the OA-D application process. The SCCP and Capping Procedure were accepted by the CNSOPB on September 30, 2015 and the Relief Well Contingency Plan was accepted by the CNSOPB on September 10, 2015. The Well Capping Procedure was updated and submitted January 25, 2016. The final update and submission of the SCCP was submitted to the CNSOPB on December 14, 2016 during the drilling of the Monterey Jack well. It was accepted by the CNSOPB on January 13, 2017.
Condition 6.7

The Proponent shall undertake a Net Environmental Benefit Analysis to consider all available spill response options and identify those techniques, including the possible use of dispersants that will provide for the best opportunities to minimize environmental consequences, and provide it to the Board for review 90 days prior to drilling.

Implementation:

Shell developed a Net Environmental Benefit Analysis (NEBA) in support of the oil spill response planning for the Project. The NEBA has been developed to compare the environmental benefits of potential response methods and to develop a response strategy that will reduce the impact of an oil spill on the environment.

In the majority of spill scenarios, no single response option is likely to be completely effective. Therefore, the best approach to minimize environmental impacts is to have multiple response options available. The objective of the NEBA is to consider all available response options and identify the techniques that will provide for the best opportunities to minimize environmental consequences. Response options included for analysis are: on-water in-situ burning (ISB), on-water mechanical recovery, shoreline protection and recovery, aerial dispersant application, and subsea dispersant injection.

The NEBA analysis concluded that successful implementation of any of the available response options will result in a reduction in consequences to the considered resources of concern, when compared to the baseline condition of no active intervention. Based on the NEBA analysis, subsea dispersant injection is considered the most operationally feasible spill response option available in association with the Project, and also offers the most environmental benefit. However, as outlined within the Venture Dispersant Preparedness and Operations Plan, an approved spill treating agent (STA)/dispersant cannot be deployed in response to an incident without regulatory approval. The use of an approved STA/dispersant in response to an incident must be assessed to determine that its use is likely to result in a Net Environmental Benefit.

Shell submitted a draft version of the NEBA to the CNSOPB on December 31, 2014. The final version was submitted on June 26, 2015, and accepted by the CNSOPB on September 21, 2015.
Condition 6.8

The Proponent shall consult with Aboriginal groups during the development of the Oil Spill Response Plan, the Well Containment Plan and Net Environmental Benefit Analysis and provide the approved versions to Aboriginal groups before the start of drilling.

Implementation:

Shell has engaged with Aboriginal groups and fisheries stakeholders on all aspects of oil spill preparedness and response. Shell organized a number of Emergency Preparedness and Response workshops with fisheries stakeholders and First Nations in Nova Scotia and New Brunswick in February, April, May and June 2015. Shell provided presentations and draft copies of the OSRP, the NEBA and the SCCP (Well Containment Plan) for review and comment in April 2015 (OSRP and NEBA) and August 2015 (SCCP). Shell also held meetings with the KMKNO and representatives of the Assembly of Nova Scotia Mi’kmaq Chiefs in September 2015 to discuss emergency response options. Two designated members of the Mi’kmaq community and a fisheries stakeholder were invited to participate in Incident Command System (ICS) training, and to observe Shell’s Tier III Emergency Oil Spill Response Exercise in April 2015.

The final hard copy versions of the OSRP, NEBA and Well Containment Plan were distributed to Aboriginal groups (KMKNO, 12 Chiefs of the Assembly of Nova Scotia Mi’kmaq Chiefs, Sipekne’katik, St. Mary’s, Woodstock and Fort Folly First Nations, Assembly of New Brunswick First Nation Chiefs) via registered mail on October 21, 2015, prior to commencement of drilling. The CNSOPB confirmed that Shell was in compliance with this condition on October 29, 2015.

An updated version of the OSRP was provided to the groups outlined above on August 25, 2016. The OSRP, NEBA and SCCP are posted on the CNSOPB website.
Condition 6.9

In the event of an accident or malfunction having the potential to cause adverse environmental effects, the Proponent shall implement its Oil Spill Response Plan, including:

6.9.1 monitoring the environmental effects of oiling on components of the marine environment to be accepted by the Board until specific endpoints identified in consultation with expert government departments are achieved. As applicable, monitoring may include:

6.9.1.1 sensory testing of seafood for taint, and chemical analysis for oil concentrations and any other substances, as applicable;

6.9.1.2 measuring levels of contamination in recreational and commercial fish species with results integrated into a human health risk assessment to determine the fishing area closure status; and

6.9.1.3 monitoring for marine mammals, sea turtles, and birds with visible oiling and reporting results to the Board.

Implementation:

During the course of drilling the Monterey Jack well there were no accidents or malfunctions that required implementation of the OSRP or the WRP.

The OSRP and WRP would be implemented in the event of an accident or malfunction having the potential to cause adverse environmental effects. All response strategies proposed including monitoring the marine environment and completing measurement and testing, as appropriate, would be developed in consultation and coordination with the applicable federal regulatory agencies, Aboriginal groups, the public, other stakeholders and the CNSOPB, as lead agency.

In the event of a significant spill, fish and shellfish would be monitored in coordination with DFO, ECCC, and the Canadian Food Inspection Agency (CFIA). The duration of any monitoring activities is correlated with the severity and magnitude of the spill. Generally, the results of monitoring activities, including environmental sample results, will provide guidance on whether the monitoring effort must continue and, if so, the appropriate scale of the effort. Criteria for termination of monitoring will be developed with input from the Environmental Emergencies Science Table (Science Table) and addressed in the spill-specific EEM plan. Relevant agencies including ECCC-NEEC and DFO would support the CNSOPB via the Science Table in assessing the environmental impact and potential resources at risk, provide scientific and technical expertise, and identify priorities and end-points.
In the event of an accident or malfunction, key resources, outlined in the WRP, would be available to guide spill response operations and provide protective measures for birds (including waterfowl, seabirds, shorebirds, and raptors), marine mammals, sea turtles, and terrestrial animals. As outlined by the WRP, monitoring and observing marine mammals, sea turtles, and birds with visible oiling would be conducted by experienced personnel via vessel based and aerial surveys. All results would be recorded and reported to the CNSOPB, as required.
Condition 6.10

In the event of a sub-sea well blowout, the Proponent shall, in addition to condition 6.9, implement its Well Containment Plan and begin the immediate mobilization of primary and back-up capping stacks and associated equipment to the project area to stop the spill.

Implementation:

As a supporting plan to the SCCP, Shell developed the Capping Procedure for the Project to outline the initiation, mobilization and deployment of the primary capping stack and back-up capping stack, if required.

Shell has access to this equipment through its global response network partners and membership agreements with a number of Tier II and Tier III OSROs. Additionally, prior to drilling out the 14” casing shoe in each exploratory well until the end of drilling activities on each well, Shell conducts weekly assessments of capping stack vessel availability and monthly assessments of relief well rig availability to inform Shell and the CNSOPB of operational readiness for capping stack and relief well rig deployment, if required.
Condition 6.11

In the event of accidents and malfunctions, the Proponent shall comply with the Compensation Guidelines with Respect to Damages Relating to Offshore Petroleum Activity issued jointly by the Canada-Newfoundland and Labrador Offshore Petroleum Board and the Canada-Nova Scotia Offshore Petroleum Board.

Implementation:

During the drilling of the Monterey Jack well, there were no accidents or malfunctions resulting in damages requiring compensation, as per the Compensation Guidelines with Respect to Damages Relating to Offshore Petroleum Activity. Shell did not receive any claims for compensation.
Implementation Schedule

Condition 7.1

The Proponent shall submit an implementation schedule for conditions contained in this Decision Statement to the Board at least 30 days prior to the start of drilling. The implementation schedule shall indicate the commencement and completion dates for each activity relating to conditions set out in this Decision Statement with sufficient detail to allow the Board to plan compliance verification activities.

Implementation:

In accordance with Condition 7.1, Shell developed an implementation schedule for the Monterey Jack well. The implementation schedule identifies the notional commencement and completion dates for each activity related to the Decision Statement conditions, as well as provides sufficient detail to allow the Board to plan compliance verification activities. The timelines within the implementation schedule only considered the Monterey Jack well, and did not reflect any well that may be drilled as part of a potential second drilling campaign. The first implementation schedule for Monterey Jack was provided to the CNSOPB on February 18, 2016. The loss of riser/LMRP incident at Cheshire on March 5, 2016 delayed the commencement of drilling of the Monterey Jack well until September 26, 2016. An updated implementation schedule was submitted on August 7, 2016 to more accurately reflect drilling commencement.

The implementation schedule was structured by drilling activity phase (Pre-spud, Drilling, Abandonment/Suspension, and All Phases) for ease of tracking and implementing associated activities to demonstrate compliance. The timelines included in the schedule were based upon the best available information and knowledge at the time of each submission. Timelines were subject to change and were dependent on factors such as operational constraints and weather. Based upon these factors, Shell revised the implementation schedule three times over the four months of activity at Monterey Jack.

The final implementation schedule will be revised based upon the final Project dates: a spud date of September 26, 2016 and well abandonment on January 21, 2017. This final implementation schedule will be submitted to the Board upon submission of this CEAA Closure Report 90 days post abandonment.

The implementation schedule will be posted on the Project webpage at:
http://www.shell.ca/shelburne
and
Condition 7.2

The Proponent shall notify the Board of any changes to the implementation schedule required under condition 7.1 at least 30 days prior to implementation of the changes, if feasible, and shall not implement the changes unless accepted by the Board.

Implementation:

In accordance with Condition 7.1, Shell developed the implementation schedule for the Monterey Jack well. The implementation schedule identified the notional commencement and completion dates for each activity related to the Decision Statement conditions, as well as provided sufficient detail to allow the Board to plan compliance verification activities. The first implementation schedule was provided to the CNSOPB on February 18, 2016. The loss of riser/LMRP incident at Cheshire on March 5, 2016 delayed the commencement of drilling of the Monterey Jack well until September 26, 2016. An updated implementation schedule was submitted on August 7, 2016 to more accurately reflect drilling commencement for the Monterey Jack well and comply with Condition 7.2.

The timelines included in the implementation schedule were based upon the best available information and knowledge at the time of submission. Most of the updates made to the implementation schedule were a result of a change to the overall Project timelines due to factors such as operational constraints and weather rather than changes to any of the activities associated with each condition. Shell updated the implementation schedule as appropriate, to best reflect the actual Project timelines. Shell revised the schedule three times over the four months of activity on Monterey Jack. Each time, the revised schedule was submitted to the CNSOPB and uploaded onto the Shell Project webpage at http://www.shell.ca/shelburne and http://www.shell.ca/en_ca/about-us/projects-and-sites/deepwater-shelburne-basin-venture-exploration-project.html
Record Keeping

Condition 8.1

The Proponent shall record, retain and make available to the Board, upon request, at a facility in Nova Scotia, information related to the implementation of the conditions set out in this Decision Statement including:

8.1.1 the place, date and time of any sampling that was conducted;
8.1.2 the dates any analyses were performed;
8.1.3 the sampling and analytical techniques, methods or procedures used;
8.1.4 the names and professional certifications of the persons who collected or analyzed each sample; and
8.1.5 the results of the sampling and analyses.

Implementation:

All Project documentation related to the implementation of the conditions set out in this Decision Statement, including the specific information identified above in Condition 8.1, will be accessible in a digital format and stored on the Shell Project SharePoint site. This information can be made available to the CNSOPB upon request and discussion with Shell. The information will be available from the Shell Canada office in Calgary, Alberta.

Shell Centre: Shell Canada Limited
400 4 Ave SW,
Calgary, Alberta
T2P 0J4
Condition 8.2

The Proponent shall retain and make available upon request to the Board the information contained in condition 8.1 for a minimum of five years after completion of the Designated Project, unless otherwise specified by the Board, at a facility in Nova Scotia (or at a location within Canada and agreed upon by the Board, should the local facility no longer be maintained).

Implementation:

The Project documentation identified in Condition 8.1 including:

- the place, date and time of any sampling that was conducted;
- the dates any analyses were performed;
- the sampling and analytical techniques, methods or procedures used;
- the names and professional certifications of the persons who collected or analyzed each sample; and
- the results of the sampling and analyses,

will be retained by Shell and can be made available upon request to the CNSOPB for a minimum of 5 years after completion of the Project (until year 2022). Documentation will be accessible in a digital format and stored on the Shell Project SharePoint site. The information will be available from the Shell Canada office in Calgary, Alberta.

Shell Centre: Shell Canada Limited
400 4 Ave SW,
Calgary, Alberta
T2P 0J4
3.0 REFERENCES


## APPENDIX 1. TABLE OF REPORTS NOTED IN DECISION STATEMENT

<table>
<thead>
<tr>
<th>Deliverable</th>
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<td>Project Implementation Schedule for the Monterey Jack Well</td>
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<td>CNSOPB</td>
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<td>(Conditions 4.1 and 4.4)</td>
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<td>April 19, 2017</td>
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<td>CNSOPB</td>
<td>December 1, 2016</td>
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<tr>
<td></td>
<td>Final: June 26, 2015</td>
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<tr>
<td>Oil Spill Response Plan (OSRP), the Net Environmental Benefits Analysis (NEBA) and the Well Containment Plan (Condition 6.8)</td>
<td>October 21, 2015 (distributed final versions via registered mail)</td>
<td>Distributed to Aboriginal groups (KMKNO, 12 Chiefs of the Assembly of Nova Scotia Mi’kmaq Chiefs, Sipekne’katik, St. Mary’s, Woodstock and Fort Folly First Nations, Assembly of</td>
<td>October 29, 2015 (CNSOPB acceptance)</td>
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| Final       |                            |                          | April 20, 2017 |

Document # EP201701217075 - 78 - Unrestricted
APPENDIX 2. SEDIMENT DEPOSITION SURVEY REPORT FOR THE MONTEREY JACK E-43A WELL

Prepared for:
Shell Canada Limited
400 4th Avenue S.W.
Calgary, AB T2P 2H5

Prepared by:
Stantec Consulting Ltd.
102-40 Highfield Park Drive
Dartmouth, NS B3A 0A3

File: 121511210

Date: April 19, 2017
TABLE OF CONTENTS

1.0 INTRODUCTION .............................................................................................................. 1

2.0 SEDIMENT DEPOSITION AND MODELLING ................................................................. 2

3.0 METHODS .......................................................................................................................... 5
  3.1 RATIONALE AND APPROACH TO SURVEY METHODOLOGY ......................................... 5
  3.2 ROV PROCEDURE ........................................................................................................... 6
  3.3 PRE-DRILL SURVEY ....................................................................................................... 7
  3.4 POST-RISERLESS SURVEY ............................................................................................ 8
  3.5 POST-DRILL SURVEY ................................................................................................... 8

4.0 RESULTS .......................................................................................................................... 9
  4.1 PRE-DRILL SURVEY ....................................................................................................... 9
  4.2 POST-RISERLESS SURVEY .......................................................................................... 10
  4.3 POST-DRILL SURVEY ................................................................................................... 13

5.0 CONCLUSION .................................................................................................................. 16

6.0 CLOSURE ........................................................................................................................ 18

7.0 REFERENCES .................................................................................................................. 19

LIST OF TABLES
Table 1 Maximum extent of thickness contours ......................................................................... 4

LIST OF FIGURES
  Figure 1 Project Area ............................................................................................................ 3
  Figure 2 ROV survey transects from the well centre completed during the post-riserless and post-drill surveys at Monterey Jack E-43A. Transect lines not to scale. Yellow polygon denotes the approximate 155 m aerial extent of the predicted 10 mm deposition .......................................................................................................................... 7

LIST OF PHOTOS
  Photo 1 Typical substrate of fine sand at the proposed Monterey Jack wellsite during the pre-drill survey on September 23, 2016 .................................................................................................................. 9
  Photo 2 Rippled depositional pattern in the sand of a darker upper layer at approximately 10 m from the wellhead on the northeasterly transect .................................................................................................................. 11
  Photo 3 Uniform granular distribution of darker deposits at the 125-m mark on the easterly transect during the post-riserless survey .................................................................................................................. 12
Photo 4  Animal tracks in sand and darker depositional sediment at approximately the 175-m mark on the northwesterly transect during the post-riserless survey. A sea cucumber (Benthodytes sp.?) is also present.................................................................12

Photo 5  Darker deposits evident in impressions of lighter-coloured fine sediment approximately 125 m from the wellhead on the easterly transect during the post-drill survey.................................................................14

Photo 6  Drilling muds and/or cuttings observed at approximately the 50-m mark on the southerly transect during the post-drill survey......................................................15

Photo 7  Fine, lighter-coloured sand approximately 175 m from the wellhead on the northwesterly transect during the post-drill survey. An unidentified fish is also visible. .................................................................................................................................15
1.0 INTRODUCTION

Shell Canada Limited (Shell) conducted visual surveys of the seafloor to evaluate the deposition of discharged muds and cuttings resulting from the drilling of the Monterey Jack E-43A (Monterey Jack) exploration well. Monterey Jack was the second well drilled as part of the Shelburne Basin Venture Exploration Drilling Project (the Project). Drilling began on September 26, 2016 and the well was abandoned in accordance with regulatory requirements on January 21, 2017. The well is located approximately 270 km offshore Nova Scotia (latitude: N 42° 12' 16.485"; longitude: W 63° 37' 29.895") in approximately 2,120 m of water.

The sediment deposition surveys were completed in accordance with Condition 3.12.2 of the Decision Statement Issued under Section 54 of the Canadian Environmental Assessment Act, 2012 (CEAA) for the Project:

The Proponent shall monitor effects on fish and fish habitat, including marine mammals and sea turtles, to verify the accuracy of the predictions made during the environmental assessment and to evaluate the effectiveness of mitigation measures identified under conditions 3.1 to 3.11, including:

3.12.2 collecting sediment deposition information during and after drilling activities to verify modelling predictions and reporting to the Board, within 90 days after a well is suspended and/or abandoned.

Shell contracted Stantec Consulting Limited (Stantec) to evaluate the results of the sediment deposition surveys and verify dispersion modelling predictions made by RPS Applied Science Associates Inc. (RPS –ASA; Vinhaterio and Horn 2014). Modelling verification was also completed for the first well of the Project, Cheshire L-97A (Cheshire), located 117 km northeast from Monterey Jack (Stantec 2016).

This report was prepared for provision to the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) within 90 days of the Monterey Jack well being abandoned. The report includes:

- an overview of the model simulation of drilling discharges and predictions made in Drilling Mud and Cuttings Operational Release SBM Accidental Release (Vinhaterio and Horn 2014);
- an overview of the deposition survey methods;
- a characterization of the seafloor, particularly the surficial sediment texture and features, before, during and after drilling activities were completed to better understand sediment deposition and distribution on the seafloor attributed to the discharge of drill muds and cuttings; and
- a discussion of deposition survey results in relation to the modelling predictions.
2.0 SEDIMENT DEPOSITION AND MODELLING

Sediment deposition refers to the drill muds and cuttings discharged and deposited on the seafloor as the result of drilling the Monterey Jack well. Drilling is completed in two phases: 1) pre-riser and 2) riser drilling. Pre-riser drilling is the drilling of the top hole of the well when there is no direct drill fluid return to the drilling rig, the Stena IceMAX (IceMAX). Water based muds (WBM) are used and the resulting cuttings and muds are discharged directly on the seafloor. Riser drilling is characterized by a closed-loop system with direct drill fluid return connection to the IceMAX. Synthetic based muds (SBM) and all generated cuttings are returned to the drilling rig. The cuttings and drilled solids are either treated to 6.9% or less synthetic-on-cuttings (as per the Offshore Waste Treatment Guidelines (OWTG) (NEB et al. 2010)) prior to being discharged to the marine environment, or returned ashore for disposal if higher than 6.9%. All components of WBM and SBM used for the Project have been assessed in accordance with the Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands (NEB et al. 2009) and accepted for use and discharge in accordance with the OWTG.

The deposition of drilling muds and cuttings on the seafloor as a result of drilling activity is largely dependent on water depth and currents, as well as the volume and density of the discharged cuttings. Persistence on the seafloor is related to sediment transport and re-suspension as well as biodegradation of the base fluid. Biological effects of cuttings are dependent on the toxicity of the cuttings and the spatial extent and deposition thickness of the drill cuttings on the seafloor. Effects may be related to a combination of physical burial, drilling fluid toxicity and drilling fluid-induced sediment anoxia (IAOGP 2003).

In 2014, as part to the Project Environmental Assessment (EA) process, Shell contracted RPS-ASA to conduct model simulations of drilling discharges associated with the Project within the Project Area (Figure 1). The objective of the modelling was to evaluate seafloor deposition and suspended sediments in the water column resulting from (i) the operational release of mud and cuttings anticipated during offshore drilling, and (ii) accidental releases of SBM from the sea surface and the marine riser.

Drilling discharge simulations were completed using RPS-ASA’s MUDMAP modelling system (Spaulding et al. 1994) to predict bottom deposition of drilling mud and cuttings (Vinhaterio and Horn 2014). Modelling simulations were conducted for spring and fall season scenarios to reflect the varying oceanographic conditions in the Project Area. Currents are the main driving force for the transport and dispersion of discharged drilling muds and cuttings in the water column. Drilling releases were simulated for April to June (spring), a period characterized by relatively weak and directionally variable surface currents, and October to December (fall), a period characterized by slightly stronger currents in the upper water column. For both periods, subsurface currents (below 500 m) are consistently weak and directed west of the release site. For both scenarios, vertically and time-varied currents derived from the Hybrid Coordinate Ocean Model (HYCOM) for a representative period (2012-2013) were used as the primary environmental influence (Vinhaterio and Horn 2014).
Figure 1  Project Area and Monterey Jack well location
Simulations performed during the spring period produced a cumulative deposit that was slightly elongated along the southern axis, while during the fall scenario a similar elongation was predicted towards the west. Overall however, both scenarios resulted in concentric depositional footprints. The modelling results indicate that much of the drill cuttings deposition was confined to an area within 100 m of the release site. Modelling predicted a deposition thickness of 10 mm that extends to a maximum of 155 m in spring and covers an area of 1.89 hectares (ha). During the fall season, a deposition thickness of 10 mm extends to a maximum of 122 m and covers an area of 2.51 ha. For a deposition thickness of 100 mm or greater, the modelling predicted deposition of the drill cuttings would extend up to 30 m from the well (spring and fall scenarios) (see Table 1). Differences between the extent of deposition between seasons, however, was nominal and limited to thicknesses of 10 mm and below (Table 1; Vinhaterio and Horn 2014).

Table 1 Maximum extent of thickness contours

<table>
<thead>
<tr>
<th>Deposition Thickness (mm)</th>
<th>Maximum Extent of Thickness (m) and Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spring</td>
</tr>
<tr>
<td>0.1</td>
<td>1360 (284.7)</td>
</tr>
<tr>
<td>1</td>
<td>681 (71.2)</td>
</tr>
<tr>
<td>10</td>
<td>155 (1.89)</td>
</tr>
<tr>
<td>100</td>
<td>30 (0.26)</td>
</tr>
<tr>
<td>500</td>
<td>14 (0.06)</td>
</tr>
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</table>

Source: Vinhaterio and Horn 2014

In both seasonal scenarios, when drilling occurs in water depths greater than 1000 m, SBMs that adhere to drill cuttings and are discharged from the water surface are not likely to contribute substantially to observed deposition on the seafloor. Discharged cuttings however settle rapidly to the seafloor. By contrast, both WBM s and cuttings discharged directly at the seafloor settle relatively quickly due to the release depth, size distribution of muds, and the relatively weak currents (Vinhaterio and Horn 2014).

The model and predictions were discussed in the Project Environmental Impact Statement (EIS) (Stantec 2014) submitted to the Canadian Environmental Assessment (CEA) Agency in June 2014 and in the Cheshire Sediment Deposition Survey Report submitted to the CNSOPB in December 2016 (Stantec 2016).
3.0 METHODS

3.1 RATIONALE AND APPROACH TO SURVEY METHODOLOGY

Upon receipt of the Decision Statement and associated conditions in June 2015, Shell began consultation with the CNSOPB and offshore industry partners in Atlantic Canada to determine the best approach for collecting sediment deposition information and verifying the modelling predictions (as per Condition 3.12.2). The methods discussed below were accepted and were applied to the sediment deposition surveys conducted at the Cheshire and Monterey Jack wellsites because of similar environmental conditions and benthic habitat.

Following the submission of the Project EIS to CEAA in June 2014, Shell completed a seabed survey (Fugro 2014) to identify any potential surface or shallow subsurface hazards. The data collected from the seabed survey was utilized in combination with reprocessed three dimensional (3-D) Wide Azimuth (WAZ) seismic data to produce a geohazard assessment to satisfy the regulatory requirements of the CNSOPB for well-site clearance. A benthic habitat survey was also conducted as part of the seabed survey to obtain information about the baseline chemical composition and diversity of the benthic environment surrounding the potential drilling locations.

Data collected as part of the seabed survey included video and still photography and box cores around the proposed Monterey Jack drilling location. Camera transects were completed at the seafloor along a north/south and east/west line through the proposed well location out to approximately 250 m, where 111 photos were taken. The video and still imagery were used to confirm seabed conditions and provide information on the macro-infaunal and epifaunal benthic community assemblages.

Five (5) box cores were taken at and around the proposed Monterey Jack wellsite; one core at the well centre and a core 250 m from the centre location at the North, East, South, and West cardinal points. The box core samples were tested for biological, physical, and chemical characteristics, including benthic invertebrate identification and enumeration.

The survey results indicated that the benthic habitat at and around the proposed Monterey Jack well location is generally sparse and devoid of epifauna. There were no aggregations or communities of corals, sponges, or other benthic epifauna observed. None of the species observed were considered species of conservation interest (i.e., listed as endangered, threatened, or special concern under the Species at Risk Act (SARA) or by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC)). The results of this survey confirmed the physical condition of the seabed and the limited potential effects sediment deposition may have on marine benthic habitat or species.

The results of the 2014 seabed survey provided the information required to understand the baseline benthic habitat and general condition of the seafloor to inform and guide the
approach to meet the intent of Condition 3.12.2. Shell, in consultation with the CNSOPB, determined that visual surveys using a remotely operated vehicle (ROV) were an appropriate method for characterizing the deposition of drill muds and cuttings on the seafloor and to verify modelling predictions.

### 3.2 ROV PROCEDURE

Shell developed a procedure to systematically examine the seafloor and verify the presence and extent of deposition modelled within the area surrounding the wellhead. Underwater video and still photographs of the seafloor at and around the Monterey Jack well location were collected using a deep-sea camera, the Millennium 129, mounted on the ROV. Video and photos were obtained during each of three surveys focused on three different phases of drilling of the Monterey Jack well:

1. **the pre-drill survey** – the collection of baseline conditions;
2. **post-riserless drilling survey** – as per Condition 3.12.2, this phase of drilling captured sediment deposition information “during” drilling when drill cuttings and WBMs were released on the seafloor; and
3. **post-drill survey** – as per Condition 3.12.2, this phase represents the collection of sediment deposition information “after” drilling when treated SBM drilling muds on cuttings were discharged from near the water surface.

The spatial boundaries for the ROV surveys were selected based upon modelling predictions made regarding sediment thickness and seasonal deposition extent (Vinhaterio and Horn 2014):

1. much of the cumulative drill muds and cuttings would be confined to an area of 100 m from the wellhead. Therefore, post-riserless drilling survey extended to a minimum of 100 m from the wellhead; and
2. the differences in the extent of deposition on the seafloor between the spring and fall seasons are limited to 155 m (worse-case spring scenario). As discussed in the Project EIS (Stantec 2014), the 155 m extent also corresponds to the extent within which benthic communities could potentially be smothered (10 mm depth; Table 1).

Based upon these predictions, visual monitoring of sediment deposition for the post-riserless and post-drilling surveys was focused within 200 m of the wellhead, to be conservative. This survey extent can also be accommodated by the tether length of the ROV.

The ROV survey pattern was based on the concentric depositional footprint modelled around the wellhead (Vinhaterio and Horn 2014). Sediment deposition information was therefore collected using eight (8) radial transects positioned at approximately every 45-degree angle around the wellhead in the N, NE, E, SE, S, SW, W, and NW directions (Figure 2).
The ROV-mounted camera was aimed slightly below the horizon at an angle to provide a field of view that included the seafloor in front of the ROV along each transect. The field of view was illuminated to be able to see the seafloor. The ROV was propelled forward at a relatively slow speed at a height ranging between 1 to 2 m above the seafloor along each transect to record continuous video and take still photographs to identify the presence and spatial extent of any deposits of drilling muds and cuttings, topographic features, benthic fauna, and biological activity relative to the wellhead. The quality of the video and still photos is critical for the assessment of the presence of drill cuttings on the seafloor.

![ROV survey transects from the well centre completed during the pre-drill, post-riserless and post-drill surveys at Monterey Jack E-43A. Transect lines not to scale. Yellow polygon denotes the approximate 155 m aerial extent of the predicted 10 mm deposition (Vinhaterio and Horn 2014).](image)

3.3 PRE-DRILL SURVEY

On September 23, 2016 Shell conducted the pre-drill ROV survey of the seafloor at and around the proposed Monterey Jack wellsite to collect information about the baseline condition of the seafloor prior to initiating drilling activities. The ROV survey was comprised of eight (8) radial transects at approximately 45-degree intervals around the wellhead. Each transect extended out to 100 m in all radial directions (Figure 2). The altitude of the ROV along each transect ranged from 1 to 5 m above the seafloor. The information collected from the pre-drill survey, in addition to using information collected during the 2014 seabed survey (Fugro 2014), was
sufficient to establish baseline condition of the seafloor at and around the wellhead prior to the commencement of drilling.

3.4 POST-RISERLESS SURVEY

The post-riserless survey was conducted immediately following the drilling of the top-hole section of the well. During this pre-riser phase of drilling, all WBM and cuttings were discharged from approximately 5 m above the seafloor.

The post-riserless sediment deposition survey was conducted on October 10, 2016. Eight (8) radial transects at approximately 45-degree intervals around the wellhead were surveyed to systematically record seafloor conditions in the area immediately surrounding the Monterey Jack wellhead out to 200 m in all radial directions (Figure 2). The length of the transects was extended to 200 m based on lessons learned during the post-riserless survey completed at the Cheshire well location where evidence of deposition was observed out to 100 m of the well head (Stantec 2016). Extending the transect to 200 m was also to be consistent with transect lengths used during the post-drill survey (Section 3.5) and to allow for comparison between surveys. Each transect began at the wellhead where the drilling muds and cuttings deposit was predicted to be thickest (within 30 m). Modelling predicted much of the cumulative drill cutting deposition would be located within the first 100 m from the wellhead.

Continuous video imaging of the seafloor was completed along each transect to allow visual observation of the WBM and cuttings deposited on the seafloor. The ROV operator provided a voiceover recording for each transect, describing the direction in which the ROV was travelling as well as the distance away from the wellhead. The ROV was flown above the seafloor at a height of 1 to 2 m but occasionally disturbed the seafloor and re-suspended sediments in the water, limiting bottom visibility. At each 25-m segment along each transect, the ROV stopped to take still photographs, with a total of 128 photographs collected. The exact radial angle travelled along each transect was recorded to be able to replicate the ROV route and photos during the post-drill survey and provide visual comparison of the deposition of muds and cuttings, if present, on the seafloor.

3.5 POST-DRILL SURVEY

The post-drill survey was conducted to capture the discharge of muds and cuttings from the riser phase of drilling. During this phase, SBM and cuttings were returned to the IceMAX and those meeting OWTG treatment criteria were discharged to the seafloor from approximately 2 m below the water surface.

The post-drill survey was completed between January 16-17, 2017, three months after the post-riserless survey. Eight (8) radial transects at approximately 45-degree intervals around the wellhead were surveyed to systematically record seafloor conditions in the area immediately surrounding the Monterey Jack wellhead out to 200 m in all radial directions (Figure 2). The ROV operator again provided a voiceover recording for each transect, describing the direction in
which the ROV was travelling as well as the distance from the wellhead. Continuous video images of the seafloor were taken with still photographs captured at 25-m segments along each transect. A total of 64 still photographs were taken during the post-drill survey.

4.0 RESULTS

4.1 PRE-DRILL SURVEY

Prior to the commencement of drilling, the seafloor surrounding the wellhead appeared generally flat, with no evidence of large mounds or depressions. The seafloor was generally comprised of fine sand, generally light greyish-white in colour (Photo 1) with small craters (< 1 m) observed throughout.

Photo 1  Typical substrate of fine sand at the proposed Monterey Jack wellsite during the pre-drill survey on September 23, 2016.

The imagery obtained during the Monterey Jack pre-drill survey confirmed the results of the 2014 seabed survey (Fugro 2014). There were no aggregations of habitat-forming corals or sponges, or species at risk at or around the wellhead. The typical benthic habitat observed around the well was relatively bare and generally devoid of epifauna, with sparse solitary macrofauna scattered in the surveyed area when present. The macrofauna noted were not considered species of conservation interest under the SARA or COSEWIC.
4.2 POST-RISERLESS SURVEY

During the drilling of the pre-riser section of the well, WBM was discharged 5 m above the seafloor. The extent to which discharged sediments accumulate on the seafloor is greatly controlled by the particle settling velocities (a function of size and density) and the prevailing currents in the water column. During the post-riserless survey, the seafloor was visible from several metres above the seafloor because of low turbidity and high water clarity. Evidence of drill muds and cuttings on the seafloor included the presence of dark, denser-looking material, which would often leave irregular patterns in the sediment. As observed during the pre-drill survey, the post-riserless survey revealed the seafloor to be generally flat, with occasional small craters/depressions in the fine sand. The general characteristics of the substrate for each 200-m transect from the wellhead were as follows:

- **North** – dark deposits observed in patches within the first 75 m for the wellhead, then uniform dusting of darker deposits with animal tracks and craters observed intermittently throughout the entire transect.
- **Northeast** – dark deposits within the first 50 m from the wellhead (Photo 2). Uniform dusting of darker deposits for the remainder of the transect with some craters and impressions/animal tracks observed intermittently throughout.
- **East** – dark deposits including larger pieces that appear to be muds or cuttings observed within 25 m from the wellhead. Uniform granular distribution of darker deposits for the remainder of the transect with some craters and impressions/animal tracks observed intermittently throughout (Photo 3). The substrate does not appear homogeneous in texture as observed for the pre-drill survey.
- **Southeast** – dark deposits including what appears to be muds or cuttings observed intermittently out to approximately the 125-m mark. Uniform dusting of darker deposits for the remainder of the transect with some craters and impressions/animal tracks observed intermittently throughout.
- **South** – dark deposits including what appears to be muds or cuttings observed intermittently out to approximately the 125-m mark. The last 75 m of the transect revealed little evidence of deposition where primarily a smooth-surface and lighter coloured substrate was observed.
- **Southwest** – dark deposits including what appears to be muds or cuttings observed intermittently out to approximately the 75-m mark. Uniform dusting of darker deposits for the remainder of the transect with some craters and impressions/animal tracks observed intermittently throughout.
- **West** – dark deposits including larger pieces that appear to be muds or cuttings observed within 25 m from the wellhead. Uniform dusting of darker deposits for the remainder of the transect with some craters and impressions/animal tracks observed intermittently throughout.
- **Northwest** – dark deposits including larger pieces that appear to be muds or cuttings observed within 25 m from the wellhead. Uniform dusting of darker deposits for the remainder of the transect with some craters and impressions/animal tracks observed intermittently throughout. Accumulation of deposits observed as a darker colour in some of these tracks towards the end of the transect (Photo 4).
There was evidence of deposition intermittently throughout each of the eight transects based upon the changes in colour and texture of the seafloor. Overall, the greatest display of mud and cutting deposition was observed within 75 m from the wellhead (e.g., Photo 2) and a dusting of darker sand or uniformly distributed darker granules throughout the remainder of the 200-m transect in most directions. Towards the end of the transect, a darker colour suggesting depositional material was often distinguished in tracks in the sand from epifaunal movement on the seafloor (Photo 4). These observations support the modelling prediction of deposition occurring within 100 m from the wellhead; however, there was no indication that deposition among the transects is elongated towards the west as the model predicted for the fall scenario.

Macrofauna observed out to 200 m included common brittle stars, crinoids (feather stars), shrimps, tall sea pens (*Funiculina quadrangularis*), common sea urchins (*Echinus* sp.), unidentified chimaera fish, sea cucumber, and unidentified gadoid and other fish species. These species were consistent with the species observed during the 2014 seabed survey and the 2016 pre-drill benthic survey at the Monterey Jack well location (completed as per a separate CEAA Condition 3.5 on September 22, 2016). The presence of drilling muds and cuttings did not appear to prevent or obstruct macrofauna as they were observed on the seafloor during the survey as well as visible animal tracks were present throughout.

![Rippled depositional pattern in the sand of a darker upper layer at approximately 10 m from the wellhead on the northeasterly transect during the post-riserless survey. Occasional coarser deposits are also visible.](image-url)
Photo 3  Uniform granular distribution of darker deposits at the 125-m mark on the easterly transect during the post-riserless survey.

Photo 4  Animal tracks in sand and darker depositional sediment at approximately the 175-m mark on the northwesterly transect during the post-riserless survey. A sea cucumber (Benthodytes sp.?) is also present.
4.3 POST-DRILL SURVEY

Well sections were drilled using SBM, with treated cuttings discharged from the IceMAX, approximately 2 m below the sea surface at a continuous discharge rate. There was no bulk release of SBM. The general characteristics of the substrate for each 200 m transect from the wellhead for the post-drill survey were as follows:

- **North** – dark deposits including what appears to be muds or cuttings observed within 25 m from the wellhead with patches of dark sand intermittently deposited throughout the entire transect. Some small craters and animal tracks observed intermittently throughout entire transect.

- **Northeast** – dark deposits including what appears to be muds or cuttings observed within 50 m from the wellhead. Evidence of deposition throughout entire transect as observed by impressions from the ROV tether line or animal tracks. Starting around the 150-m mark, deposition is less obvious.

- **East** – dark deposits including what appears to be muds or cuttings observed within 50 m from the wellhead. Evidence of deposition out to approximately the 125-m mark with darker sand in between a lighter-coloured substrate (Photo 5). Small impressions and craters/animal tracks observed intermittently throughout entire transect.

- **Southeast** – dark deposits including what appears to be muds or cuttings observed within 50 m from the wellhead. For the remainder of the transect the substrate is more uniform with minimal evidence of deposition. Small craters observed throughout the entire transect.

- **South** – greatest amount of muds and cuttings deposition within 25 from the wellhead and scattered intermittently out to approximately the 150-m mark (Photo 6). Minimal disturbance or impressions throughout the last 50 m of the transect.

- **Southwest** – greatest amount of deposition within 10 m from the wellhead with muds or cuttings scattered intermittently out to approximately the 100-m mark. The last 100 m of the transect is fairly uniform with minimal evidence of deposition and little disturbance of the seafloor.

- **West** – greatest amount of deposition within 10 m from the wellhead with what appears to be muds or cuttings scattered intermittently throughout the entire transect. Craters and animal tracks were observed intermittently throughout the entire transect.

- **Northwest** – dark deposits including what appears to be muds or cuttings observed within 25 m from the wellhead. The remainder of the transect was mostly uniform with a light-coloured substrate (Photo 7), suggesting no or minimal deposition, and with small craters and impressions/animal tracks observed throughout the transect.

Analysis of the post-drill survey results indicates cumulative deposition of drilling muds and cuttings are visually detectable intermittently up to 200 m from the wellhead along all transects, with the majority observed within the first 50 m from the wellhead. This was identified in the video recordings and photographs by the presence of darker substrates and animal tracks on the seafloor intermittently throughout these transects (Photo 5). This supports the modelling predictions that cumulative deposition occurred within at least 155 m of the wellhead, although
the varying thickness of this deposit from the wellhead is not known. Although the greatest evidence of deposition was observed within 50 m from the wellhead along all transects, the modelling prediction of a depositional thickness of 100 mm or greater extending up to 30 m from the well cannot be verified. There were however no aggregations or communities of corals or sponges, and no species of conservation interest observed. These observations confirmed the limited potential effects sediment deposition may have on marine benthic habitat or species. There was also no indication that deposition is elongated towards the west as the model predicted.

Similar to the previous two surveys of the seabed for Monterey Jack, the benthic macrofauna observed during the post-drill survey include common brittle stars, unidentified chimaera fish, feather stars, tall sea pens, uncommon sea cucumbers, and other occasional unidentified fish species. These species were also identified during the 2014 seabed survey within the Project Area. The presence of deposited material on the seafloor did not appear to impact the movement of species observed, as evidenced by animal tracks in the sand.

Photo 5 Darker deposits evident in impressions of lighter-coloured fine sediment approximately 125 m from the wellhead on the easterly transect during the post-drill survey.
Drilling muds and/or cuttings observed at approximately the 50-m mark on the southerly transect during the post-drill survey.

Fine, lighter-coloured sand approximately 175 m from the wellhead on the northwesterly transect during the post-drill survey. An unidentified fish is also visible.
5.0 CONCLUSION

As per Decision Statement Condition 3.12.2, Shell collected information on the deposition of drilling muds and cuttings during and after drilling activity at the Monterey Jack well and verified modelling predictions made by Vinhaterio and Horn (2014).

Visual observation was selected, in consultation with the CNSOPB, as an appropriate method for characterizing the deposition of drill muds and cuttings on the seafloor and to verify modelling predictions. This approach was informed by the 2014 seabed survey completed around the Monterey Jack well location. The survey results indicated that the benthic habitat at and around the proposed Monterey Jack well location is generally sparse and devoid of epifauna. There were no aggregations or communities of corals, sponges, or other benthic epifauna and no species of conservation interest were observed. The results of these surveys confirmed the physical condition of the seabed and the limited potential effects sediment deposition may have on marine benthic habitat or species.

Visual information collected with an ROV during the post-riserless and post-drill surveys verified the presence of muds and cuttings deposited during the pre-riser and riser drilling phases along each of the transects. Survey results are summarized below and compared to the corresponding modelling predictions:

**Model: The majority of discharges are confined within 100 m of the wellsite**

- For both the post-riserless and post-drill surveys, evidence of sediment deposition was observed within 100 m of the wellhead but as far out as 200 m for some transects based upon the changes in colour and texture for the seafloor.

**Model: The cumulative deposit was slightly elongated towards the west during seasonal scenarios**

- In the post-riserless survey, there was a surficial layer of darker deposit present for all transect lines out to the 200-m mark, with exception for the southern transect. There was no elongation observed of the sediment deposition from the well.
- For the post-drill survey there was a surficial layer of darker deposit up to the 100 to 125-m mark in all directions except for the southeast and northwest transect lines. There was no elongation observed for the deposition of sediment to the west of the well.

**Model: Spring discharge resulting in a deposition thickness of 10 mm extends to a maximum of 155 m in spring and the deposition thickness of 10 mm extends to a maximum of 122 m in the fall**

- Sediment deposition was observed along most transects out to 200 m from the wellhead, confirming the presence of deposition within 155 m of the wellhead during both surveys. Depositional thickness of 10 mm cannot be verified however the ROV surveys confirm the
physical condition of the seabed and limited potential effect of sediment deposition on marine benthic species and habitat.

Model: **Thickness of 100 mm or greater is confined to a distance of 30 m from the well (spring and fall scenarios)**

- The greatest evidence of deposition, i.e. dark deposits including larger pieces that appear to be muds or cuttings, was observed within 75 m of the wellhead during the post-riserless survey, and 50 m from the wellhead during the post-drill survey, along most transects; however, a depositional thickness of 100 mm or greater cannot be verified. The ROV surveys confirm the benthic habitat to be sparse with limited epifauna and there were no aggregations or communities of corals, sponges, or species of conservation interest observed.

Baseline benthic habitat data collected as part of the 2014 seabed survey and the 2016 Monterey Jack pre-drill benthic survey (CEAA condition 3.5) confirmed there is limited benthic habitat or species of significance to be potentially affected by sediment deposition resulting from drilling activities at the Monterey Jack wellsite. The presence of deposited material on the seafloor did not appear to impact the presence of benthic epifauna, macrofauna and fish species, nor their movement based on their observed presence in the vicinity of the wellhead during each ROV survey, as well as observed by tracks in the sand. The distribution, species type and relative numbers did not greatly fluctuate between the 2014 seabed survey and these sediment deposition ROV surveys. No aggregations of habitat-forming corals, sponges or species at risk were observed in any of these surveys.

The results from the post-riserless and post-drill surveys conducted at the Monterey Jack wellsite were generally analogous to those observed at the Cheshire wellsite (Stantec 2016). Similarities in findings exist between the depositional surveys completed at both wellsites despite the differences in timing between drilling phases and surveys, as well as the presence of the riser on the seabed near the Cheshire wellsite. Because the transect lines were extended to 200 m from the wellsite at Monterey Jack for the post-riserless survey, compared to 100 m extension completed for the Cheshire post-riserless survey, it was possible to confirm that deposition of discharged muds and cuttings occurred beyond the 100 - m mark. A conclusive comparison of results could be made at the Monterey Jack wellsite because all eight transects were surveyed to 200 m during the post-riserless and post-drill surveys. There was an improvement in the quality of the video captured at Monterey Jack, which allowed for reliable observations of all transects around the wellhead.
6.0 CLOSURE

This report was undertaken exclusively for the purpose outlined herein and was limited to the scope and purpose specifically expressed in this report and the referenced documents. This report cannot be used or applied under any circumstances to another location or situation or for any other purpose without further evaluation of the data and related limitations. Any use of this report by a third party, or any reliance on decisions made based upon it, are the responsibility of such third parties. Stantec Consulting Ltd accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken.

This report represents the best professional judgment of Stantec Consulting Ltd personnel available at the time of its preparation. Stantec Consulting Ltd reserves the right to modify the contents of this report, in whole or in part, to reflect any new information that becomes available. If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

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7.0 REFERENCES


SHELBURNE BASIN VENTURE EXPLORATION DRILLING PROJECT

Migratory Bird Environmental Effects Monitoring Report:
Monterey Jack E-43A Well

Stantec

April 3, 2017
Table of Contents

1.0 INTRODUCTION ......................................................................................................................... 1
1.1 BACKGROUND .............................................................................................................................. 1
1.2 MONITORING PLAN OBJECTIVES ............................................................................................. 3

2.0 METHODS AND APPROACH ...................................................................................................... 3

3.0 RESULTS ..................................................................................................................................... 4

4.0 CONCLUSIONS ............................................................................................................................ 8

5.0 REFERENCES ............................................................................................................................... 9

LIST OF TABLES

Table 1 Capture and Release of Birds Between September 22, 2016 and February 13, 2017 ................................................................. 6
1.0 INTRODUCTION

Shell Canada Limited (Shell) is conducting an exploratory drilling program for the Shelburne Basin Venture Exploration Drilling Project (the Project) located within Exploration Licences (ELs) 2423, 2424, 2425, 2426, 2429 and 2430 (the Licences), approximately 270 km offshore from Halifax, Nova Scotia on the Western Scotian Slope. The drilling of the second well of the Project, the Monterey Jack E-43A well (Monterey Jack), began on September 26, 2016 and the well was abandoned on January 21, 2017.

As part of the Decision Statement conditional environmental assessment (EA) approval issued under the Canadian Environmental Assessment Act, 2012 (CEAA 2012), Shell is required to implement and report on approval conditions outlined in the Decision Statement issued under Section 54 of CEAA 2012. This report is intended to fulfill reporting requirements associated with Conditions 4.1, 4.2, 4.3 and 4.4 related to migratory birds.

1.1 BACKGROUND

The Shelburne Basin Venture Exploration Project Environmental Impact Statement (EIS) (Stantec 2014) assessed the significance of residual environmental effects of the Project on migratory birds and concluded that residual environmental effects during routine Project activities were predicted to be not significant.

A significant adverse residual environmental effect on marine birds was defined as a Project-related environmental effect that:

- causes a decline in abundance or change in distribution of marine birds within the Local Assessment Area (LAA), such that natural recruitment may not re-establish the population(s) to its original level within one generation
- jeopardizes the achievement of self-sustaining population objectives or recovery goals for listed species, or
- results in permanent and irreversible loss of critical habitat as defined in a recovery plan or an action strategy for a listed species.

The EIS predicted a change in risk of mortality or physical injury to birds related to the presence and operation of the mobile offshore drilling unit (MODU; the Stena IceMAX) and offshore support vessels (OSVs). In particular, artificial lighting on the MODU and OSVs, and short-duration flaring by the MODU during emergencies or well testing were the primary mechanisms identified as resulting in predicted changes in risk of mortality or physical injury to birds.

Mitigation measures were proposed to reduce adverse environmental effects including a reduction of lighting to the extent that worker safety was not compromised, and restrictions on
flaring to events required to maintain safe operations. No flaring occurred as part of this drilling campaign at Monterey Jack.

Although no significant adverse residual environmental effects were predicted to occur for migratory birds as a result of routine Project activities, follow-up and monitoring commitments were made to quantify and determine the nature, timing and extent of bird mortality caused by the Project (refer to Section 7.4 of the EIS).

The Decision Statement issued by the Minister of Environment under CEAA 2012 included several requirements related to mitigation for and monitoring of migratory birds as referenced below.

4.1 The Proponent shall carry out all phases of the Designated Project in a manner that protects and avoids harming, killing or disturbing migratory birds or destroying or taking their nests or eggs. In this regard, the Proponent shall take into account Environment Canada’s Avoidance Guidelines. The Proponent’s actions in applying the Avoidance Guidelines shall be in compliance with the Migratory Birds Convention Act, 1994 and with the Species at Risk Act.

4.2 The Proponent shall notify the Board at least 30 days in advance of flaring to determine whether the flaring would occur during a period of migratory bird vulnerability and how it plans to prevent harm to migratory birds.

4.3 The Proponent shall implement measures to prevent harm to, or killing of migratory birds such as:

4.3.1 restricting flaring to the minimum required to characterize the well’s hydrocarbon potential and as necessary for the safety of the operation;

4.3.2 minimizing flaring during night time and during periods of bird vulnerability; and

4.3.3 operating a water-curtain barrier during flaring.

4.4 The Proponent shall monitor effects on migratory birds to verify the accuracy of the predictions made during the environmental assessment and to determine the effectiveness of the mitigation measures. The Proponent shall document and submit to the Board the results of any monitoring carried out under conditions 4.1, 4.2, and 4.3. The documentation shall demonstrate whether the mitigation measures have proven effective and if additional measures are required to comply with condition 4.1.
1.2 MONITORING PLAN OBJECTIVES

Condition 4.1 requires the consideration of Environment Canada’s Avoidance Guidelines. Of particular relevance to the Project are the Guidelines to Avoid Disturbance to Seabird and Waterbird Colonies in Canada (Environment Canada 2016). In order to avoid or reduce adverse effects on seabird and waterbird colonies, Shell implemented protocols for helicopter and OSV traffic. Helicopters transiting to and from the IceMAX, flew at altitudes greater than 300 m and at a lateral distance of 2 km from active colonies when possible. Helicopters also avoided flying over Sable Island (recognizing a 2 km buffer) and Roseway Basin. OSVs travelling from mainland Nova Scotia followed established shipping lanes, where applicable, and reduced speeds to 18.5 km/hour (10 knots) within the Project Area.

Emissions and discharges from the IceMAX and OSVs were in adherence to the Offshore Waste Treatment Guidelines (OWTG) and the International Convention for the Prevention of Pollution from Ships (MARPOL) as applicable, thereby reducing adverse effects from waste discharges on birds at sea. Adherence to these guidelines support compliance with Condition 4.1.

There was no flaring associated with the Monterey Jack well. The implementation of the mitigations identified within Conditions 4.2 and 4.3 are therefore not applicable to the drilling of the Monterey Jack well and are not addressed within this monitoring program.

This monitoring program for migratory birds was developed primarily to fulfill Condition 4.4 and verify the accuracy of EIS effects predictions. It consisted of routine checks for stranded birds on the IceMAX and OSVs to document stranding events, injuries, and mortality of migratory birds.

2.0 METHODS AND APPROACH

Prior to the commencement of drilling, Shell obtained a permit from Environment and Climate Change Canada (Canada Wildlife Service [CWS]) under the Migratory Birds Regulations made pursuant to the Migratory Birds Convention Act, 1994 to authorize the collection of dead migratory birds and the capture, transfer and release of live migratory birds. Shell developed Bird Handling Guidelines to provide personnel on board the IceMAX and OSVs with instructions on how to manage and document the capture, handling, transport, and release of live and dead birds that may be encountered during the Project, as per the conditions of the CWS permit.

Designated crew members on the IceMAX and the OSVs received training on the Bird Handling Guidelines and were tasked with undertaking daily walk-throughs to search all decks and easily-accessible open areas of their respective vessels for dead, stranded or injured birds.

Monitoring occurred over the extent of Project activities for each vessel, from September 22, 2016 to February 13, 2017. All birds found injured, stranded or dead on each vessel were documented, and photographed whenever possible. Photos of injured and dead birds were sent to Shell’s Environmental/Regulatory onshore representative for proper identification and/or
discussions with CWS. Records were compiled regularly from the IceMAX and each OSV and reported to CWS, as required.

3.0 RESULTS

The following section presents the results of the monitoring program that was implemented for the Monterey Jack Well in order to fulfill Condition 4.4.

Exploratory drilling of the Monterey Jack well commenced September 26, 2016 to January 21, 2017. The IceMAX and three OSVs (Scotian Sea, Skandi Flora and Maersk Nexus) were engaged for the entirety of the Project. A fourth OSV, the Breaux Tide, was active until November 18, 2016. Monitoring for birds occurred between September 22 to February 13, 2017, vessel dependent.

A total of 72 birds were found stranded onboard the IceMAX or OSVs (Table 1). Of these, 45 individuals were found dead, of which 29 were disposed of at sea and 16 were shipped to CWS. Another 25 individuals were captured alive and released, and two individuals were found injured and were sent to shore for rehabilitation. Almost all strandings occurred on the IceMAX. Seven strandings were recorded on the Skandi Flora, and no strandings occurred on any of the other OSVs.

In addition to birds, there were also three occurrences of bat strandings on the IceMAX. All three records were of silver haired bats (Lasionycteris noctivagans), and it is possible that these records may have been of the same bat. Two records indicated that an individual was found alive and released, and one record indicated that the bat was found dead and disposed of at sea. All records occurred between October 23 and November 27, which corresponds with the migration period of silver haired bats. Shell contacted CWS regarding the bat and provided photos and location information for their records.

A total of 10 bird species were identified. However, obtaining a positive species identification on dead birds was not always possible given that some birds were found in poor condition. Two individuals could not be identified to species for this reason, including an unidentified gull and an unidentified warbler. Of the birds that were identified, two species made up the vast majority of all strandings: blackpoll warbler (Setophaga striata) and Leach’s storm petrel (Oceanodroma leucorhoa). These species accounted for 34 and 21 individuals, respectively, and together accounting for 76% of all strandings. Other species encountered included dovekies (Alle alle) (7 individuals) and red phalaropes (Phalaropus fulicarius) (2 individuals). One individual of each of the following species was also recorded: belted kingfisher (Megaceryle alcyon), black-throated green warbler (Setophaga virens), glaucous gull (Larus hyperboreus), lesser black-backed gull (Larus fuscus), peregrine falcon (Falco peregrinus), and Wilson’s snipe (Gallinago delicata).

One species at risk (SAR) was recorded: a peregrine falcon was found on the IceMAX on October 11, 2016. Peregrine falcons are listed as special concern under the Species at Risk Act (SARA), and as vulnerable under the Nova Scotia Endangered Species Act (NS ESA). This bird
was found alive, but had an injured wing and grease in its feathers. The source of this grease is unknown. The peregrine falcon was captured and placed in a box to rest. It was immediately sent to shore, where it was taken for treatment at the Hope for Wildlife facility in Dartmouth, Nova Scotia. The bird was later released.

Only one other bird was sent to shore for treatment during the drilling of the Monterey Jack well; an unidentified gull with an injured wing was found on the IceMAX on October 30, 2016. This bird was captured, placed in a box and sent to shore, where it was sent to Hope for Wildlife for treatment. The final status of the bird is unknown.

The majority of bird strandings occurred in September (21 records) and October (42 records). These two months account for 88% of all strandings that occurred during the four month period of Project activity. During this time, blackpoll warblers (34 records) and leach’s storm petrel (21 records) were the dominant species. Both of these species are migratory, and breed in parts of Canada, including Nova Scotia and Newfoundland. During the fall, these birds migrate south to warmer areas to spend the winter. The increased number of strandings in September and October is associated with this migratory period.

There was only one stranding per month in November and December 2016, and seven strandings in January 2017. All records of strandings that occurred in January were of dovekies. Dovekies breed in the high arctic. As the ice forms in the fall and winter, they move south to remain in open water. For this reason, they are likely to arrive at the Scotian Shelf around January, which accounts for the increase in strandings during this time.
Table 1  Capture and Release of Birds Between September 22, 2016 and February 13, 2017

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**NOTES:**
- *Species-at-risk*
- DOAS – Disposed of at sea
- DIC – Died in care
- Rls’d – Released
- SFR – Sent for rehabilitation
4.0 CONCLUSIONS

The monitoring and reporting of bird strandings fulfills Conditions 4.1, 4.2, 4.3 and 4.4 of the Project Decision Statement. Several mitigation measures and best management practices were implemented in accordance with Environment Canada’s Guidelines to Avoid Disturbance to Seabird and Waterbird Colonies in Canada (Environment Canada 2016) thereby fulfilling Condition 4.1. No flaring occurred in association with the Project; therefore, Conditions 4.2 and 4.3 were not applicable. As required under Condition 4.4, this report describes the bird monitoring activity carried out throughout the Project and the results.

Bird monitoring on the IceMAX and OSVs identified 72 stranded birds, of which 45 were found dead (approximately 63%), 25 were found alive and were released (approximately 35%), and two were found injured and were sent for rehabilitation (approximately 3%). Species composition varied seasonally. The most abundant species were leach’s storm-petrel and blackpoll warblers, which were recorded in September and October, 2016. Dovekies were observed in lesser numbers and were only encountered in January, 2017. One SAR, a peregrine falcon, was found injured on October 11, 2016. This individual was immediately sent to shore and taken to Hope for Wildlife for treatment, rehabilitation, and release.

Mitigation measures that were implemented to reduce Project effects on migratory birds included the reduction of lighting on the IceMAX and ROVs to the extent that worker safety was not compromised, routine checks for stranded birds, and maintaining defined distances from bird colonies, Sable Island and Roseway Basin when transiting in helicopters. Based on monitoring results and the significance criteria established in the EIS, it can be confirmed that there were no significant adverse environmental effects on migratory birds as a result of the Project.
5.0 REFERENCES

