The International Environmental, Social and Health Impact Assessment (iESHIA) for 2018 4D Seismic Surveys

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1 Executive Summary

1.1 Background

Seismic surveys are planned by Sakhalin Energy Investment Company (Sakhalin Energy) in 2018. These will be four-dimensional (4D) geophysical surveys for the three fields comprising the Sakhalin-II oil and gas project licence area. The fields are Piltun, Astokh and Lunskoye and are located off the north-east coast of Sakhalin Island, Russia. The Piltun and Astokh fields lie within 15km of the near-shore, seasonal feeding area of the protected gray whale *Eschrichtius robustus.* The Lunskoye field lies approximately 40km south of the gray whales' offshore feeding area. This group of gray whales, returning to Sakhalin each year, is deemed by the International Union for Conservation of Nature's (IUCN) Red List of Threatened Species, to comprise Critically Endangered Western Gray Whales. Consequently, they are accorded higher levels of protection through national regulations and international standards. Although managing risk to the gray whales from the project activities is the primary focus of this document, it addresses also the protection of other marine mammals and the wider environmental, health, safety and social aspects of the Company's seismic surveys. The Company manages its activities within the context of the International Finance Corporation's Performance Standards 2012 and, as part of the covenanted agreement with the Lenders, the Health, Safety, Environment and Social Action Plan.

1.2 Project Description

1.2.1 Start of Surveys

The surveys will begin in June 2018, immediately after ice retreat, and for Piltun and Astokh will consist of a streamer acquisition phase resembling the 2015 survey, plus an Ocean Bottom Node (OBN) phase to cover data-gap patches. The Lunskoye survey is to be achieved solely through the deployment of OBN.

1.2.2 Survey Objectives

For the Piltun-Astokh area (P-A) 350Km^2, the objectives are to continue with production monitoring and to start reservoir behaviour monitoring in the data gaps around the two platforms (25km^2 per platform gap). These objectives led to the selection of a combined streamer and Ocean Bottom Node survey, using a design maximising the chance of successful backwards 4D compatibility with the 1997/2015 streamer surveys. The survey duration must fit within six to seven weeks (bounded by ice-retreat in mid-June and peak gray whale season in Piltun Bay area in early August).

For Lunskoye (LUN), the key aims of the OBN survey are to image through a gas cloud obscuring the crestal (uppermost) part of the field (approximately 115 km^2) and to establish an adequate 4D baseline for post-2018 field monitoring. It is recognised that the use of OBN puts comparability with the 1997/2015 streamer surveys at risk, but that risk is considered as acceptable by the Company. A secondary objective is the provision of a second 4D monitor survey (185km^2). Generally, OBN timing is: P-A is in July; LUN following in Aug - mid-Sep.

1.3 Legal Context for the Seismic Survey Activities

1.3.1 NOTE: Regarding the Denial of Permit, updated Monitoring and Mitigation Plan and Acoustic Modelling

The present Monitoring and Mitigation Plan (MMP) updates the 2018 MMP (produced within the WGWAP/Noise Task Force processes) in response to the notification of Permit Denial, in late March 2018, by the Russian authorities in respect to the deployment of the devices for underwater acoustic monitoring by Sakhalin Energy's contractors for the 2018 seismic survey. Real time monitoring of the underwater acoustics during the survey is an important method by which seismic noise can be managed to reduce the risk of harm to marine mammals and other creatures. No explanation for the denial of permit was offered by the Russian authorities and it was interpreted by the Company as final: not subject to negotiation or appeal. The Panel issued a statement stressing the importance of acoustic monitoring to the MMP and recommended that Sakhalin Energy and IUCN seek a solution to allow for even some underwater acoustic monitoring to take place during the 2018 seismic survey. The Company agreed with the importance of underwater acoustic monitoring but informed the Panel that neither it nor its Contractors had, at that time, any formal lines of communication for attempting to achieve the recommendation.

After further discussions and a presentation to the Panel, the Company released a response to the Panel's statement confirming that it would not be able to implement the planned underwater acoustic monitoring and proposing an approach by its acoustical consulting services provider, JASCO, to compensate for lack of field corroboration through adjustments to the modelling based on newly available data and a detailed analysis of the error bounds. That approach, which is now incorporated into the updated MMP, bounds as much as possible the uncertainty in the modelling estimates and applies a precautionary adjustment to minimize the risk of exposure for the whales. The Panel Co-chairs issued an immediate reply, providing their own interpretation of the circumstances plus their views on how the situation should be handled thenceforth. They were sympathetic to the position in which the Company was placed and recognised the good faith in which each party involved had attempted to resolve the situation. They acknowledged that the Denial of Permit would not be overturned and that underwater acoustic monitoring would not be carried out by the Company in 2018. Although they welcomed the precautionary adjustments made by JASCO and the Company to the modelled estimates, they noted that the effectiveness of the approach could not be confirmed without measurements in the field. The Co-chairs pointed out that for the 2018 seismic survey to go ahead without underwater acoustic monitoring all other elements of the agreed MMP should be implemented in full and that the situation should not set a precedent for future seismic surveys. Sakhalin Energy appreciates and accepts the points made by the Panel's Co-chairs. The Company agrees that the absence of underwater acoustic monitoring in the 2018 seismic survey does not set a precedent for successive ones. Learning from this unprecedented experience, it will work in future cases with the contracted scientists to engage jointly with the permitting authorities as early as possible to avoid any possibility of a repeat.

1.3.2 Environmental, Health, Safety and Social Legal Requirements

In accordance with the Production Sharing Agreement and the adopted project financing procedure, the Project is being developed in compliance with the following environmental and social legal requirements:

- Russian national laws, regulations and standards
- Regional laws, regulations and standards of the Sakhalin Oblast
- International treaties, conventions and agreements ratified by Russia
- Sakhalin Energy's and Shell's internal environmental, health and social policies and regulations
- Standards and requirements of potential lenders and insurers, which typically include:
    - The Equator Principles III (June 2013)
    - The International Finance Corporation's Policy on Environmental and Social Sustainability:
        - The IFC Environmental and Social Performance Standards (1 January 2012)
        - The IFC Environmental, Health and Safety General Guidelines (30 April 2007)
        - IFC EHS Guidelines. Onshore Oil and Gas Development, (April 2007)

Sakhalin Energy complies with the Russian Federation Environmental Impact Assessment process (through the OVOS, provided by the Seismic Survey contractor in this instance) and submits its documentation for State Environmental Expert Review (SEER). SEER approval was granted to the company for the surveys on 8th June 2018 (SEER positive conclusion was prepared and signed; Russian Federation Ministry of Natural Resources and Ecology issued approval Order #195, 08 June 2018).

1.3.3 Statutory Public Hearings and Community Consultations

Public hearings for this seismic campaign were held on 17th and 18th January 2018 in the settlements closest to the survey areas most likely to have stakeholders at risk of impact: Nogliki and Okha. Relevant notifications about the hearings and materials publications (including OVOS) were made in 2017 as per Russian Federation requirements. In addition to the more general announcements, Indigenous Peoples' representatives of Nogliki and Okha Districts were invited to participate in the public hearings. No concerns or issues in regard to the survey were raised by participants at either meeting.

1.4 Impacts Assessment Methodology

Starting in the scoping phase and refined throughout the ESHIA process, specific aspects of the Project are identified that may give rise to impacts: positive or negative. Impact definition is iterative throughout the ESHIA process and generally entails developing a description of the aspect, pathway and receptor which comprise the impact, as outlined below:

Aspect is the mechanism by which Project activities may cause impacts (examples of those in this Seismic Survey, in the context of gray whales, would be **seismic source noise** and **vessel activities**)

Receptor is a person, natural ecosystem, structure, flora/fauna species or infrastructure system that experiences the impact (in this case, the prime example *inter alia* for this Project would be **gray whales**)

Pathway is the mechanism by which the aspect affects the receptor (in this case, for example, the **marine environment** especially the **acoustic qualities of sea water** and **proximity to the source**)

Impacts are defined where there is a plausible pathway between the Project aspects and receptors. The aspects, pathways and receptors are identified based on:

- previous environmental or social studies
- review of the evolving Project description to identify aspects
- consideration of the area of influence to determine pathways and receptors
- experience of the ESHIA and Project specialists
- consideration of issues raised by stakeholders
- findings of baseline investigations as they become available

1.4.1 Key Environmental Impact Issues Identification

The key environmental impact issues for this assessment have been identified from previous seismic survey ESHIAs in 2012 and 2015 (as recommended by WGWAP) as:

- Disturbance and injury to marine mammals (with additional conditions for gray whales)
- Disturbance to marine and migratory fish and fisheries
- Effluent discharge, emissions and waste disposal
- Accidental spills, leaks and dropped objects
- Interaction with other users of the area

1.5 Baseline Assessment of gray whales

The latest assessment by IUCN (up to and including the 2016 season) reveals that there are estimated to be 175 to 192 predominantly Sakhalin-feeding whales. No attempt is made to estimate the total number of calves born each year because an unknown fraction does not survive the journey to the Sakhalin feeding grounds. Photo identification studies and satellite tagging have revealed many examples of repeat, annual visits by individual whales back to Sakhalin. In north-eastern Sakhalin, data collection is focussed on gray whales. However, due largely to the lack or absence of settlements, official fisheries and the large distance from main population centres there is a paucity of data or information regarding the marine/commercial fishes, fisheries, zooplankton or human inhabitants. Examination of environmental data for those areas revealed information from directly around oil and gas platforms but none from outwith those limited areas. In addition, data collection around the platforms is aimed primarily at compliance with regulations and standards.

1.5.1 Impacts

1.5.1.1 Marine Mammals

Marine mammals rely heavily on the use of underwater sound to communicate and to gain information about their environment. Experiments have shown that they hear, react to, and can have their hearing affected by anthropogenic sounds of many kinds. Underwater noise thus has the potential to interfere with the ability to communicate, find food and avoid harm (e.g. predation, vessel strike); noise can affect the animals' distribution, abundance, behaviour and general well-being. Potential impacts of noise exposure which have been most commonly considered from an environmental compliance perspective are:

- Temporary or permanent hearing threshold shifts (TTS and PTS respectively), whereby the animal is impaired by losing hearing sensitivity following noise exposure or for a period of time during which it recovers or indefinitely. Permanent hearing loss constitutes direct physical injury
- Behavioural modification, such as deflection from a migration path, disruption of mother-calf bonds, avoidance of an area, changes in orientation, changes in respiration rates and interrupted feeding

The full lists of Issues and Impacts are presented in Tables A and B below.

Issue	Impact	Unmitigated Impact	Mitigated Impact
Disturbance and Injury to Marine Mammals			
The effects of noise and physical presence of survey vessels	TTS, PTS and non-auditory physiological effects on all cetaceans and pinnipeds	Moderate	Minor
	Disturbance and short-range avoidance movements in non-endangered baleen whales	Moderate	Minor
	Disturbance and short-range avoidance movements in odontocetes and pinnipeds	Moderate	Minor
	Disturbance and short-range avoidance movements in North Pacific right whales	Moderate	Minor
	Disturbance, short-range avoidance movements and reduced feeding opportunities, possible loss of breeding potential, reduced growth, reduced survival in Gray Whales	Moderate	Minor
	To marine mammals from collisions/entanglement with vessels and deployed equipment	Minor	Negligible
Disturbance and Injury to Fishes			
The effects of noise and physical presence of survey vessels	Injury and fatality from underwater airgun noise	Minor	Minor
	Sea water intake causing entrainment	Negligible	Negligible
	Spawning disturbance or damage to eggs	Minor	Minor
	Behavioural disturbance e.g., dispersal of fish shoals	Minor	Minor
Effluent Discharge, Emissions, and Waste Disposal			
Effluent discharge	Impacts on water quality and marine biota from cooling water and deck-surface runoff (e.g., sea spray and rain water)	None	None
	Impacts on water quality and marine biota from non-accidental release of drainage and sanitary waste water discharges; chlorinated water discharge	Negligible	None
Emissions from combustion & incinerators	Reduction in local air quality	Negligible	Negligible
	Contribution to regional and global atmospheric pollution	Negligible	Negligible
Solid and hazardous waste	Impacts on water quality and marine biota (toxicological effects)	None	None

Table A. Comparisons between unmitigated and mitigated impacts

Issue	Impact	Unmitigated Impact	Mitigated Impact
Accidental Spills, Leaks and Dropped Objects			
Spills and leaks	Small release of harmful substances (e.g., wastes, oil, lubricants, streamer fluid) resulting in a decrease in water quality and impact on marine organisms	Negligible	Negligible
	Large release of harmful substances (e.g., wastes, oil, fuel) resulting in a decrease in water quality and impact on marine organisms	Moderate	Minor
Dropped objects	Loss of small objects/equipment	Negligible	Negligible
	Loss of large objects and cargo causing pollution, impact on marine organisms, and obstruction to other vessels	Moderate	Minor
Interaction with Other Users of the Area			
Vessel and equipment interference Use of local resources	Potential for collision or other accident with other vessels, equipment and concomitant injury, loss of human life, vessel damage, loss of property	Minor	Negligible
	Temporary interference with commercial fishing/damage to fishing equipment	Minor	Negligible
	Interference with military use of the area (irony alert)	None	None
	Damage to marine archaeology and cultural heritage	Negligible	Negligible
	Hunting of marine mammals	Negligible	Negligible
	Effects on the local social environment and economy	Negligible	Negligible
	Disturbance or damage to cables and other submarine infrastructure	Negligible	Negligible
	Disturbance to natural resources e.g. regularly hunted animal species	Negligible	Negligible
	Effect on fisheries quotas	Negligible	None

Table B. Comparisons between unmitigated and mitigated impacts (continued)

1.6 Mitigation and Monitoring

Mitigation, monitoring and management of risks to *inter alia* marine mammals from Sakhalin Energy's seismic survey activities are managed through the:

- Health, Safety, Environment and Social Action Plan (HSESAP)
- Updated 2018 Seismic Survey Monitoring and Mitigation Plan (MMP) with SEER conclusion for exclusion distances
- 2018 Marine Mammal Protection Plan (MMPP)
- 2018 Marine Mammal Observer (MMO) Onshore and Offshore Manuals
- 2018 Update of the Maritime HSE Standard.

To promote transparency and good communications, the whole survey is overseen by an Independent Observer recruited by IUCN on behalf of the WGWAP. The Independent Observer will be based at Seismic Survey Command Centre with the Seismic Survey Central Commander. Further, an Advisory Group of WGWAP Noise Task Force Members has been established for the 2018 Seismic Survey. The primary purpose of the Group is to be available to provide advice at short notice to the Company, if, for example, circumstances lead the Company to consider modifying its MMP during the survey. The Independent Observer may also seek formal advice from the Advisory Group should he/she so wish.

1.6.1 Mitigation Principles

The fundamental mitigation principles established originally in the 2010 MMP remain:

(1) Design ahead of the survey to:

(a) Minimise the area surveyed

(b) Minimise the sound levels reaching the areas of highest expected whale density based on previous experience

(2) Take measures during the survey to:

(a) Carry out the survey as early in the season as possible, i.e. when fewest whales are expected to be present

(b) Stop the survey when necessary to protect the marine mammals that are present

1.6.2 General design and conduct of survey

The most stringent mitigation measures in relation to whales (other than those observed in the exclusion zone around the seismic vessel) should be applied in the A-zone. The monitoring measures defined within the MMP must be in place and operational for the acquisition of lines.

1.6.2.1 Definition of A-zones (2018 JASCO Precautionary Model)

(1) The area for which the additional mitigation measures are in effect (A-zone) is defined by the overlap of the region inshore of the PML and the area bounded by the 156 dB per-pulse SEL isopleth for the current acquisition point.

(2) The 156 dB per-pulse SEL isopleth will be estimated through numerical modelling of the airgun array acoustic output and the propagation of underwater sound. The numerical models for source levels and propagation have been validated over several previous years of operations and most recently during the monitoring of the 2015 seismic survey, for which many comparison data points are available between pulse levels measured along the PML and their model estimated values. For the 2018 season, improvements have been made to the modelling software and/or its parametrization that intrinsically yield more realistically accurate estimates:

- The bathymetry dataset has been improved from the one used in 2015 pre-field and earlier modelling: additional depth logs from Pacific Oceanological Institute were standardized and incorporated into the earlier bathymetry to improve resolution.
- A more advanced version of the AASM airgun array source model, calibrated against a newly available collection of airgun measurement results, was introduced; this produces slightly increased source levels compared to the estimates for the same source used in 2015 and earlier.

(3) In the absence of acoustic monitoring data at the PML that would allow an adaptive offset to be applied to the model output to reduce the discrepancy between estimates and measurement, a fixed precautionary adjustment of the model output will be applied to ensure that the statistical distribution of the error (expressed as the difference between actual levels and estimated levels) bounds the occurrence of positive values, i.e. underestimation of true levels by the model, to an adequately small percentile. An error analysis based on the comparison of the estimates from the improved modelling for 2018 and the pulse levels measured at the PML during the entire 2015 seismic survey, for all pulses having measured levels above 154 dB per-pulse SEL to focus the analysis on a behaviourally relevant subset, showed the model results to be predominantly conservative (overestimating the measurements), with a residual incidence of 4% of the pulse levels being underestimated by 3dB or more. By adding a fixed precautionary adjustment of +2dB to the model results, the incidence is reduced to 1% of the pulse levels at the PML being underestimated by 2dB or more. This was considered an adequate bound in balancing the opposite risk of excessive overestimation resulting in unnecessary prolonging of the seismic survey.

(4) The precautionarily adjusted model will be used to generate the estimated 156 dB per-pulse SEL isopleth at each acquisition point as well as its envelope for the complete line. Based on the model predictions, shot line segments for which an overlap is predicted between the 156 dB per-pulse SEL contour and the PML will be classified as A-segments, for which the additional mitigation measures specified below apply.

1.6.2.2 Measures near the seismic vessel – entire survey

(1) After more than 20 minutes of inactive source, ramp-up procedures will be followed such that the individual air guns will be activated in a progressively larger combination over a

period of 20 minutes (6 dB increments every 5 minutes). Ramp-up to full operational power should be achieved as close to the start of the line as possible.

(2) The Senior MMO will initiate source shutdown if a gray whale is observed within the exclusion zone of the source decreed by SEER Conclusion 8th June 2018 as not less than 1000 metres (Table D).

(3) The Senior MMO will initiate a precautionary shutdown if a gray whale is observed to be on a course that will result in its entering the exclusion zone.

(4) Various types of field-tested remote-sensing (non-acoustic) equipment may be installed onboard the seismic vessel to assist in detecting marine mammals at night and/or during periods of poor visibility, recognising that there is no technology that works in fog or heavy rain. The use of such equipment will not be regarded as fully compensatory for the lack of visual monitoring, but instead as uncontrolled field experimentation. This caveat remains until such time as the technology has been proven to be at least as efficient at detecting whales as visual monitoring by experienced MMOs.

Table D. SEER 2018 Seismic Survey Exclusion Distances

Status IUCN/МСОП	Status Red Book RF/ Красная книга РФ	Species	Distance
Whales/Китообразные			
Critically endangered	1st Category	Gray Whale/Серый кит	1000m
Endangered	1st Category	Bowhead Whale/Полярный кит	
Endangered	1st Category	Northern Right whale/Южный (Японский) гладкий кит	
Endangered	2nd Category	Fin Whale/Финвал	
Vulnerable	3rd Category	Curvier's Beaked whale/Клюворылый дельфин Кюрвье	
No	No	Other whales and dolphins/прочие киты и дельфины	1000m
Seals/Ластоногие			
Endangered	2nd Category	Sea Lion	350m

1.6.2.3 Additional considerations for the A-zone

A considered trade-off is required between preventing the disturbance of a smaller number of animals expected to be present early in the season and preventing the disturbance of a larger number of whales expected to be present later in the season if operations are still ongoing due to temporary stoppages early in the season. The following conditions will apply in 2018[1].

(1) For the streamer part of the survey, all reasonable attempts will be made to acquire the A-line segments positioned closest to shore repeating the 2015 acquisition

[1] While the decision has been made to suspend operations only if mother-calf pairs are sighted in the A-zone for this 2018 MMP, this condition is not necessarily to be assumed for future MMPs (or to exclude potential measures to protect other critical segments of the population e.g. pregnant females).

direction during daylight hours in ‘good visibility’, i.e., the PML must be within the effective sighting range of a shore station or a vessel-based ‘distant’ monitoring team. If a choice is to be made between postponement (e.g., by two weeks needed to get a feather match between the line to be acquired and the baseline survey) and acquiring the line or segment at night or in poor visibility conditions as defined in Annex D of the MMP, then that choice is made by the Central Commander on the day, after considering all available information. If acquisition is planned to take place at night, then a pre-dusk scan must take place and confirm that no mother-calf pairs are present in the A-zone.

a. No acquisition will occur if mother-calf pairs are observed (with a 100m radius buffer around geo-referenced positions) in the A-zone. When a mother-calf pair is observed in the A-zone, ongoing acquisition (if any) will be suspended. No acquisition will commence or resume until either (a) the mother-calf pair are outside the A-zone, or (b) at least 3 hours have passed since the pair were last sighted.

For the OBN part of the survey, A-line segments will only be acquired during good visibility (as defined in Annex C of MMP), unless the Central Commander, after consultation with the Company and the WGWAP Advisory Group, decides that complications would lead to prolonged duration of the survey. Paragraph 1(a) above with respect to mother-calf pairs also applies for the OBN segment[2].

1.7 Critical Habitat Assessment

1.7.1 Discrete Management Units

The following areas have been selected for Critical Habitat Assessment: coastal north-eastern Sakhalin Island from the northern border of Tropto Bay to the northern border of Central ridge (located to south from Lunskyi Bay) including lagoons; the Coastal Land Zone; Aniva Bay (from the promontory Aniva on the east to the promontory Crillon on the west) and onshore areas from Piltun Bay to Aniva bay.

Subsequently, the following are proposed as Discrete Management Units (DMU):

1. **The North Marine DMU -** part of the marine environment with depths ranging from 0m to 100 m. The 0m to 20 m zone is important for a range of marine organisms. Gray whales congregate there each summer to forage; North Pacific right whales have been recorded; it is an important site for foraging and roosting seabirds and waders, whose habitat range is considerably spatially limited compared to marine mammals or pelagic fishes

[2] If such complications would be identified during planning and prior to execution of the OBN survey, then relaxation of this restriction will be discussed and agreed with the Advisory Group. If such complications would arise during execution itself, caused by near-platform or simultaneous operations, then a potential relaxation would be decided by the Central Commander, after considering all available information.

2. **The South Marine (Lagoons) Zone DMU** - sites for breeding, rest and foraging for water and wetland birds
3. **The Coastal Land Zone DMU** – areas between lagoons and the sea are important for nesting birds
4. **The Onshore Zone DMU –** areas for rare species of plants, animals and birds

For the purposes of this document, only the North Marine DMU is appropriate. (The other marine DMU, South Marine (lagoons) Zone, effectively Aniva Bay, is hundreds of kilometres distant and not Critical Habitat for the four key marine mammals). With seismic survey operations focussed on the sea and the shore-based observers' operations concentrated on set locations and a single access route, any threat or impact on the natural habitat or the four bird species is judged as negligible to none. Regarding the marine mammals, the North Marine DMU includes two species: gray whale and North Pacific right whale. The North Pacific right whale is uncommon off north-east Sakhalin. Two North Pacific right whales were registered travelling together in 2005 in the Lunskoye area. If the species is observed during the survey then the event automatically falls under the mitigation and protection plans prevailing for the gray whales.

Table C, from draft CHA. Results of Marine Mammal Habitats Assessment of the North Marine DMU, north-eastern Sakhalin Island

	English common name	**Criterion 1**	**Criterion 2**	**Criterion 3**	**Criterion 4**	**Criterion 5**
1	Gray whale	**Tier 1 (a)**	NO	**Tier 2(b)**	YES	YES
2	Bowhead whale	NO	NO	NO	NO	NO
3	North Pacific right whale	**Tier 2 (d)**	NO	NO	NO	NO
4	Fin whale	NO	NO	NO	NO	NO

Offsets

1.8 Biodiversity Offsets

In addition to operating a mitigation policy of avoiding then minimising and restoring losses to biodiversity, the Company, under its obligations to the Lenders'/IFC Performance Standard 6, must take the outcome of the qualification of the North-east Sakhalin seas DMU as Tier 1 Critical Habitat (criterion 1a) for North Pacific gray whale and North Pacific right whale and deliver biodiversity offsets. For Natural Habitat, those should be designed and implemented to achieve measurable conservation outcomes that can reasonably be expected to result in no net loss and preferably a Net Gain of biodiversity. However, a Net Gain is required in Critical Habitats. Net Gains are additional conservation outcomes that can be achieved for the biodiversity values for which the Critical Habitat was designated, in this instance gray whales (and bowhead whales should they ever be observed/recorded). Officially, these Net Gains may be achieved through the development of a biodiversity offset and/or, in instances where the client could meet the requirements of paragraph 17 (on Critical Habitats) of the IFC Performance Standard 6 without a biodiversity offset, the client should achieve Net Gains through the implementation of programmes that could be implemented *in situ* to enhance habitat and protect and conserve biodiversity. The Company is aware of the issues of practicality and effectiveness in creating, say, habitat for vagile marine mammals such as gray whales and endeavours to achieve the Net Gains nevertheless. Under the terms of the IFC Performance Standards 2012, simply carrying out industrial activities in Critical Habitat triggers a requirement for Net Gains even if no impact can be observed or measured to the biodiversity values for which the Critical Habitat was designated in this instance, for example, gray whales.

1.9 Net Gains

Net Gains can be achieved through the implementation of programmes applied on-the-ground to enhance habitat, protect and conserve the gray whales. Given the caveats on the creation of habitat for vagile marine mammals mentioned above, in that respect, the Company, has been determined and realistic in developing Net Gains. Through its approach and commitment to scientific programmes, environmental management, assurance practices and its willingness to work with experts, Sakhalin Energy has built up enormous experience in carrying out its activities in Critical Habitats. It has now genuine influence and a well-earned reputation, regionally and internationally, in the oil and gas sector and among environmental NGOs, particularly for operating responsibly in sensitive areas.

1.9.1 Island-wide Biodiversity Action Plan

The Company is developing a Biodiversity Action Plan (BAP). This plan takes an island-wide approach including the marine areas. It will be used to plan, mitigate and manage the Company's activities on the island and offshore for future projects and years. Potential offsets within the BAP include developing or publicising good practice and influencing regulators and averted risk (in this instance, fishing gear). These are practical measures that are difficult to measure or demonstrate, therefore qualitative assessments may be required. These will be developed as part of the BAP and, while not an offset in itself, the Company has contributed to improved knowledge that is vital for the conservation and protection of the Sakhalin gray whales.

1.9.2 Substantial contribution to gray whale scientific knowledge base

A major gain, but not strictly an Offset, is the contribution made by the high quality and volume of new scientific data and information on Sakhalin gray whales generated by the two scientific programmes with which the Company is involved. In the first, the Company independently and solely funds and manages the Whale Programme, which includes the

IUCN/WGWAP process. This has led to industry-leading, scientifically-based measures and plans being developed, then applied widespread to avoid and mitigate risk from industrial activities on gray whales and applied to cetaceans more generally worldwide. In the second, the Joint Scientific Programme on Gray Whales with its industry partner, Exxon Neftegas Ltd (ENL), between 2002 and 2018 generated 306 publications (48 of which were presented at International Whaling Commission conferences and workshops) including 51 peer-reviewed papers. The publications covered a wide range of scientific and technical subjects: distribution, feeding, genetics, migration, photo identification, benthos, population dynamics and acoustics. As a result, far more is known now about the gray whales off Sakhalin Island and how to manage their conservation.

1.9.3 Promotion of good practice

A second major gain is the positive influence the Company has in terms of the proactive promotion of good practice to other operators' activities around Sakhalin. This open attitude to sharing experience and practice resulted in two other major operators feeling encouraged enough to make approaches and discuss with the Company the development of Environmental Management Systems (EMS) in the context of their own operations off Sakhalin in the proximity of gray whales. In recent years, awareness of other operators' activity plans, such as for seismic surveys or heavy lifts, reveals close adherence to the Company's standards and practice developed through, for example, the WGWAP process. The WGWAP and IUCN have produced Good Practice guidelines based on this experience https://portals.iucn.org/library/node/46291. The Company does acknowledge that causal-effect on other operators' working practices is difficult or impossible to demonstrate let alone quantify, as is required under PS6. However, this influence has been rewarded and marked in the Russian Federation by several awards and tributes from the agencies, national and regional governments.

1.9.4 Influence on Industry standards within Russian Federation

A third gain is the acceptance of the Company's EMS and standards on Russian Federation's national and local (Oblast) regulatory processes and policies. The Company has observed that the State Environmental Expert Review (SEER) is now advising the deployment of Marine Mammal Observers and the production of Marine Mammal Protection Plans and Monitoring and Mitigation Plans in advice to other operators off Sakhalin. This may be a consequence of the UNDP/GEF project "*Mainstreaming biodiversity conservation into Russia's energy sector policies and operations*" which was initially promoted by the Company, working with the Ministry of Natural Resources (MNR) and The Russian Environmental Protection Agency (RPN) to inform the SEER and Interdepartmental Working Group (IWG) on managing risk and impacts on the environment from the oil and gas industry in the Russian Federation. However, at a regional (Sakhalin Oblast) level, the Company's Biodiversity Strategy has largely informed the Sakhalin Biodiversity Action Plan and given rise, for example, to the genetic conservation of Taimen project.

1.9.5 Reduction in risk to gray whales from Fishing Gear

A fourth gain is the reduction in direct risk from fishing gear to gray whales (and other marine mammals) in the Sea of Okhotsk. Whether the fishing gear is in operation or abandoned, it is the activity presenting the highest risk of injury and death to gray whales (especially mother-calf pairs at Sakhalin) in the North Pacific. The Company has highlighted the risk of fishing gear to the fisheries and environment authorities in Sakhalin Oblast allowing them to re-examine licensing agreements, fishing practices and fishing locations.

1.9.6 Development of Marine Mammal Rescue Response

The Company sponsors 'Club Boomerang' which is a group, created for youths and lead by adults with specialist experience, investing in activities and training to bring societal and environmental gains to Sakhalin. Specifically, it has an ongoing training plan, with the involvement of local veterinarians and visiting experts, for producing personnel with expertise in marine mammal rescue response. One particular aspect of this activity is gaining expertise in the removal of dangerous fishing gear from the nearshore to avoid entanglement with gray whale adults and calves. They have also trained in techniques for removing fishing gear from live animals.

1.10 Cumulative Impacts

Critical Habitat designation is actually an assessment of biodiversity importance of an area, based on the biodiversity values and not the potential project or activity impacts. If there are no project/activity impacts, the fact that a species or habitat qualifies the area for designation as Critical Habitat does not necessarily mean that it will require any specific mitigation. However, where potential for impacts do occur, PS6 requires project proponents to 'fully exercise the mitigation hierarchy', with an emphasis on measures aimed at avoiding and minimising impacts. The receptors potentially at risk of cumulative impacts off north-east Sakhalin are primarily marine mammals. The sources of these potential cumulative impacts for marine mammals include entanglement with operating or abandoned fishing gear; within year and year-on-year noisy activities (not just seismic sources but also large operations such as heavy transportation and landing activities, dredging and pile driving); general or increased vessel movements. Within the Company and often between the Company and its industry scientific joint programme partner, cumulative impacts are discussed and addressed through project planning and within the HSESAP. In the course of carrying out its activities over the past 18 years, the Company has not observed or measured an impact on gray whales or any other marine mammals. This does not mean that there are no impacts and within the PS 1 and PS6 processes, actual impact is not necessary for action to be taken, potential for impact is enough. Much of that potential impact is managed. So, although describing cumulative impacts is problematic when none has been observed or measured, the assumption is taken that risk still has to be averted. The Company achieves the management of that potential risk in the ways mentioned above but it also looks pro-actively at factors such as timing of an activity or linking activities to biodiversity strategy plans. The responsible decision-making by the Company prior to the 2015 seismic survey undertaken when ENL was also carrying out a seismic survey is a good example of pragmatic management of potential risk based on previous guidance from the WGWAP and knowledge accrued from experience.

1.10.1 *Further mitigation is achieved in the context of:*

1.10.1.1 Entanglement with fishing equipment

The Company's influence has been two-fold: first, it has highlighted the risk of fishing gear to the fisheries and environment authorities in Sakhalin Oblast allowing them to re-examine licensing agreements, fishing practices and fishing locations; and second, the Company sponsors 'Club Boomerang' which is a group, created for youths and lead by adults with specialist experience, that invests in activities and training to bring societal and environmental gains to Sakhalin. Specifically, it has an ongoing training plan, with the involvement of local veterinarians and visiting experts, for producing personnel with expertise in marine mammal rescue response. One particular aspect of this activity is gaining expertise in the removal of dangerous fishing gear from the nearshore to avoid entanglement with gray whale adults and calves. They have also trained in techniques for removing fishing gear from live animals.

1.10.1.2 Positive dissemination of good practice within the industry

The Company's open attitude towards sharing experience and practice resulted in two other major operators feeling encouraged enough to make approaches and discuss with the Company the development of Environmental Management Systems (EMS) in the context of their own operations off Sakhalin in the proximity of gray whales. In recent years, awareness of other operators' activity plans, such as for seismic surveys or heavy lifts, reveals close adherence to the Company's standards and practice developed through, for example, the WGWAP process.

1.10.1.3 Source reduction for future surveys

The Company intends carrying out source reduction tests during the 2018 seismic survey period. The aim of the tests is to identify to what extent nominal source volume can be reduced while still achieving effective data and information coverage of the fields.

1.10.1.4 Support for Range-wide Initiatives by International Whaling Commission (IWC)

This is a mechanism by which the Company would seek to support the aims of the IWC in order to help address cumulative impacts on gray whales throughout their range.

2 Introduction

2.1 Sakhalin Energy Seismic Surveys in 2018

Seismic surveys are planned by Sakhalin Energy Investment Company (Sakhalin Energy or the Company) in 2018. These will be four-dimensional (4D)[3] geophysical surveys for the three fields comprising the Sakhalin-II oil and gas project licence area. The fields are Piltun, Astokh and Lunskoye and are located off the north-east coast of Sakhalin Island, Russia (See Figures 1, 2 and 3 below). The Piltun and Astokh fields lie within 15km of the near-shore, seasonal feeding area of the protected gray whale *Eschrichtius robustus* (see Figure 4, below). The Lunskoye field lies approximately 40km south of the gray whales' offshore feeding area. This group of gray whales, returning to Sakhalin each year, is deemed by the International Union for Conservation of Nature's (IUCN) Red List of Threatened Species, to comprise Critically Endangered Western Gray Whales. Consequently, they are accorded higher levels of protection through national regulations and international standards.

This document presents the Environmental, Social and Health Impact Assessment (ESHIA) for the planned surveys. Although managing risk to the gray whales is the primary focus of this ESHIA, it addresses also the protection of other marine mammals and the wider environmental, health and social aspects of the Company's seismic surveys and has been developed in line with the International Finance Corporation's Performance Standards 2012 *www.ifc.org/performancestandards* and, as part of the covenanted agreement with the Lenders, the Health, Safety, Environment and Social Action Plan (HSESAP) http://www.sakhalinenergy.ru/en/hse/hsesap/.

[3] A 4D survey is a repeat survey of the same area at a later time, in which time is the 4th dimension, to enable the imaging of production effects in the field.

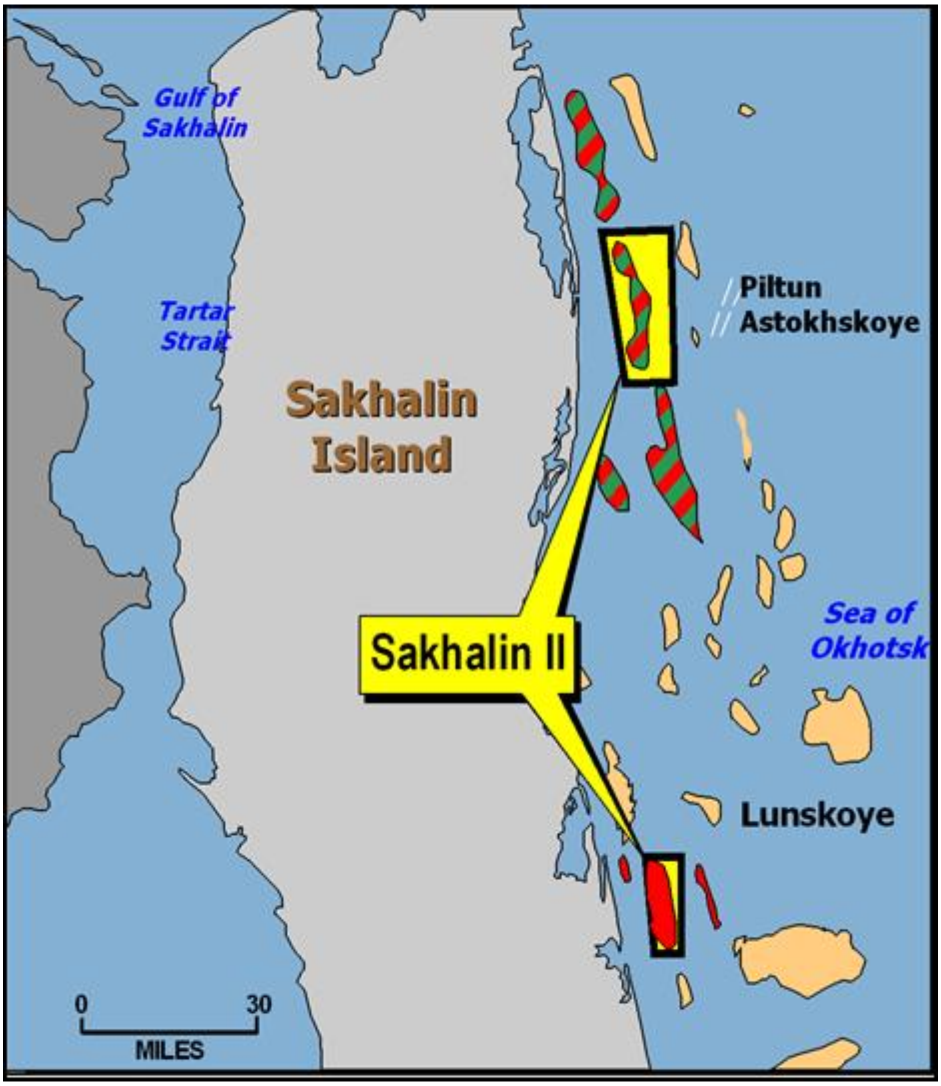

Figure 1. Location of Piltun Astokhskoye and Lunskoye (Sakhalin II) Fields

(Red for gas and green for oil)

PILTUN - ASTOKHSKOYE

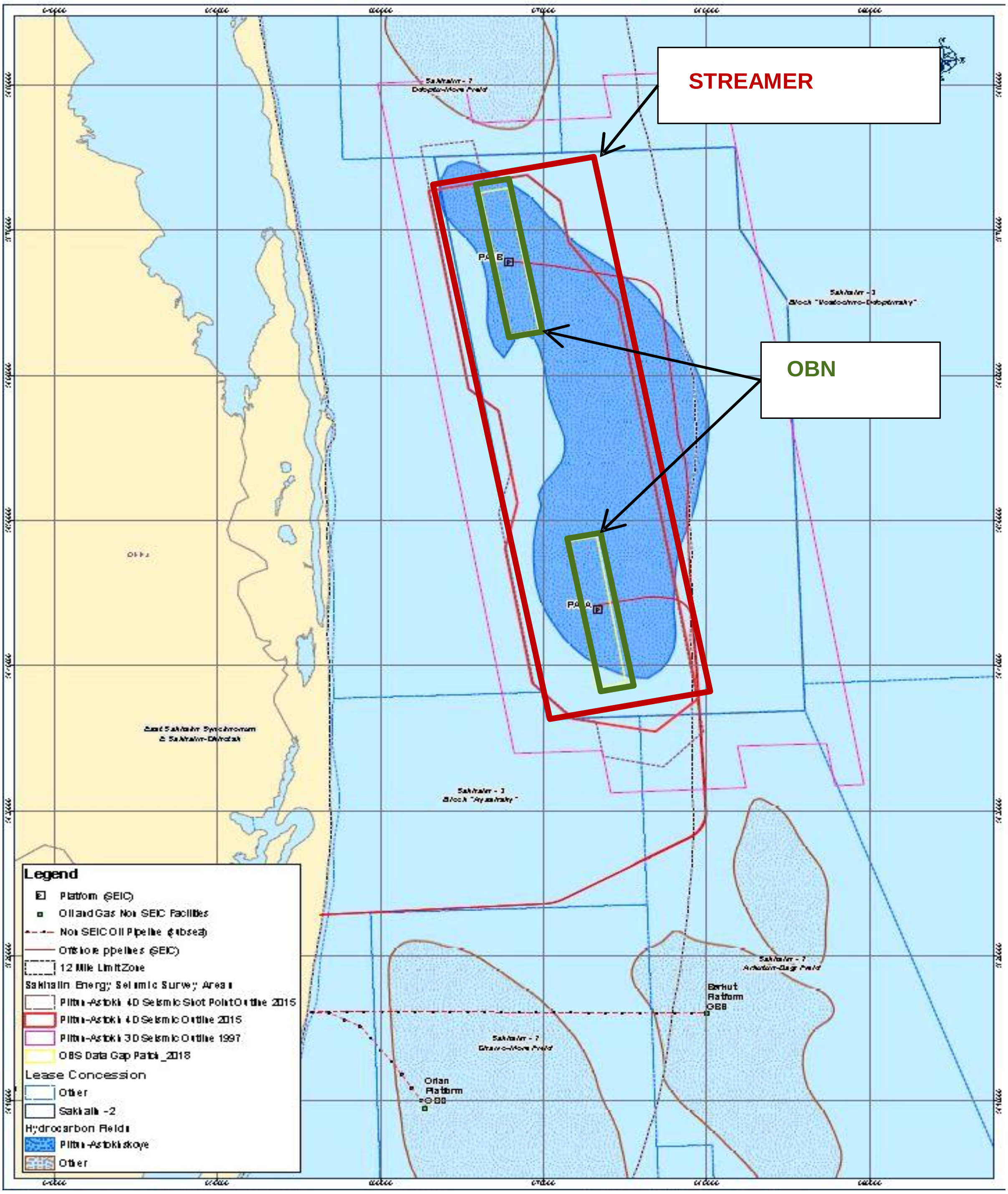

Figure 2. Streamer and OBN Survey Areas Piltun Astokhoye

LUNSKOYE

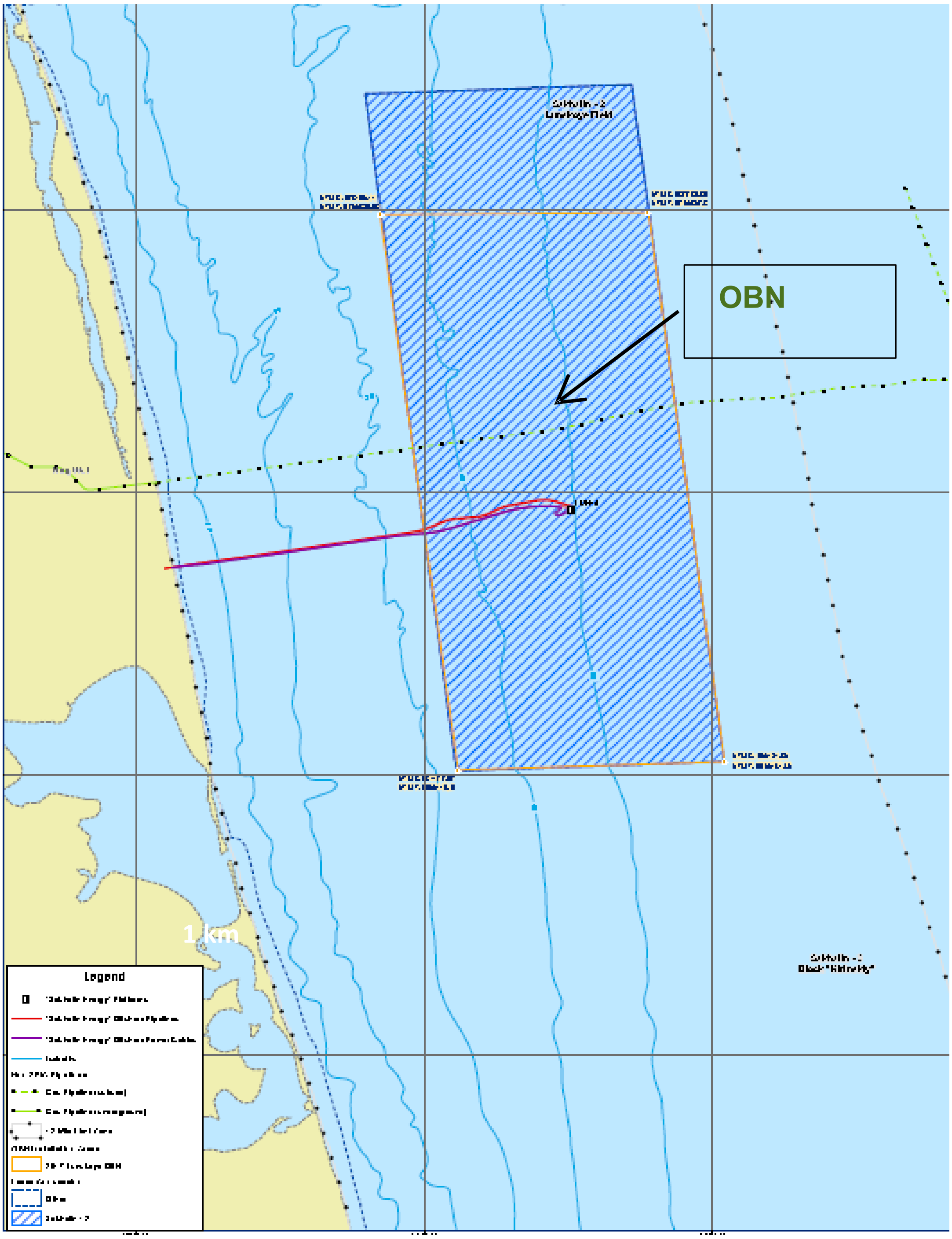

Figure 3. OBN Survey Area Lunskoye

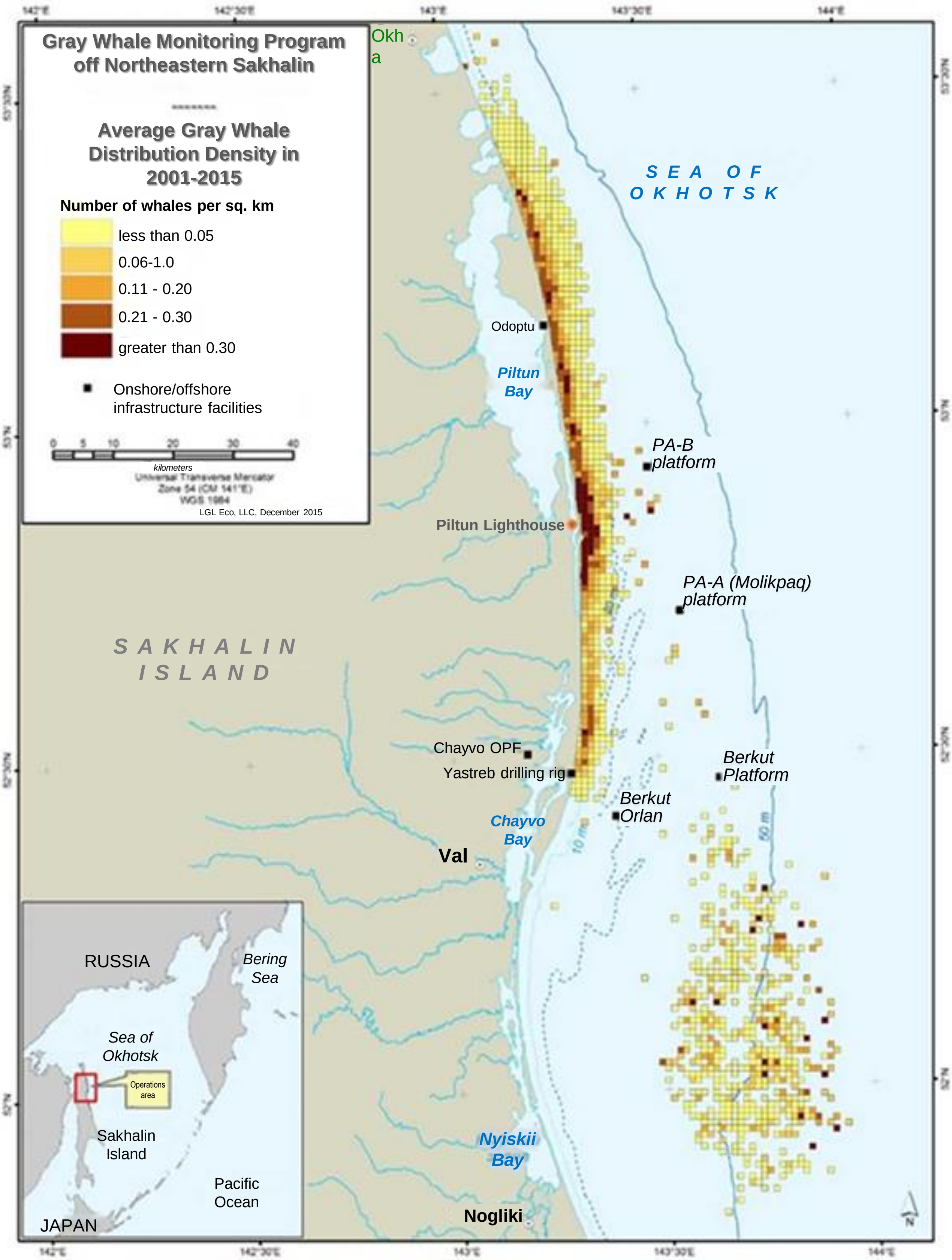

Figure 4. Gray whale distribution along the Sakhalin coast, 2001-2015

3 Project Description

3.1 Alternatives to the Project, Outline and Rationale of the 2018 seismic survey

Alternatives to the proposed activities were considered by the Company and discussed with the Noise Task Force (a sub-group of specialists from the WGWAP process with responsibility for advising the WGWAP on noise issues) and the wider WGWAP. They concluded that there are no like-for-like alternatives to the proposed seismic surveys and that the monitored, managed and mitigated survey was, in the context of alternative approaches to the seismic survey at this time, justifiable/desirable for a number of reasons. For example, postponement to 2019 may have the effect of increasing the risk of noise disturbance in the area because Exxon Neftegas Limited (ENL) is planning a major seismic survey of its licenced areas in that year. Postponement to 2020 is problematic also because major maintenance is planned for PA-A platform and this could entail raised noise levels and vessel activities.

3.1.1 4.1.1 No Alternative to Project

Cancellation of the surveys would bring genuine commercial risks to Sakhalin Energy and its assets. When compared to a seismic survey, no other methods or techniques could produce the quality and quantity of data at that scale in the time available to inform the safe and efficient management of the water and hydrocarbons in the fields. In-well monitoring, for example, would produce only very limited information for up to 20 metres from the well. Consequently, a seismic survey will be conducted. Options considered for the performance of the seismic survey are to use streamers, Ocean Bottom Nodes (OBN) or a combination of both methods.

The use of OBN may provide some advantages to the Company, which envisions using them in future surveys, as follows:

1. They are ideal for deployment in specific areas, such as close to platforms (where streamer surveys are difficult to perform)
2. There is the potential for using a smaller source[4]
3. They offer flexibility during a survey if a whale is encountered (the vessel temporarily moving to another area of the survey zone to avoid whales is more practicable because precise areas are easily re-located than when a streamer is deployed and thus repeatability is ensured)

However, because OBN tend to have fewer recorders than utilised in streamer surveys, more shots are required to be fired to produce the resolution desired.

3.2 Start of Surveys

The surveys will begin in June 2018, immediately after ice retreat, and for Piltun and Astokh will consist of a streamer acquisition phase (Fig. 3) resembling the 2015 survey, plus an OBN

[4] Note on mitigation investment for future surveys: the Company intends carrying out source reduction tests during the 2018 seismic survey period. The aim of the tests is to identify to what extent nominal source volume can be reduced while still achieving effective data and information coverage of the fields.

phase (Fig. 4) to cover data-gap patches (detailed timings in Appendix i). The Lunskoye survey is to be achieved solely through the deployment of OBN.

3.3 Survey Objectives

For the Piltun-Astokh area (P-A) 350Km^2, the objectives are to continue with production monitoring and to start reservoir behaviour monitoring in the data gaps around the two platforms (25km^2 per platform gap). These objectives led to the selection of a combined streamer and Ocean Bottom Node survey, using a design maximising the chance of successful backwards 4D compatibility with the 1997/2015 streamer surveys. The survey duration must fit within six to seven weeks (bounded by ice-retreat in mid-June and peak gray whale season in Piltun Bay area in early August).

For Lunskoye (LUN), the key aims of the OBN survey are to image through a gas cloud obscuring the crestal (uppermost) part of the field (approximately 115 km^2) and to establish an adequate 4D baseline for post-2018 field monitoring. It is recognised that the use of OBN puts compatibility/comparability with the 1997/2015 streamer surveys at risk, but that risk is considered as acceptable by the Company. A secondary objective is the provision of a second 4D monitor survey (185km^2)

Generally, OBN timing is: P-A is in July; LUN following in Aug - mid-Sep.

Details on intended order of OBN activities in P-A:

- Commence laying nodes in Astokh while streamer operations are wrapping up
- Laying nodes in Piltun while OBN shooting is ongoing in Astokh
- Picking up nodes in Astokh while shooting is ongoing in Piltun,

3.4 Detailed Technical Design

3.4.1 Streamer Acquisition

A vessel in 8-streamer configuration will be deployed for the survey. The streamer length will be 4,500m and operating at a depth of 7m. Streamer separation will be 100m, resulting in a 700m wide tow. The vessel will be deployed to a pre-plot established from the 1997/2015 surveys. A support vessel and a chase vessel will be present and operating to the same mitigation principles.

The source will be an airgun array, operating with three sub-arrays spaced 10m apart and towed at a depth of 7m. Source nominal volume will be 2500-3500 cu in. The output of this airgun array was modelled by the ‘Nucleus’ software package, which is the industry standard. Modelling by JASCO in 2017 indicated that the 180dB rms per pulse sound level would be found at a radius of 500m around the source.

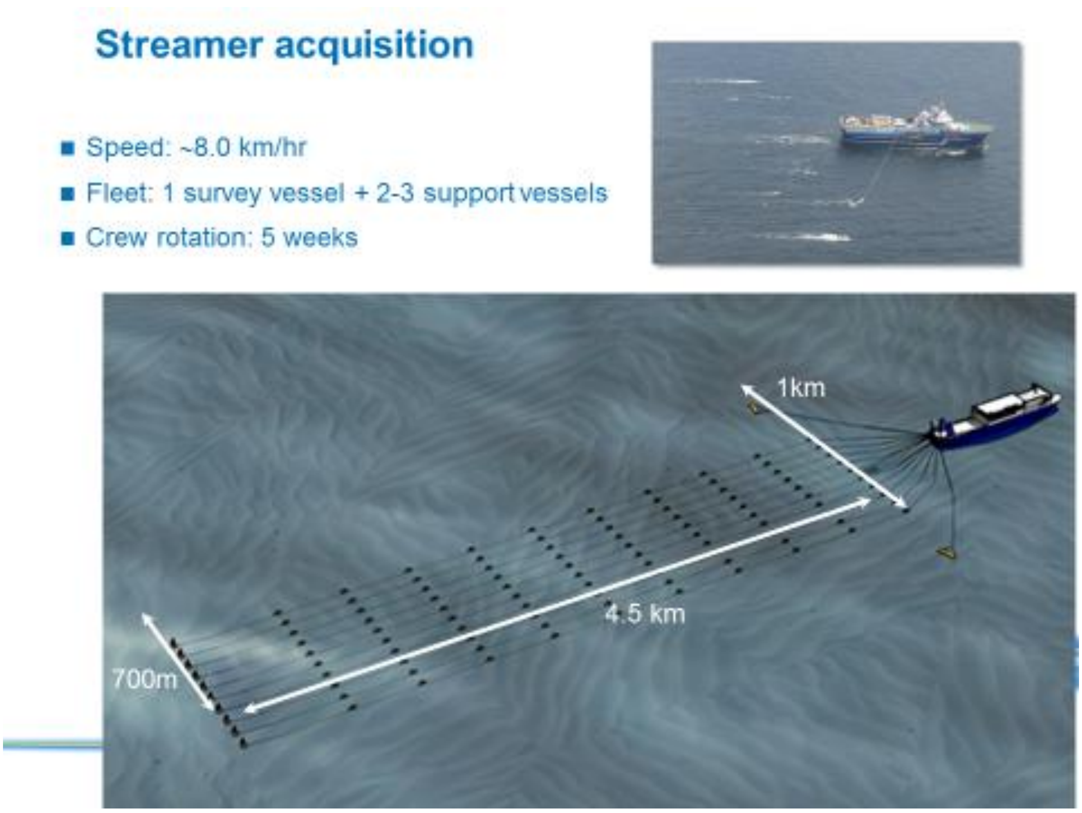

Figure 5. Streamer Configuration

3.4.2 OBN Acquisition

The OBN acquisition is using the "parallel method" at both Piltun-Astokhskoye and Lunskoye, meaning that the direction of the OBN receiver lines is parallel to the OBN shooting lines. The source used is as in the streamer survey.

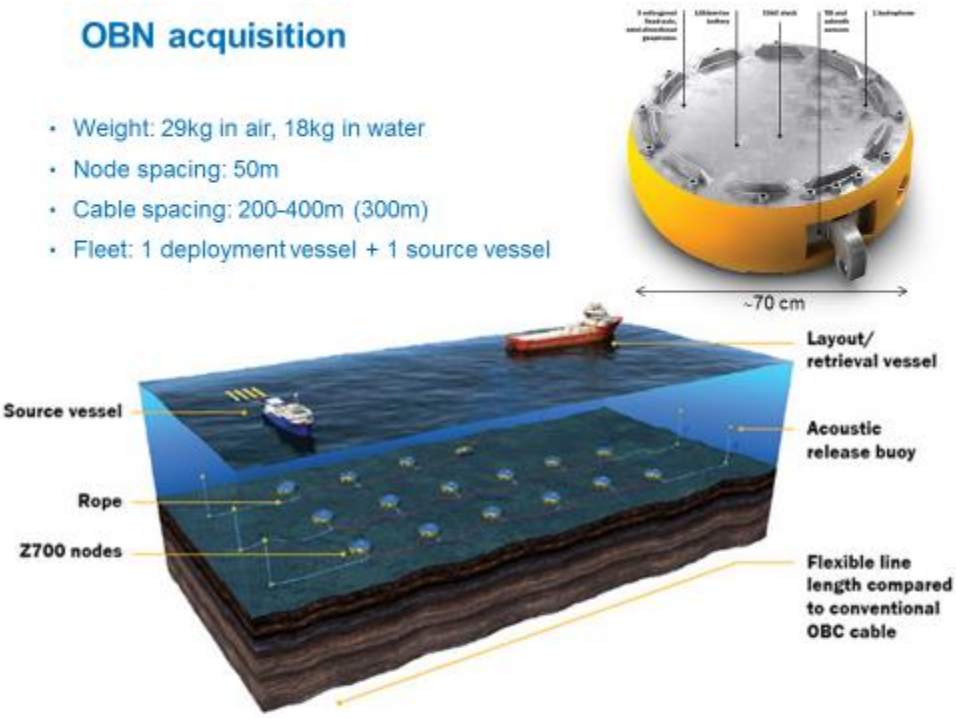

Figure 6. Ocean Bottom Node Acquisition

4 Legal Context

4.1 Environmental and Social Legal Requirements

In accordance with the Production Sharing Agreement[5] and the adopted project financing procedure, the Project is being developed in compliance with the following environmental and social legal requirements:

- Russian national laws, regulations and standards
- Regional laws, regulations and standards of the Sakhalin Oblast
- International treaties, conventions and agreements ratified by Russia
- Sakhalin Energy’s and Shell’s internal environmental, health and social policies and regulations
- Standards and requirements of lenders and insurers, which include:
    - The Equator Principles II
    - The International Finance Corporation’s Policy on Environmental and Social Sustainability:
        - The IFC Environmental and Social Performance Standards (1 January 2012)
        - The IFC Environmental, Health and Safety General Guidelines (30 April 2007)
        - IFC EHS Guidelines. Offshore Oil and Gas Development

4.1.1 Russian Federation and Regional (Sakhalin Oblast) Legal Requirements

An environmental impact assessment (OVOS) is a mandatory procedure for any activity if the corresponding design (or substantiating) documentation is subject to a State environmental expert review (SEER).

The following laws regulate the environmental review and impact assessment processes:

- Federal Law No.174-FZ **“On Environmental Review”** of 23 November 1995;
- Order No. 372 of 16 May 2000 of the State Environmental Committee **“On an environmental impact assessment of proposed economic and other activities in Russia”**.

[5] Sakhalin Energy Investment Company Ltd. (hereinafter referred to as “Sakhalin Energy”, or “the Company’’) is developing Piltun-Astokhskoye oil field and Lunskoye gas field off the north-eastern coast of Sakhalin Island. The Company operates under the *Production Sharing Agreement (PSA*) signed in June 1994. Sections 24 (laws and regulations) and 25 (on protection of the environment and personnel security) of the Agreement state that the activities have to be carried out in accordance with:

- Officially enacted and publicly available laws, regulations, decrees and other acts of the government effective in Russia;
- Environmental standards generally accepted in the international oil and gas industry.

Sakhalin Energy complies with the Russian Federation Environmental Impact Assessment process (through the OVOS, provided by the Seismic Survey contractor in this instance) and submits its documentation for State Environmental Expert Review. SEER approval was granted to the company for the surveys on 8th June 2018 (the SEER positive conclusion was prepared and signed; Russian Federation Ministry of Natural Resources and Ecology issued approval Order #195, 08 June 2018).

Air Protection

- Russian Government's Decree No. 183 **"On Standards for Air Emissions of Pollutants and Adverse Physical Impacts on Atmospheric Air"** of 2 March 2000

Marine Water Protection

- Federal Law No. 155-FZ **"On internal marine waters, the territorial sea and the adjacent zone of the Russian Federation"** of 31 July 1998
- Federal Law No. 187-FZ **"On the continental shelf of the Russian Federation"** of 30.11.1995
- Sakhalin Oblast's Law No. 104 "On the Red Book of Sakhalin Region" of 10 March 1999

4.1.2 International Conventions

International conventions on climate change and sustainable energy management:

- Convention on Long-range Transboundary Air Pollution (Geneva, 1979) – ratified by the Russian Federation
- UN Framework Convention on Climate Change
- The Kyoto Protocol to the UN Framework Convention on Climate Change (December 1997) – ratified by the Russian Federation

International conventions on conservation of habitats, biodiversity and protection of natural heritage:

- UN Convention on biological diversity, Rio de Janeiro, 1992, ratified by the Russian Federation
- Convention on Wetlands of International Importance, especially as Waterfowl Habitat (the Ramsar Convention), 1971 – ratified by the Russian Federation
- Convention on the Conservation of Migratory Species (the Bonn Convention) Bonn, 1979 signed by the Russian Federation
- Convention between the government of the USSR and Japan on the conservation of migratory birds and birds under threat of extinction; and their habitat, 1973 – ratified by the Russian Federation

International conventions on protection of water resources:

- International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, Brussels, 1969 ratified by the Russian Federation
- MARPOL 73/78 — International Convention for Prevention of Pollution from Ships, Annexes I to V, 1978 (with amendments of 1 September 2002) in relation to marine vessels and operations under the control of Sakhalin Energy – ratified by the Russian Federation
- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (the London Convention) (1972) – ratified by the Russian Federation
- International Convention on the Control of Ships ' Ballast Water and Sediments
- International Convention on Oil Pollution Preparedness, Response and Co-operation

4.1.3 Sakhalin Energy Internal EHS Standards

In 2009, Sakhalin Energy joined the UN Global Compact (UNGC) and pledged to consistently follow UNGC's principles on human rights, labour, environment and anti-corruption. In 2011, Sakhalin Energy became the first and (as of the beginning of 2017) the only Russian company chosen by the UN to participate in its new Sustainable Corporate Leadership platform — the UN Global Compact LEAD, established in the framework of the UN Global Compact. LEAD companies are obliged to carry out certain activities in the areas of environmental protection, social performance and corporate governance, as well as to develop new CSR standards.

Sakhalin Energy applies the following main international standards and requirements:

- ISO standards (environmental management, quality control, health and safety and social responsibility)
- European Union and United Nations standards and directives (environment, human rights, indigenous peoples, etc.)
- World Bank and International Finance Corporation standards (governance systems, risk and impact assessment, biodiversity, public health, cultural heritage, indigenous peoples, involuntary resettlement, stakeholder engagement, grievance management, etc.)
- GRI and AA1000SES standards (non-financial reporting, stakeholder engagement)

Based on the aforementioned international standards, the Company has developed a set of its internal HSE and social standards and regulations as presented below:

- Statement of General Business Principles
- Code of Conduct

- Sustainable Development Policy
- Commitment and Policy on Health, Safety, Environment and Social Performance (HSE & SP)
- Health, Safety, Environment and Social Action Plan: HSESAP Commitments to Company Standards with list of Company Standards
- Hydrocarbon Flaring Commitment
- Statement of Industrial Safety Policy
- Regulations on the Industrial Safety Management System
- Regulation on Industrial Environmental Control
- Business Continuity Policy
- Regulations on the Business Continuity Management System

The documents listed above were approved by the committee of executive directors, signed by Sakhalin Energy's Chief Executive Officer and communicated to all direct and contractor employees.

4.2 Sakhalin II Project Lenders' Standards

Under an agreement with the investment banks (which comprise the Lenders to the Sakhalin II project), the Company is contracted to manage its activities, *inter alia*, to avoid, mitigate and minimise any risk to the environment and respective human populations' social welfare, safety and health. Under the loan agreement the Company is committed to meeting the 2012 IFC PS. Under the IFC Performance Standards, the borrower must first comply with national laws and international conventions. However, where two or more standards/regulations apply to the same subject, then the most stringent is adopted (except where this would lead to legal non-compliance). In practice, Russian Federation legislation, although not covering all of the elements pertaining (such as ecosystem services or some social requirements), is broadly consistent with the requirements of the IFC PS in many areas, although there are important differences in scope and detail.

As part of the compliance process, typically the Project develops an Environmental Social and Health Impact Assessment (ESHIA), an Environmental and Social Management System (ESMS) and an Environmental and Social Management Plan (ESMP). In Sakhalin Energy, the ESMP is referred to as the Health, Safety, Environment and Social Action Plan (HSESAP) and is viewed as the guiding framework for the 2018 Seismic Survey and this ESHIA. The HSESAP is covenanted within the loan documentation. Therefore, its content cannot be changed without the Lenders' agreement. The Lenders and their independent environmental consultant (LIEC) agree the contents of the HSESAP with the Company to ensure compliance with the Performance Standards. The LIEC then monitors the project to ensure compliance with the HSESAP, partly through ESHIAs for significant activities/projects. Subsequently, this 2018 seismic survey IESHIA is a key contribution to that process and procedure

4.3 Statutory Public Hearings and Community Consultations

Public hearings for this seismic campaign were held on 17th and 18th January 2018 in the settlements closest to the survey areas most likely to have stakeholders at risk of impact: Nogliki and Okha. Relevant notifications about the hearings and materials publications (including OVOS) were made in 2017 as per Russian Federation requirements. In addition to the more general announcements, Indigenous Peoples' representatives of Nogliki and Okha Districts were invited to participate in the public hearings. No concerns or issues in regard to the survey were raised by participants at either meeting.

No impacts (adverse or beneficial) on local communities, amenities, the local economy, recreational activities and tourism are therefore predicted.

4.4 Approvals status

4.4.1 Underwater monitoring

Underwater monitoring systems have been used by Sakhalin Energy has part of its monitoring and mitigation programmes during previous seismic surveys (e.g. in 2010 and 2015). Such monitoring was intended to be used during the 2018 seismic survey as part of the 2018 Monitoring and Mitigation Plan (MMP) developed in agreement with the WGWAP as described in Section 9 below. The deployment of the devices for underwater acoustics monitoring by Sakhalin Energy's contractors, the National Scientific Centre of Marine Biology and Pacific Oceanological Institute (POI), requires permit approval from the relevant RF authorities. However, on March 2nd 2018, POI received a Notification of Permit Denial in respect to the deployment of the underwater monitoring devices. This resulted in a number of important late changes to the MMP, which are described further in Section 9.

4.4.2 Seismic Survey

A copy of the State Environmental Expertise Review conclusions (issued to the Contractor in Moscow on 8th June 2018) was received by the Company in Sakhalin on 9th June 2018. An exclusion zone of not less than 1000m was prescribed for all marine mammals. Given that this definition was likely to increase the likelihood of shut-downs of operations due to the wide range of animals covered by the term 'marine mammals', the Company proposed clarification from the SEER authority on the specific animals which would trigger a shut-down. (For example, the SEER conclusion of 2015 set a 350m limit for sea lions and a 2000m limit for gray whales.). Clarity from the SEER authority was important because one of the key mitigations required for the survey by the Western Gray Whale Advisory Panel is to start as early as possible and to finish as soon as possible. This manages the potential risk from the operations knowing that gray whale numbers increase as the season progresses, resulting in higher whale numbers in the vicinity. However, if there was any increase in the frequency of shut-downs in the survey then potential risk to the gray whales from those activities would increase with time as the survey was prolonged (for example, delays are incurred because it takes most of a day to turn the seismic vessel and re-position it for acquiring a new line or if the ship has to wait for the whale to move out of the exclusion zone before progressing). The Company received confirmation from the SEER authorities, accepting the Company's proposal and summarised in the table below (Table 1.).

Table 1. 2018 SEER Conclusions for Sakhalin Energy Seismic Survey

Status IUCN/МСОП	Status Red Book RF/ Красная книга РФ	Species	Distance
Whales/Китообразные			
Critically endangered	1st Category	Gray Whale/Серый кит	1000m
Endangered	1st Category	Bowhead Whale/Полярный кит	
Endangered	1st Category	Northern Right whale/Южный (Японский) гладкий кит	
Endangered	2nd Category	Fin Whale/Финвал	
Vulnerable	3rd Category	Curvier's Beaked whale/Клюворылый дельфин Кюрвье	
No	No	Other whales and dolphins/прочие киты и дельфины	1000m
Seals/Ластоногие			
Endangered	2nd Category	Sea Lion	350m

5 Impacts Assessment Methodology

Note: *Following a recommendation from the WGWAP to Sakhalin Energy, the 4D Seismic Survey in 2018 is to use the standards established in the 2010 and 2015 Impact Assessments for this Project:* http://www.sakhalinenergy.ru/en/media/library/environmental_impact_assessment/

5.1 Impact identification and definition

Starting in the scoping phase and refined throughout the ESHIA process, specific aspects of the Project are identified that may give rise to impacts: positive or negative. Impact definition is iterative throughout the ESHIA process and generally entails developing a description of the aspect, pathway and receptor which comprise the impact, as outlined below:

Aspect is the mechanism by which Project activities may cause impacts (examples of those in this Seismic Survey, in the context of gray whales, would be **seismic source noise** and **vessel activities**)

Receptor is a person, natural ecosystem, structure, flora/fauna species or infrastructure system that experiences the impact (in this case, the prime example *inter alia* for this Project would be **gray whales**)

Pathway is the mechanism by which the aspect affects the receptor (in this case, for example, the **marine environment** especially the **acoustic qualities of sea water** and **proximity to the source**)

Impacts are defined where there is a plausible pathway between the Project aspects and receptors. The aspects, pathways and receptors are identified based on:

- previous environmental or social studies
- review of the evolving Project description to identify aspects
- consideration of the area of influence to determine pathways and receptors
- experience of the ESHIA and Project specialists
- consideration of issues raised by stakeholders
- findings of baseline investigations as they become available

The key environmental impact issues for this assessment have been identified from previous seismic survey ESHIAs in 2012 and 2015 (see note above) as:

- Disturbance and injury to marine mammals (with specific conditions for gray whales)
- Disturbance to marine and migratory fish and fisheries
- Effluent discharge, emissions and waste disposal
- Accidental spills, leaks and dropped objects
- Interaction with other users of the area

5.2 Impact Assessment Criteria

DETERMINING CONSEQUENCE RATING *Rate consequence based on definition of magnitude, spatial extent and duration*				
MAGNITUDE	**TIMEFRAME**	**SPATIAL SCALE**		
		Small	**Inter-mediate**	**Extensive**
Minor	**Short term / low frequency**	Low	Low	Medium
	Medium term / frequency	Low	Low	Medium
	Long term / high frequency	Medium	Medium	Medium
Moderate	**Short term / low frequency**	Low	Medium	Medium
	Medium term / frequency	Medium	Medium	High
	Long term / high frequency	Medium	High	High
Major	**Short term / low frequency**	Medium	Medium	High
	Medium term / frequency	Medium	Medium	High
	Long term / high frequency	High	High	High

Impacts may be direct or indirect, permanent, long-term, short-term or temporary. Quantitative predictions of environmental impacts are generally acknowledged as problematic and there are numbers of different methods used to define impact and significance levels.

To determine the significance of potential impacts, assessment criteria in relation to the status (i.e. vulnerability, sensitivity, and value) of the environmental receptor are taken into consideration; four levels of impact significance are applied (Sakhalin Energy 2014):

- Major Impact: affects an entire population or species in sufficient magnitude to cause a decline in abundance and/or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would not return that population or species, or any population or species dependent upon it, to its former level within several generations of the species being affected
- Moderate Impact: affects a portion of a population and may bring about a change in abundance and/or distribution over one or more generation(s) of the species affected, but does not threaten the integrity of that population or any population dependent on it. Moderate Impact to the same resource multiplied over a wide area would be regarded as a Major Impact
- Minor Impact: affects a specific group of localised individuals within a population over a short time period (one generation of the species affected or less), but does not affect other trophic levels or the population itself

- Negligible or No Impact: where no significant impact is predicted to occur; the impact is of such small magnitude that it does not require further consideration in the assessment

5.3 Sakhalin Energy Standards

In addition to the aforementioned HSESAP, the Company has produced several specific Standards and Procedures to minimise its risk and impact on human health, safety, society and the environment. All staff and contractors operate within these standards and procedures, http://www.sakhalinenergy.ru/en/media/library/standards/ :

- Occupational Health and Hygiene Standard
- Incident Reporting and Follow up Standard
- Personal Protective Equipment Provision Standard
- Emergency Preparedness and Response Standard
- Hazardous Activities Standard
- Dropped Objects Prevention Standard
- Road Transport HSE Management Standard
- Lifting Standard
- Chemicals Management Standard
- Effective Observation and Intervention Procedure
- HSE Competence Standard
- HSES-SP Management in Contracts
- Safety Consequence Management Standard
- Risk assessment matrix
- Control of Worksite Jewellery Procedure

In the Impact Assessment (Section 8 below), assessments have been made using available data, but where uncertainty remains, this is acknowledged and an indication of its scale is provided. Where the sensitivity of a receptor to a particular activity is unknown and the level of impact cannot be predicted, the EIA team has used professional judgement as to whether a significant impact is likely to occur.

6 Baseline

6.1 Gray Whale (Eschrichtius robustus)

The gray whales at Sakhalin are observed feeding mainly using their baleen plates to filter out food organisms from mouthfuls of sea floor sediments ploughed up and sucked in. Subsequently, they were found to congregate at two vitally important and distinct feeding areas:

1. The Onshore Feeding Area -a shallow and narrow (generally <10m deep and <4km wide) discrete region of sea bed hugging the coast and running for tens of kilometres north and south from Piltun Bay and beyond (see Fig. 2). It is used particularly in the early part of the season, offering ideal feeding opportunities to the mother and calf pairs

2. The Offshore Feeding Area is deeper and less discrete (covering approximately 50 x 80 km^2 and straddling the 100m depth contour), its northern edge lies approximately 50km south of PA-A platform and its southern edge lies approximately 50km north of LUN platform (see Fig. 2, area south-east of Chaivo Bay). It offers a wider range of dietary items and requires deeper diving skills to feed there, so is not suitable for young or inexperienced whales. This area tends to be used more as the season progresses.

6.1.1 Assessed numbers of gray whales off of Sakhalin

Numbers of gray whales are assessed based on Photo I.D. data collected by two field teams. One is from the Russian Gray Whale Project (RGWP) funded by the International Fund for Animal Welfare (IFAW) and the other is the MBNRC (formerly known as the Institute of Marine Biology, Vladivostok) and supported by Sakhalin Energy and Exxon Neftegas Limited in their Joint Scientific Programme. Photos have only been matched between the projects for the years up to 2011. For the years 2012 onwards, it was necessary to designate for analysis purposes a primary or lead data set. Most of the calculations were done using the RGWP data set as the lead set for the post-2011 years, but a comparison given in the document (link below) shows that the results are essentially the same whichever data set is designated the primary set. The analysis has not been formally published but that is currently under negotiation between the data suppliers under the mediation of the International Whaling Commission (IWC).

The latest assessment results (up to and including the 2016 season) are available here: https://www.iucn.org/sites/dev/files/content/documents/wgwap-18-24_cooke_-_updated_assessment_of_the_sakhalin_gray_whale_population_and_its_relationship_to_gray_whales_in_other_areas.pdf. There are estimated to be 175 to 192 predominantly Sakhalin-feeding whales. No attempt is made to estimate the total number of calves born each year because an unknown fraction does not survive the journey to the Sakhalin feeding grounds. Photo identification studies and satellite tagging have revealed many examples of repeat, annual visits by individual whales back to Sakhalin.

Please refer to Critical Habitat Assessment (Section 10) for further details on the selection and mitigations for gray whale, bowhead whale, North Pacific right whale, fin whale and Steller sea lion.

6.2 Other Cetaceans (IUCN Red List *www.iucnredlist.org*)

6.2.1 North Pacific Right Whale (Eubalaena japonica)

North Pacific right whales were formerly classified as North Atlantic right whales (*E. glacialis*). However, genetic studies recognise that the North Pacific population is a separate species (Rosenbaum et al. 2000). North Pacific right whales are listed as Endangered (Category 1) in the Red Book of the Russian Federation and as Endangered by the IUCN. Right whales are particularly susceptible to collisions with ships because they are slow, spend considerable time at the surface and utilise some habitats in the vicinity of major shipping lanes (Clapham et al. 1999). Ship strikes are a significant cause of mortality for North Atlantic right whales and it is possible that right whales in the North Pacific are also vulnerable to this threat. Entanglements of right whales have been reported in the Sea of Okhotsk (Brownell 1999; Bukhtiyarow 2001 in Burdin et al. 2004; V.S. Strygin pers. comm. in Burdin et al. 2004). However, due to their rare occurrence and scattered distribution it is not possible to assess the threat of ship strikes and/or entanglements to the North Pacific right whales at this time.

North Pacific right whales were once abundant in the Sea of Okhotsk. Prior to industrial whaling, the number of individuals in the region was ~10,000 animals. However, over-exploitation from the 1840s to the 1920s drastically reduced the numbers of this species. At one time, population levels were so low it was thought that the species had become extinct. All right whales were protected from commercial whaling in the 1930s, and in 1946, the International Whaling Commission (IWC) declared the North Pacific population completely protected. Those measures resulted in a slow increase in the total population numbers, until by the 1970s there were perhaps 200 to 400 individuals throughout the North Pacific range. Current population estimates for the species are largely speculative and range from 100 to the low thousands, however, most authorities tend toward the lower end of this range (Brownell et al. 2001). It has been proposed that as many as 800 to 900 right whales inhabit the Sea of Okhotsk (Vladimirov 1994) and that 150 to 200 animals stay in waters off the east coast of Sakhalin Island during summer and autumn.

Migratory patterns of the North Pacific stock are unknown, although it is thought that the whales migrate from high-latitude feeding grounds in summer to more temperate waters during the winter, possibly offshore (Braham 1984; Clapham et al. 2004). In the eastern region of Sakhalin Island, North Pacific right whales have been reported occasionally, and they may rarely move through, or adjacent to, the Piltun Astokh field. Sporadic sightings in the past 30 years have indicated that the whales use various locations throughout the Sea of Okhotsk (Kuzmin and Berzin 1975), including Sakhalin Island's eastern coast. In 1967, approximately 70 North Pacific right whales were observed in the area of Terpeniie Bay, and solitary animals were seen along Sakhalin Island up to its northern tip (Berzin and Vladimirov 1989). Recently, solitary individuals and small groups of North Pacific right whales have been reported off the east coast of Sakhalin Island (Shuntov 1994). In 1992, nine North Pacific right whales were observed far offshore to the south of Piltun Bay. The same year, seven whales were observed in the area between the northern end of Sakhalin Island and Cape Terpeniie, and in 1993, two individuals were observed in the area east of Cape Terpeniie. One was sighted about 95 km off Lunsky Bay in 1992 (Myashita and Kato 1998 in Brownell et al. 2001), and one individual was found stranded in Lunsky Bay in 1939 (Tomilin 1957 in Brownell et al. 2001). In 2005, during Sakhalin Energy construction activities, two right whales were observed at Lunskoye area on 13 October, at a distance of 2,000 m from the vessel.

6.2.2 Bowhead Whales (Balaena mysticetus)

Bowhead whales are listed as Category 1 —Endangered in the Red Book of the Russian Federation. The IUCN categorizes the species generally as —Lower Risk-Conservation Dependent, but also designates distinct populations independently. The Sea of Okhotsk population is classed as Endangered (IUCN).

There has been some difficulty in assessing the historical distribution and abundance of bowhead whales in the Okhotsk Sea. Right whales and gray whales were sometimes misidentified as bowhead whales, and whaling records maintained during the short period of time this stock was hunted were incomplete (Bockstoce and Botkin 1983). Whales in this stock were discovered by commercial whalers in 1848 (Bockstoce 1986), but intensive hunting did not begin until 1852 when whales in the Bering Sea stock were no longer as plentiful in "traditional" whaling areas (Bockstoce and Burns 1993). By 1860, the Okhotsk Sea stock was severely depleted, and whalers had already resumed whaling in the Bering Sea (Bockstoce 1986). Mitchell estimated the pre-exploitation size of the population to be 6500 based on a total estimated catch of 3506 whales (Mitchell and Reeves 1982). Ross (1993) suggested that this estimate may be too high for the reasons stated above and offered "a conservative, though mostly speculative, compromise" of 3000 as a minimum population estimate. In the north-eastern Okhotsk Sea, whalers found bowhead whales in Penzhinskaya Gulf and Gizhiginskaya Gulf, while in the southwest they were found in Tauyskaya Bay. Farther south, the best whaling grounds were within the gulfs and bays south of the Shantarskiye Islands and west of Sakhalin Island. Fedoseev (1984) observed bowhead whales deep in the ice north of Sakhalin Island in 1969, 1981, and 1983; in addition, he observed one east of Sakhalin Island in 1981 and another a little over 200 km south of Tauyskaya Bay in 1982. Berzin et al. (1991) noted that by mid-November, bowhead whales were no longer found in the Shantarskiye region, despite the waters being ice-free. Almost all of the areas where summer concentrations of bowhead whales occurred in the past are still occupied today. As recent as August 1995, during joint Russian-American surveys, a few dozen bowhead whales were observed in a feeding aggregation south of the Shantarskiye Islands. Berzin et al. (1990) estimated the population in this area to be at least 250-300 animals. An estimate of abundance of 300-400 was made for the entire Okhotsk Sea based on data collected since 1979 (Vladimirov 1994). However, "no quantitative data are available to confirm" these estimates. There is some speculation as to whether animals found during the summer in the north-eastern Okhotsk Sea form a distinct population from those in the Shantarskiye region. The winter distribution of both of these groups is unknown. During February and March, 50 to 100 bowhead whales may be present close to the ice edge along the north and east coasts of Sakhalin Island (Vladimirov 1994). In April 2007, 2 bowhead whales (a cow and calf) were observed along the edge of the ice southeast of Tyuleniy off Sakhalin Island's east coast (ENL, pers. comm., 2007).

6.2.3 Fin Whales (Balaenoptera physalus)

Fin whales are listed as Vulnerable (Category 2) in the Red Book of the Russian Federation and classified as Endangered by the IUCN. The fin whale used to be one of the most numerous species of great whales. The population was drastically reduced by intensive whaling but has since gradually increased in size and by the late 20th Century was estimated to number approximately 2700 individuals in the Sea of Okhotsk (Vladimirov 1994), of which 400 to 600 inhabit the waters of eastern Sakhalin Island during the summer and autumn. Fin whales feed on fish, cephalopods and planktonic crustaceans. Some individuals are present year round in the Sea of Okhotsk. They move into the area from the Pacific Ocean through the straits in the Kuril Islands and from the Sea of Japan through La Perouse Strait. In 2005, during Sakhalin Energy construction activities, a total of 19 fin whales were observed (SEIC 2006). Most of them occurred far offshore, near the navigational corridors used by vessels in transit. Although they are predominantly a pelagic species, it is possible that fin whales may be observed in the vicinity of the PA field, as individuals sometimes occur in shallow water both along the coast and offshore (Perlov et al. 1996, 1997).

6.2.4 Minke Whales (Balaenoptera acutorostrata)

Minke whales are designated as Lower Risk/Near Threatened by the IUCN. They are the most numerous of the baleen whales remaining in the Okhotsk Sea. They are widely distributed and tend to remain in large bays, where they feed mainly on crustaceans and fish, although their diet varies greatly with the season. Minke whales are found along the entire east coast of Sakhalin Island. They are usually encountered in Terpeniie and Sakhalin bays (Sobolevsky 1984). About 19,000 individuals occur in the Sea of Okhotsk (Buckland et al. 1992; Vladimirov 1994), and 3000 to 3500 are estimated to inhabit the area east of Sakhalin Island, and are commonly seen in the PA field. Minke whales are noted for their curiosity around ships (Perrin and Brownell 2002).

6.2.5 Sperm Whales (Physeter macrocephalus)

Sperm whales are not considered endangered in the Sakhalin region but are listed as Vulnerable by the IUCN. They occur throughout the eastern and southern areas of the Sea of Okhotsk, but the waters offshore the Kuril Islands appear to be the centre of distribution for this species in the region. During the summer and autumn period, the total population of sperm whales within the Sea of Okhotsk is estimated to be 1000 individuals (Vladimirov 1994). Sperm whales mainly feed on cephalopods, but also eat some fish. Approximately 200 to 300 sperm whales are believed to inhabit waters seasonally along eastern Sakhalin Island; they are most frequently seen around Cape Terpeniy, Cape Aniva and adjacent waters. Because of the absence of focused research, most observations are anecdotal and often unreliable (Perlov et al. 1996, 1997). Sperm whales are unlikely to be encountered in the PA field area, as they are a deep-water species that is rarely seen over continental shelves, i.e. inshore of the shelf break.

6.2.6 Orca / Killer Whales (Orcinus orca)

Orcas, or killer whales, are designated as Lower Risk/Conservation Dependent by the IUCN. They have been recorded throughout almost all salt-water and some fresh-water areas, including many long inlets, narrow channels and deep embayments. These animals possess a complex vocal repertoire with variation in signals between populations and social groups (Deecke et al. 1999, 2000; Miller and Bain 2000; Thomsen et al. 2001; Yurk et al. 2002).

They are found throughout the Sea of Okhotsk, especially along the coasts. This species is frequently encountered in the vicinity of the Kuril Islands, western Kamchatka, and in the northern and southern parts of the Sea of Okhotsk. In total, 2500 to 3000 animals are estimated to inhabit the Sea of Okhotsk (Vladimirov 1994). Orcas occur along the entire eastern coast of Sakhalin Island at a total number estimated to be as high as 300 to 400 animals.

Orcas have been well studied in the northeast Pacific, offshore British Columbia and Alaska. Two groups of orcas are described, viz. residents and transients, based on morphology, ecology, genetics, and behaviour (Baird et al. 1992; Hoelzel et al. 1998; Baird 2001; Yurk et al. 2002). Residents live in large pods of six to 50 animals and prey mostly on fish, in particular, salmon (Ford et al. 1998; Saulitis et al. 2000; Anon 2004). Transients form small pods of two to four animals and feed on marine mammals such as seals, sea lions and porpoises, and also sea turtles, sea birds, as well as sea and river otters (Baird and Dill 1995, 1996; Ford et al. 1998; Baird and Whitehead 2000; Saulitis et al. 2000).

Orcas are likely to be observed in the PA field, and have been observed regularly during shore, aerial, and vessel-based distribution surveys (Sobolevsky 2000, 2001; Razlivalov 2004; Shulezhko et al. 2004; Sakhalin Energy Marine Mammal Observers Sightings Database 2006). Most sightings were of single individuals or small groups up to 30 individuals.

6.2.7 Beluga /White Whales (Delphinapterus leucas)

Belugas, also known as white whales or *belukhas*, are designated as Vulnerable by the IUCN (IUCN 2007), but are not considered endangered in the Sakhalin region. Belugas have a circumpolar distribution in the northern hemisphere. In the summer, belugas are associated with estuaries where animals moult. In autumn, they are driven away from bays and estuaries by ice to winter primarily in polynyas near the edges of pack ice or in areas of shifting ice. They are abundant throughout the Sea of Okhotsk, although their distribution is variable. There are principally three populations of belugas in the Sea of Okhotsk (Perlov et al. 1996, 1997):

- Sakhalin-Amur population (7,000 to 10,000 individuals)

- Shantar population (3,000 to 5,000)
- North-Okhotsk population (about 10,000)

The total number of belugas inhabiting the Sea of Okhotsk during the summer and autumn is estimated to be 20,000 to 25,000 individuals (Vladimirov 1994). Belugas do not permanently inhabit the waters off eastern Sakhalin Island, but are present in relatively small numbers (400 to 500 individuals) in the waters off north-eastern and northern parts of the island during their spring migration. Areas where belugas are known to form large and stable concentrations are Sakhalin Bay, bays in the Shantarskie Islands, and Gizhiginskaya and Penzhinskaya bays. These areas are a significant distance from the eastern coast of Sakhalin Island, but observations made more than a century ago indicated the existence of belugas in Terpeniie Bay and in the Poronai River. Arsen'ev (1939) reported that in the 1930s, belugas were sometimes observed along the eastern coast of Sakhalin Island. Adult animals mostly feed on fish, whereas young animals also feed on invertebrates. TINRO scientists conducted numerous surveys of the eastern coast of Sakhalin Island in the 1980s, and belugas were only found in 1989 when approximately 100 animals were observed among large ice floes near and southeast of Cape Elizabeth, at the northern tip of the island (Perlov et al. 1996, 1997). On 2 June 1989, up to 30 individuals were found in Nyiskii Bay, and about 50 animals moving northwards were seen north of the bay (between Chaivo and Piltun bays). Nyiskii Bay is likely to be the southern limit of the distribution of this species in the Sea of Okhotsk (Perlov et al. 1996, 1997). Belugas are only expected to be seen off north-eastern Sakhalin Island during their spring migration and should not be encountered during the proposed survey.

6.2.8 Dall's Porpoises (Phocoenoides dalli)

Dall's porpoise is designated as Lower Risk/Conservation Dependent by the IUCN. It is endemic to the Northern Pacific and one of the most numerous species of cetaceans in the Sea of Okhotsk (20,000 to 25,000 individuals). They rarely form large concentrations, and feed on schooling fishes and cephalopods. Although sometimes seen near land, Dall‘s porpoises are most often observed far offshore in waters > 180 m deep. The western North Pacific population of Dall‘s porpoise follow a well-defined annual migration in which the Japanese population moves northward to summer in the Sea of Okhotsk and around the Kuril Islands. About 3500 to 4000 individuals occur in waters along the entire eastern side of Sakhalin Island, (Shuntov 1995). Dall‘s porpoises are apparently more common south of Cape Terpeniie. In 1965 to 1971, A.E. Kuzin and A.S. Perlov regularly observed Dall‘s porpoises southeast of Terpeniie Bay during the spring and summer, and east of Aniva Bay during the autumn and winter. Most observations have occurred between those two bays (Kuzin et al. 1984). Surveys in September 1990 revealed the presence of several groups of Dall‘s porpoises north and northeast of Cape Elizabeth. Twenty-one groups totaling 80 animals were recorded on 11 September and 13 groups of 70 individuals were recorded on 12 September. In 1993, Dall's porpoises were seen singly and in small groups (three to five animals) between Terpeniie Bay and Aniva Bay. Shuntov (1995) observed them in and around Terpeniie Bay, and east of Aniva Bay, while. Sobolevsky (2000) observed them often in Terpeniie Bay and to the northeast of Cape Terpeniy. Dall's porpoises are unlikely to be commonly encountered in the vicinity of the PA field, as they prefer deep, offshore waters (Jefferson 2002). However, Dall's porpoises have been sighted in shallow (~ 20m) waters off Piltun Bay.

6.2.9 Harbour Porpoises (Phocoena phocoena)

Harbour porpoises are designated as Vulnerable by the IUCN. The harbour porpoise is a fairly abundant species and prefers shallower, inshore waters of the continental shelf (Bjørge and Tolley 2002). In the Sea of Okhotsk, the species inhabits waters near the Kuril Islands, along the west coast of Kamchatka, along the east coast of Sakhalin Island, in Sakhalin Bay, and north of the Shantarskie Islands (Perlov et al. 1996, 1997). Sobolevsky (2000) reported seeing single individuals and small groups in coastal areas adjacent to Lunsky Bay. Numerous sightings of harbour porpoise have been recorded in waters along Piltun Bay by Sakhalin Energy marine mammal observers.

6.2.10 Baird's Beaked Whales (Berardius bairdii)

Baird's beaked whales are not considered endangered in the Sakhalin region but are designated as Lower Risk/Conservation Dependent by the IUCN (IUCN 2007). Baird's beaked whales are endemic to the North Pacific. The eastern and western Pacific populations are migratory, arriving at the continental slope in summer and autumn. They can usually be found in deep waters over the continental slope, but they do occur in shallow waters in the Sea of Okhotsk (Kasuya 2002). Approximately 1000 to 1500 animals occur in the Sea of Okhotsk along the islands of the Kuril archipelago, the coast of Kamchatka, east Sakhalin Island, in Sakhalin Bay, near Shantarskie and Ion islands, and in the southern part of the Sea of Okhotsk. About 250 to 300 individuals occur in waters along the southern part of Sakhalin Island, mainly in Aniva Bay and east of Cape Aniva. Recent observations of this species are scarce, and most of them have been made in the southern part of the Sea of Okhotsk near the southern coast of Sakhalin Island, in La Perouse Strait, and east of Cape Terpeniy (Perlov et al. 1996, 1997). In winter-spring 2007 and early winter 2008, observers reported >30 Baird's beaked whales (during 13 separate sightings) in heavy ice conditions along Sakhalin's south-east and north-east coast (ENL, pers. comm., 2007).

6.2.11 Pacific White-sided Dolphins (Lagenorhynchus obliquidens)

Pacific white-sided dolphins are not rated in the Red Book of the Russian Federation and are classified as Lower Risk/Least Concern on the IUCN Red List of Threatened Species (IUCN 2007). This species is among the most numerous inhabiting the north-western part of the Pacific Ocean. They are often found in large groups (average of 90) but sometimes concentrate in groups of up to 3000 individuals (Waerebeek and Würsig 2002). They appear to be most common in the southern part of the Sea of Okhotsk, along the Kuril Islands, at Cape Aniva, and in La Perouse Strait (Perlov et al. 1996, 1997). Pacific white-sided dolphins are mostly pelagic, moving offshore in spring and summer in rough synchrony with movements of anchovy and other prey (Waerebeek and Würsig 2002). They do not appear to be common in shallow waters along the northeast Sakhalin coast and are likely uncommon in the PA field.

6.2.12 Short-beaked Common Dolphins (Delphinus delphis)

Short-beaked common dolphins are classified as Lower Risk/Least Concern on the IUCN Red List of Threatened Species (IUCN 2007). They are found throughout the temperate and tropical waters of the Pacific. This species is highly gregarious and may be seen in groups of more than 1000 animals; it is the most common dolphin in offshore waters (Perrin 2002). The world population is believed to be several million strong. Short-beaked common dolphins occur in the southern part of the Sea of Okhotsk, along the Kuril Islands and in waters along the west coast of Kamchatka. This species also inhabits the waters east of Sakhalin Island and north of the Shantarskie Islands (Perlov et al. 1996, 1997).

6.2.13 Bottlenose Dolphins (Tursiops truncatus)

Bottlenose dolphins are classified as Data Deficient on the IUCN Red List and are fairly uncommon in the Sea of Okhotsk. They occupy the southern half of the Sea of Okhotsk and may be found up to the central Kuril Islands, and from Cape Terpeniie south to Cape Aniva and Aniva Bay (Perlov et al. 1996, 1997). Bottlenose dolphins are primarily coastal, but also occur over the continental shelf, especially over the shelf break (Wells and Scott 2002). Bottlenose dolphins are unlikely to be found in the PA field area but do occur further to the south.

6.3 Pinnipeds

Eastern Sakhalin Island is one of the major reproductive regions for pinnipeds in the Sea of Okhotsk. The total number of pinnipeds in this area has not changed significantly since the 1980s (Perlov et al. 1996). Six species of pinnipeds occur in the vicinity of eastern Sakhalin Island. Four species of true or ice seals viz. ringed seals (*Phoca hispida*), largha or spotted seals (*Phoca largha*), ribbon seals (*Histriophoca fasciata*) and bearded seals (*Erignathus barbatus*), are closely associated with the ice through the winter-spring season. Two species of eared seals, viz. the northern fur seal (*Callorhinus ursinus*) and the Steller sea lion (*Eumetopias jubatus*), are mainly open-water visitors to the area. Although sea otters were reported from southern Sakhalin Island in the 1960s, they have not been seen near Sakhalin Island in recent years.

6.3.1 Ringed Seals (Phoca hispida)

Ringed seals are generally regarded as the most numerous northern pinnipeds. The subspecies (*P. hispida ochotensis*) is classified as Lower Risk/Least Concern on the IUCN Red List of Threatened Species and is harvested from the Sea of Okhotsk. Ringed seals are not listed in the Red Book of the Russian Federation. Sealing was unregulated between 1955 and 1968 and the average annual catch during this time was about 78,500 ringed seals (Fedoseev 2000). Since then sealing has been restricted and is now subject to compliance monitoring and scrutiny by scientific review committees. The species is abundant within the Sea of Okhotsk and is found along the entire eastern coast of Sakhalin Island (Fedoseev 2000). From aerial surveys conducted between 1968 and 1990, it is estimated that the average population within the Sea of Okhotsk was approximately 750,000, with the waters of eastern Sakhalin Island supporting a multi-year average of approximately 130,000 (Fedoseev 2000). Between year variation in the Sea of Okhotsk population was low, about 20% (Fedoseev 2000), but two surveys along the eastern coast of Sakhalin Island in 1968 and 1969 showed greater fluctuations in numbers. In 1968 and 1969, respectively, the estimated ringed seal populations were 28,500 and 138,000 on north-eastern Sakhalin Island, and 15,000 and 40,000 on south- eastern Sakhalin Island (Fedoseev 1971). An estimate of 140,000 to 180,000 has been used in recent years by the Russian Federation to calculate a total admissible catch for eastern Sakhalin Island (V. Vladimirov, pers. comm. 2007). Ringed seals breed, whelp and moult on the ice, often forming large concentrations during the winter to spring months. As the ice thickens in late autumn and winter, ringed seals maintain openings in ice more than 2 m wide to breathe. As snow accumulates over breathing holes the seals may excavate lairs. Ringed seals in the Sea of Okhotsk give birth on shore-fast ice, not in lairs as they do in other areas. The highest densities of breeding adults are found on stable land-fast ice, while non-breeders concentrate on the moving pack ice. Ringed seals also remain in the region during the open water period and are found hauled out on land and in near shore waters during the summer. During the spring, summer, and autumn, ringed seals spend most of their time swimming and feeding among the ice floes. Ringed seals are often described as being cautious and easily disturbed by human activity (Burns and Harbo 1972; Burns and Frost 1979; Alliston 1981; Nowak 1999). The species has been observed regularly within Nyisky, Lunsky, Chaivo and Piltun bays, predominantly at the mouths of estuaries, rivers, straits and channels connecting north-eastern Sakhalin Island‘s lagoon habitats with the sea (Grachev 2006). In summer 1999, ringed seals were present at some rookeries (traditional locations of annual breeding aggregations) and scattered along the coast in the area surveyed from Niysky Bay to Piltun Bay (Sobolevsky 2000). In 2000, their distribution was similar in the larger area surveyed (Lunsky Bay to Piltun Bay), but their numbers had increased in Chaivo and Piltun bays (Sobolevsky 2001). Aggregations of between 20 and 70 individuals are often recorded. The species' main food sources consist of euphausiid shrimps, walleye pollock fry, Pacific herring, Asian smelt and sand lance. Shrimp and crabs represent a lesser constituent (Nikolaev and Skalkin 1975).

6.3.2 Largha Seals (Phoca largha)

Largha seals, also known as spotted seals, are classified as Lower Risk/Least Concern on the IUCN Red List of Threatened Species and are harvested from the Sea of Okhotsk. This species is not listed in the Red Book of the Russian Federation. They are considered to be abundant within the Sea of Okhotsk and have been observed off the north- eastern coast of Sakhalin Island throughout the year; they are closely associated with the ice during much of this time (Sobolevsky 1984).

Based on ten years of aerial surveys conducted between 1968 and 1990, estimated numbers in the Sea of Okhotsk ranged from 180,000 to 240,000, with about 15 to 20% in the waters of eastern Sakhalin Island (Fedoseev 2000). Two surveys along the eastern coast of Sakhalin Island in 1968 and 1969 showed that largha seal numbers were fairly stable during that period: 12,000 to 13,000 animals, of which 4,000 individuals occurred in Terpeniie Bay

(Fedoseev 1971). More recently, numbers off eastern Sakhalin Island have exceeded 40,000 (Trukhin 1999). An estimate of 30,000 to 40,000 has been used in recent years by the Russian Federation to calculate total admissible catch for eastern Sakhalin Island (V. Vladimirov pers. comm., 2007). A breeding site between Sakhalin and Hokkaido Islands has also been established with 13,600 seals being observed in March and 6,500 in April 2002 (Mizuno et al. 2002). Largha seals are present along the entire eastern coast of Sakhalin Island, but during the winter months they are concentrated along the northern third of the Island in Terpeniie Bay. Largha seals show an annual migration in the autumn and winter to the edge of the pack ice. Pupping rookeries are generally located offshore on drift ice, especially on hummocked floes. Breeding takes place in late winter and spring and after breeding the seals stay on the ice to moult. Pups are born between February and March, and are weaned at one month. When the ice retreats, some seals migrate from the breeding region, whilst others remain in Sakhalin coastal waters forming many haul outs along the coast. Most of these haul outs are located at the mouths of salmon spawning rivers, especially at the inlet of Chaivo Bay, Cape Popova, Tyulenii Island and Aniva Bay (Blokhin et al. 2003a). During the summer, largha seals gather at approximately 54 rookeries at the mouths of rivers and on coastal bars along the east and south coasts of Sakhalin Island, including Lunsky, Nabilskyi, Piltun and Aniva bays (Kosygin et al. 1986; Lagerev 1988; Perlov et al. 1996, Bradford and Weller 2005). In July 2000, three rookeries with a total estimated 600 to 800 individuals, and in August 2000, four rookeries with a total estimated 4,000 to 5,000 individuals were observed on a sand spit at the entrance to Chaivo Bay, waiting for the annual migration of Pacific salmon (Sobolevsky 2001). In 1998, 16 to 489 largha seals were counted during systematic shore-based counts in Piltun lagoon between 24 July and 31 August (Bradford and Weller 2005), and in August 2000, one rookery with more than 500 individuals was recorded at the mouth of Piltun Bay (Sobolevsky 2001). There was a noticeable peak in seal numbers in late August (1998 and 2000) that appeared to coincide with seasonal herring and salmon runs (Bradford et al. 1999; Bradford and Weller 2005). In July 2000, more than 50 individuals were recorded at the mouth of Nabilskyi Bay and 38 individuals were recorded at the mouth of Lunsky Bay. In August, numbers increased to more than 100 at the mouth of Lunsky Bay, and remained the same at Nabilskyi Bay, possibly because of the continuous presence of fishermen there (Sobolevsky 2001). Rookeries were not present at Lunsky and Nabilskyi bays in September, and almost no seals were found at the mouth of those bays in October (Sobolevsky 2001). SakhNIRO has conducted baseline studies focused specifically on the Piltun, Lunsky and Aniva bay areas (SakhNIRO 1999a). In Piltun Bay, over 200 largha seals were observed. The majority of seals were encountered at the mouth to the bay, in the riptides and surf over the many sandbars. Beyond the bay mouth, the number of sightings diminished significantly, and about 2 km from the bay mouth no seals were observed. SakhNIRO noted, however, that the observed reduction in numbers beyond the bay may have been due to the presence of fishermen in the area who were fixing dog salmon nets at the time of the studies. On the shoreitself, the studies recorded that the bay was isolated due to the dense covering of dwarf cedar trees, alder and bushes, and inaccessible due to the high-energy wave environment over the sandbars when approaching from the water. These access difficulties minimise human occupation and associated disturbance that may explain the relatively high numbers of seals observed in Piltun Bay. In Lunsky Bay, SakhNIRO reported similar observations to those made for Piltun Bay. Largha seals dominated sightings, with over 150 individuals being recorded. Animals were mainly concentrated at the bay mouth, in the surf zone, over the sandbars and along the shore. Seals were generally not aggregating into groups but were encountered singly. As in Piltun Bay, the number of seals decreased with increasing distance from the bay mouth. It was noted that the animals exhibited cautious avoidance behaviour, diving 50 to 100 m away from the survey boats and leaving the open water area for the sandbars as soon as the vessels entered the bay. This behaviour may be a reaction to local hunting (SakhNIRO 1999a). In Aniva Bay, observed seal numbers were generally low, with only five largha seals being recorded (SakhNIRO 1999a). Adult seals feed on fish, cephalopods and crustaceans, whereas newly weaned pups apparently feed on euphausiids and small amphipods found around the ice floes (few data are available on ice biota from this region). When hauled out on ice or land, largha seals are very sensitive to approaches by aircraft, often moving into the water when the aircraft is still at a lateral distance of 1 km (Frost and Lowry 1990; Frost et al. 1993; Rugh et al. 1993).

6.3.3 Ribbon Seals (Histriophoca fasciata)

Ribbon seals are classified as Lower Risk/Least Concern on the IUCN of Threatened Species and are not included in the Red Book of the Russian Federation. They are harvested from the Sea of Okhotsk. The average annual catch during the period of unregulated sealing (1955-68) was up to 13,000 ribbon seals (Fedoseev 2000), but since that time sealing has been restricted. Ribbon seals are found off the northeast coast of Sakhalin Island with a concentration from Lunsky Bay to Chaivo Bay during winter-spring (Fedoseev 1997) beginning in February (Kosygin et al. 1985). Based on ten years of aerial surveys conducted between 1968 and 1990, estimated numbers in the Sea of Okhotsk ranged from 200,000 to 630,000, with an average of 350,000 to 450,000. The average in the waters of eastern Sakhalin Island was 110,000 (Fedoseev 2000). Two surveys along the eastern coast of Sakhalin Island in 1968 and 1969 showed that fluctuations in numbers might be significant for ribbon seals (Fedoseev 1971). In 1968 and 1969, respectively, the estimated ribbon seal populations were 47,000 and 27,000 on north-eastern Sakhalin Island, and 30,000 and 10,000 on south-eastern Sakhalin Island. Between 1975 and 1990, there was a trend of rapid growth and earlier maturation (Fedoseev and Volokhov 1991), and numbers began to increase rapidly in the late 1970s. Average numbers for the 1988, 1989, and 1990 surveys were approximately 550,000 in the Sea of Okhotsk (Fedoseev 2000). Estimates of 80,000-100,000 has been used by the Russian Federation in recent years to calculate total admissible catch for eastern Sakhalin Island (V. Vladimirov, pers. comm., 2007). During the winter and spring, the majority of animals are concentrated offshore on hummocked flows with open water areas along the north-eastern coast between Lunsky Bay and Chaivo Bay. Rookeries may be established 200 to 240 km from the ice edge. In years where there is low ice cover or early ice retreat, the seals may move to coastal waters, where they establish moulting rookeries on drifting ice. Ribbon seals are not known to establish coastal rookeries. As the ice melts, the density of animals on the remaining ice cover increases. When the ice disappears altogether, the seals convert to a completely pelagic lifestyle, and are distributed across the entire Sea of Okhotsk. Ribbon seals are reportedly easy to approach and are not easily disturbed (Nowak 1999). In the southern part of the Sea of Okhotsk, ribbon seals have a higher abundance than ringed seals but are less abundant than largha seals. No ribbon seals were observed during surveys conducted in Terpeniya Bay and Aniva Bay by SakhNIRO in September 1998 or by DVNIGMI in July 2001 (DVNIGMI 2002). Ribbon seals feed predominantly on pelagic fish such as walleye pollock, Pacific cod and capelin, cephalopods and crustaceans (LGL 2003).

6.3.4 Bearded Seals (Erignathus barbatus)

Bearded seals are classified as Lower Risk/Least Concern on the IUCN Red List of Threatened Species and are not included in the Red Book of the Russian Federation. They are harvested from the Sea of Okhotsk and the average annual catch during the period of unregulated sealing (1955-68) was approximately 10,000 individuals (Fedoseev 2000), but since that time sealing has been restricted. They are strongly associated with the ice and they tend to be concentrated to the north of the Sea of Okhotsk. Fedoseev (2000) estimated that there are 200,000 to 250,000 bearded seals in the Sea of Okhotsk, including 60,000 to 75,000 in the waters of eastern Sakhalin Island. More recent estimates report 350,000 seals in the Sea of Okhotsk and 35,000 to 40,000 seals in the eastern Sakhalin region (V. Vladimirov, pers. comm., 2007). Bearded seals are usually found in shallow waters over the continental shelf, avoiding areas of continuous, thick, shore-fast, or drifting ice, but favouring moving ice with numerous open water gaps. In winter-spring, beginning in February (Kosygin et al. 1985), they occur all along the northeast coast of Sakhalin Island (Fedoseev 1971). In summer, they are scattered along the northeast and west coasts in low numbers, occurring at some rookeries but not in large numbers; during summer 1999, bearded seals were present at some rookeries and scattered along the coast in the areas surveyed (from Niyskiy Bay to Piltun Bay), but were not common and were observed only as single individuals (Sobolevsky 2000, 2001). In 2000, the distribution was similar in the area surveyed (Lunsky Bay to Piltun Bay), but they occurred in groups of 5 to 10 animals, and more were seen in coastal rookeries than in 1999 (Sobolevsky 2001). The main reproductive groups are observed between Cape Elizabeth, at the north of the island, and 50°N (approximately halfway down the island). Bearded seals generally tend not to congregate on ice, but occur singly on the shear zone between shore-fast and drift ice (Nikolaev and Silishchev 1982 in LGL 2003). The only known large haul-out locations are gravel beaches on the north-western coast of Sakhalin Island, where they come on shore in large numbers (~2,000) during the summer to rest and moult (Kosygin et al. 1986). Bearded seals often stay close to the water when hauled out and will typically dive immediately if disturbed (Burns and Harbo 1972; Burns and Frost 1979; Alliston 1981; Nowak 1999). Bearded seals are typically benthic feeders, feeding upon crustaceans, gastropods, bivalves, annelids and cephalopods. The seals also feed upon some fish species including walleye pollock, sand lance and plaice (Bukhtiyarov 1990 in LGL 2003). As benthic feeders, the distribution of bearded seals is restricted to depths of less than 200 m).

6.3.5 Northern Fur Seals (Callorhinus ursinus)

Northern fur seals are listed as Vulnerable on the IUCN Red List of Threatened Species but are not considered rare in the Sea of Okhotsk and are a harvested species in Russia. In the Sea of Okhotsk, the total population may be as high as 200,000 individuals (V. Vladimirov, pers. comm., 2007). Approximately 95,000 to 100,000 individuals are found in a rookery on Robben (Tuyleni) Island, southeast of Cape Terpeniie, and in adjacent waters eastward of the Island (V. Vladimirov pers comm., 2007). Most northern fur seals occur along the south-eastern coast of Sakhalin Island. Small numbers are reported in Aniva Bay during the ice-free season. They feed on small schooling fish and cephalopods, especially squid (Sobolevsky 1984). The northern fur seal is a highly pelagic species, with only young fur seals spending appreciable amounts of time on land. Fur seals concentrate in areas of upwelling over seamounts and along continental slopes and are rarely encountered close to shore except in the vicinity of rookeries. Northern fur seals typically winter in the Sea of Japan, migrating north to the Sea of Okhotsk in the spring to return to established rookeries. Most pups are born from late June to late July and are weaned at three to four months. While breeding males may remain at the rookeries for the entire breeding season, females return to sea regularly. Large numbers of fur seals were killed for their pelts in the 19th and early 20th centuries; there have also been a significant number of fur seals killed accidentally by entanglement in fishing nets (Lander and Kajimura 1982). Northern fur seals enter Piltun Bay infrequently (Sobolevsky 2000). In summer 2000, they were observed at some rookeries during surveys from Lunsky Bay to Piltun Bay (Sobolevsky 2001). Small numbers of animals have been recorded within Aniva Bay during the spring and autumn migrations and some sightings have been made between Lunsky and Piltun Bays (DVNIGMI 2001). During surveys by SakhNIRO in September 1998 and by DVNIGMI in July 2001, animals were only observed in Terpeniya Bay (including the Poronaysk Port area and Cape Terpeniy) where they were abundant. Approximately 75,000 to 80,000 individuals were observed at the rookery on Tyuleni Island, some 20 km southeast of Cape Terpeniya, and in adjacent waters eastward of the Island (Vladimirov 2002 in LGL 2003).

6.3.6 Steller Sea Lions (Eumetopias jubatus)

Steller sea lions, also known as northern sea lions, are listed as Vulnerable in the Red Data Book of Russia and as Endangered in the IUCN Red List of Threatened Species. Steller sea lions are distributed around the North Pacific Ocean rim from northern Hokkaido, Japan through the Kuril Islands and Sea of Okhotsk, Aleutian Islands and central Bering Sea, southern coast of Alaska and south to the Channel Islands, California. The world population of Steller sea lions includes two stocks divided at 144°W longitude (Cape Suckling, just east of Prince William Sound, Alaska). The stock differentiation is based primarily on genetic differences, but also on differing population trends in the two regions. Steller sea lions have undergone dramatic declines in population across large portions of their range. This is thought to be due to a combination of habitat loss, habitat degradation, invasion by alien species, and the effects of hunting. The population has declined by approximately 10% annually since the early 1990s. Approximately 9,500 to 10,000 Steller sea lions now inhabit the Sea of Okhotsk with approximately 1,100 individuals in the eastern Sakhalin region (Burkanov et al. 2006; V. Vladimirov pers. comm., 2007). In 2005, more than 1,500 adult and 407 newborn animals were recorded at the only known breeding rookery on Sakhalin, located on Tyuleni Island (Kuzin 2006). Two main bachelor haul outs have also been identified, on Kamen Opasnosti Rock in La Perouse Strait and Kuznetsova Cape on the south-western coast of Sakhalin Island. Kamen Opasnosti Rock is used throughout the year, with up to 700 animals congregating there and with more animals occurring in the late winter and spring. The haul out at Kuznetsova Cape is also used year-round with more animals occurring in the late winter and spring; approximately 350 to 500 animals have been observed at this location (LGL 2003; Cupakhina et al. 2004). During harsh winters when land ice or solid ice at the shore is formed, the sea lions leave the area (Cupakhina et al. 2004). A smaller haul out is also present on the harbour breakwater at Nevelsk (on the western coast, 50 km south of Kholmsk). Animals start hauling out in late January through February and abandon the location in late November (Cupakhina et al. 2004). During the summer, animals may be seen along the entire eastern side of Sakhalin Island and across the northern section of Sakhalin Island into Amurskiy Bay. In September 1982, more than 200 Steller sea lions were recorded along the western coast of Sakhalin Island in Tatar Strait (Berzin et al. 1984). Rookeries tend to be located on remote, rocky coasts and islands. The number of Steller sea lions at rookeries begins to increase in early May and reaches a maximum in July. Females give birth from mid-May to mid-July, with most births occurring in early June. Fish, such as Atka mackerel, walleye pollock, salmon, sculpins and sandlance dominate the diet of Steller sea lions (Sobolevsky 1984; Waite and Burkanov 2004). Steller sea lions may occur in small numbers near the PA license area. Their closest large rookery is more than 300 km to the south of Lunskoye. They enter Piltun Bay infrequently (Sobolevsky 2000), and were not observed in summer 2000 during surveys from Lunsky Bay to Piltun Bay (Sobolevsky 2001). In 2005, 138 observations of 151 individuals were recorded during Sakhalin Energy construction activities and it was considered a fairly common species for the project area. It was encountered in all operational areas and during transit, however most of these observations were recorded in the Lunskoye area (SEIC 2006).

6.4 Birds

A baseline for birds is not presented in this document. As identified from previous assessments, no significant impact will be likely, therefore birds have been screened out.

6.5 Hunting of Marine Mammals and Birds

6.5.1 Hunting of Marine Mammals

Commercial, aboriginal and research groups hunt seals and other marine mammals in the Sea of Okhotsk. Traditionally, seal meat, fat (oil) and liver were used for food, while clothes and footwear were made out of sealskin. Today, many indigenous people still consume seal oil and meat, and they use seal fur in souvenir making. The main marine mammal hunting grounds are Chaivo, Nysky, Nabil and Lunsky bays, where largha, ringed and ribbon seals are hunted during the winter months. Hunting of seals in the Piltun area is mainly confined to shoreline areas and occurs through sea ice during the winter. Available evidence indicates that that seal populations have remained constant in recent decades indicating a sustainable level of hunting is being achieved. Commercial whaling is not permitted and does not occur in coastal areas.

6.5.2 Hunting of Birds

The hunting of ducks is officially prohibited in the Piltun area. However, illegal hunting practices have been observed in the bay during the autumn migrations when the largest numbers of birds are present. During this period, it has been reported that numerous shots have been heard and that the birds in the area display random flight behaviour in response to this threat (Fauna Information and Research Centre 2001). Some gull and duck egg collecting is undertaken by indigenous people, but there is no information available on the scale of this activity or of its likely impact on local breeding bird populations.

6.6 Ports & Vessel Navigation

Shipping is the primary method for import and export of goods to and from Sakhalin Island. There are 11 ports on the island, the two main ones being Korsakov and Kholmsk in the south, where ice-free conditions prevail for most or all of the year. Major merchant shipping routes do not extend northwards from these southern ports. During the winter only icebreakers and specially strengthened (ice class) vessels can operate in the northern seas of Sakhalin Island due to the volume and thickness of sea ice that restricts the importing and exporting capabilities of these areas. Existing, non-industrial vessel activity within the Piltun-Astokh and Lunskoye areas is therefore low and is likely to include only small numbers of commercial fishing ships during the summer-autumn months as well as vessels servicing the oil and gas platforms of PA-A (Molikpaq), PA-B and LUN.

6.6.1 Submarine Infrastructure

There are no existing, non-industrial submarine cables or other submarine infrastructure in the vicinity of the Piltun-Astokh area.

6.6.2 Maritime Archaeology & Cultural Heritage

Sea level at the end of the last glaciation, some 12,000 years ago (Early Holocene) was approximately 120 m lower than today and the present seabed in the Piltun-Astokh area was an exposed land area. As sea level rose following the melting of the large continental ice sheets, land areas became inundated. This former land surface, now covered by marine sediments, may contain fossilised organic remains and, potentially, evidence of past human presence. The Laboratory of Archaeological Research at the Yuzhno-Sakhalinsk State University considers the potential for finds-of archaeological interest to be high in marine areas up to sea depths of 100-120 m, with the highest concentrations likely to occur in water depths of 10-20 m. There are no known wrecks of maritime archaeological interest in the Piltun area.

6.6.3 Military Interests

There are no known military interests (military bases, ports, establishments or unexploded ordinance) in the Piltun-Astokh area or surrounding areas.

7 Impacts Assessment

(See Tables 2a and 2b below for results)

7.1 Underwater Noise (Marine Mammals)

7.1.1 Risk of Underwater Noise Impacts to gray whales and other marine mammals

Marine mammals rely heavily on the use of underwater sound to communicate and to gain information about their environment. Experiments have shown that they hear, react to, and can have their hearing affected by anthropogenic sounds of many kinds (see: reviews by Southall et al. (2007; 2016), Ellison et al., 2012; Finneran (2015; 2016)). Underwater noise thus has the potential to interfere with the ability to communicate, find food and avoid harm (e.g. predation, vessel strike); noise can affect the animals' distribution, abundance, behaviour and general well-being. Potential impacts of noise exposure which have been most commonly considered from an environmental compliance perspective are:

- Temporary or permanent hearing threshold shifts (TTS and PTS respectively), whereby the animal is impaired by losing hearing sensitivity following noise exposure or for a period of time during which it recovers or indefinitely. Permanent hearing loss constitutes direct physical injury
- Behavioural modification, such as deflection from a migration path, disruption of mother-calf bonds, avoidance of an area, changes in orientation, changes in respiration rates and interrupted feeding

7.1.2 Auditory effects on marine mammals

Noise at relatively lower received levels can interfere with (mask) the detection of important sounds (Erbe *et al* 2016). While explicit criteria have generally not been identified and are not proposed here, such interference may limit the ability of animals to detect important signals. Temporary Threshold Shift (TTS) is a form of hearing impairment that can be caused by exposure to relatively louder sounds. While experiencing TTS, hearing sensitivity is decreased and the animal's functionality in compromised. Although it has only been measured directly in a few marine mammal species (and no whales), TTS can last from minutes or hours to days, the magnitude of which depends on the level and duration of sound exposure, among other considerations (see: Finneran, 2015). For sound exposures at or somewhat above the TTS onset threshold, hearing sensitivity usually recovers after exposure to the sound ends; the recovery time as well as the amount of sensitivity loss increase with increasing exposure level. However, repeated sound exposure during the TTS period that can lead to permanent damage (i.e. further loud noise on a temporally damaged ear can make the damage permanent. Beyond a certain limit, Permanent Threshold Shift (PTS) can occur. This can be due to several different kinds of unrecoverable physical damage to structures within the ear. Physical damage to a marine mammal's hearing apparatus can occur from exposure to pulsed sound with high peak pressures, especially if the pulses have very short rise times or from extended or quite high levels of continuous, non-impulsive noise. Such damage can result in permanent decrease in functional sensitivity of the hearing system at some or all frequencies.

Noise exposure thresholds for physical injury from auditory effects typically consider permanent hearing loss. The thresholds for physical damage adopted in this ESHIA are 190 dB re 1 µPa root mean square sound pressure level (rms SPL) for pinnipeds and 180 dB re 1 µPa for cetaceans, for both pulsed and continuous noise. For the specific case of exposure of Gray Whales to pulses from seismic surveys, however, this ESHIA recognises the exposure criteria recently developed by the Noise Task Force (NTF-13 report). They reviewed all available information on hearing, potential effects of noise on hearing, and proposed noise exposure criteria for estimating potential injury. While noting the presence of additional scientific data for some species and more recent proposed exposure criteria, the NTF noted the complete absence of direct data for whales and thus derived an adapted and slightly more precautionary interpretation of the recommendations of Southall et al. (2007). This resulted in an exposure criterion for physical damage of 195 dB re 1 μPa^2-s cumulative sound exposure level (cSEL) frequency, calculated using the low frequency cetacean M-weighting function defined by Southall et al. (2007) over a single survey line. The NTF also defined a measurement and/or modelling approach with which to determine a precautionary interpretation of the physical range over which this received level may occur for whales. The application of this approach for the specific case of the proposed 2018 seismic survey off Sakhalin was determined to result in an exclusion zone of 1 km around the seismic survey (depending on SEER approval and exclusion zone figure); any whale detected within this radius of the source when active would result in the termination/postponement of the line acquisition until safe to proceed.

TTS, PTS and non-auditory physiological effects on all cetaceans and pinnipeds are Moderate if unmitigated and Minor, if mitigated; Disturbance and short-range avoidance movements in non-endangered baleen whales is considered Moderate if unmitigated and Minor, if mitigated; Disturbance and short-range avoidance movements in odontocetes and pinnipeds is considered Moderate if unmitigated and Minor, if mitigated; Disturbance and short-range avoidance movements in North Pacific right whales is considered Moderate if unmitigated and Minor, if mitigated;

Disturbance, short-range avoidance movements and reduced feeding opportunities, possible loss of breeding potential, reduced growth, reduced survival in Gray Whales are considered Minor if unmitigated and Negligible, if mitigated.

7.1.3 Marine Mammal Behavioural Modifications within the Feeding Areas

Based on scientific information available about behavioural reactions of cetaceans to anthropogenic sound, 120 dB re 1 µPa rms SPL has been adopted as the level at which substantial behavioural disruption from continuous noise can occur. A noise impact assessment and mitigation approach for gray whales has evolved based on the assumption that 50% of the animals would avoid an area ensonified above that threshold. This strategy includes criteria referring to (1) estimated amount of potential feeding area avoided and (2) duration of sounds above the threshold level in the feeding area. Both the scientific information and the noise impact assessment approach are described in more detail in Chapter 4 of the CEA (SEIC, 2004b). For pulsed noise Malme et al. (1983, 1984) documented avoidance reactions of migrating gray whales beginning at 160 dB re 1 µPa rms SPL, with 10%, 50%, and 90% probabilities of avoidance estimated at levels of 164, 170, and 180 dB re 1 µPa respectively. In this ESHIA a threshold of 163 dB re 1 µPa rms SPL[6] (156 dB per-pulse SEL) has been adopted for behavioural disruption from pulsed noise.

The area around the platforms is monitored for anthropogenic noise, especially sound entering the near-shore feeding zone with the capacity to harm whales and other marine mammals. Acoustic monitoring of the area around the platforms and supply vessels showed that the safe level is largely maintained but that peaks or periods of noise exceeding the adopted level are recorded occasionally though not related to routine operations. Noise level from routine marine operations entering the near-shore GW feeding area do not exceed safe levels. The acoustic threshold levels used in this ESHIA are summarized in the table below. However, mitigation will largely be achieved through a minimum shut-down distance from source to marine mammal, decreed by the SEER process to be not less than 1000 metres.

[6] The behavioural disruption threshold has now changed from 163 dB rms SPL to 156 dB per-pulse SEL. The latter is intended as an equivalent of the former expressed as a more stable metric (both to model and to measure).

7.1.4 Marine Mammal Noise Threshold Levels:

DESCRIPTION	THRESHOLDS
Hearing impairment due to physical damage	190 dB rms for pinnipeds
	180 dB rms for cetaceans other than gray whales 195 dB SEL (M-weighted for low frequency cetaceans) for gray whales
Behavioural disruption	120 dB rms for continuous noise
	163 dB rms (156 dB per pulse SEL) for pulsed noise
Note: These levels are guidelines that can change in specific situations, based on regulations, international precedents or for other reasons. Modelling has demonstrated a risk of TTS or PTS within the 500m radius of the source. Therefore, a precautionary approach has been applied, producing a 1000m exclusion zone. Zones ensonified to above behavioural thresholds (A-zones) are outside of the nearshore feeding grounds and thus not breached. However, some lines shot west of the nearshore feeding grounds will encroach and are therefore subject to additional mitigation. See Section 9 for details.	

7.2 Underwater Noise (Marine fishes, zooplankton, fish larvae and fish eggs)

One reason for the adoption of airguns as the standard energy source for marine seismic surveys is that, unlike explosives, they have not been associated with large-scale fish kills. Existing information on the impacts of seismic surveys on marine fish and zooplankton populations is still limited. However, a paper published in 2017 has provided evidence of high mortality of zooplankton, at greater distance than assumed previously, as a result of exposure to seismic survey airgun noise (McCauley, R. D. *et al.* Widely used marine seismic survey air gun operations negatively impact zooplankton. *Nat. Ecol. Evol*. **1,** 0195 (2017)). There are three types of potential effects on fish from exposure to underwater seismic and other anthropogenic sounds: pathological, physiological and behavioural. The specific received sound levels at which permanent adverse effects on fish could potentially occur are little studied and largely unknown. Furthermore, available information on the potential impacts of seismic surveys on marine fish involves studies of individuals or portions of a population and not at the population scale. The potential for pathological damage to hearing structures in fish depends on the energy level of the received sound and the physiology and hearing capability of the particular species. For a given sound to result in hearing loss, the sound must exceed, by some specific amount, the hearing threshold of the fish for that sound (Popper 2005). The consequences of temporary or permanent hearing loss in individual fish or a fish population are unknown.

Little is known about the mechanisms and characteristics of potential injury to fish from exposure to seismic survey sounds. McCauley *et al.* (2003) found that exposure to airgun sounds caused observable anatomical damage to the auditory structures of caged pink snapper. This damage had not been repaired in fish examined almost two months post exposure. However, the fish were exposed to high cumulative levels of seismic survey sound that may not be analogous to that experienced by free-ranging fish. Popper *et al.* (2005) documented TTS in two of three fishes in the Mackenzie River Delta but also found that broad whitefish that received an SEL of 177 dB re 1 $\mu Pa^2 \cdot s$ showed no hearing loss. In both cases, the sound exposure was greater than would have occurred in a typical seismic survey. TTS was also observed in studies involving goldfish and catfish (Amoser and Ladich 2003). In those experiments, fish were exposed to white noise (158 dB re 1µPa) for periods of 12-24 hours and were then tested for post- exposure hearing sensitivity. Both species showed a loss of hearing sensitivity, with sensitivity returning to normal in 3 days for the goldfish and 14 days for the catfish. Smith *et al.* (2004b) reported threshold shift in goldfish after just 10 minutes of exposure to white noise (160-170 dB re 1µPa), with recovery in 14 days. Wardle *et al.* (2001) suggest that in water, acute injury and death of organisms exposed to seismic energy depends on two features of the sound source: the received peak pressure and the time required for the pressure to rise and decay. Generally, as received pressure increases the period for the pressure to rise and decay decreases and the chance of acute pathological effects increases. However, numerous studies provide examples of no fish mortality upon exposure to seismic sources (Falk and Lawrence 1973; Holliday *et al.* 1987; La Bella *et al.* 1996; Santulli *et al.* 1999; McCauley *et al.* 2000a, b; Thomsen 2002; Hassel *et al.* 2003; McCauley *et al.* 2003; Popper *et al.* 2005). Some studies have reported, some equivocally, that mortality of fish, fish eggs, or larvae can occur close to seismic sources (Kostyvchenko 1973; Dalen and Knutsen 1986; Booman *et al.* 1996; Dalen *et al.* 1996), although in some cases, the treatment examined was very different from any real-world scenario. Saetre and Ona (1996) applied a 'worst-case scenario' mathematical model to investigate the effects of seismic energy on fish eggs and larvae. They concluded that mortality rates caused by exposure to seismic surveys are so low, as compared to natural mortality rates, that the impact of seismic surveying on recruitment to a fish stock must be regarded as negligible.

Fish Mortality Assessment: Unmitigated Impact is deemed to be Minor;
Mitigated Impact is deemed to be Minor
Fish Larvae and Eggs Assessment: Unmitigated Impact is deemed to be Moderate;
Mitigated Impact is deemed to be Moderate

7.2.1 Impacts of commercial fish resources

As discussed above, the proposed survey has the potential to affect marine fish. It is apparent from the available studies that fish responses to seismic sources are species specific and may differ according to the species' life stage. Immediate mortality and physiological damage to eggs, larvae, fry and adult and juvenile marine fishes is unlikely to occur, unless the fish are present within 5 m of the sound source (although mortality is far more likely to occur within 1 m). Behavioural changes resulting from increased noise levels may include disoriented swimming behaviour; displacement to areas outside of the noise disturbance; interruption of important biological behaviours (e.g., feeding, mating); shifts in vertical distribution and occurrence of alarm and startle responses. Some fish may be displaced from suitable habitat for hours to weeks, depending on the intensity and duration of the seismic survey work. The potential zone of ensonification that could potentially elicit a response from fish (i.e. displacement as a result of behavioural change) is likely to be localised and focused around the airgun array during firing, within tens of metres. Thus, a large area of coastal/offshore waters would remain unaffected (with regard to enhanced noise levels) or noise disturbance would be at levels below which a response from fish would be unlikely to occur. Significant areas of coastal waters would therefore not be disturbed during seismic firing to the extent that the migratory behaviour of salmonid fish would be disrupted. Potential migratory routes for salmon to coastal lagoons and river mouths would remain open and the available resource would not be diminished as a result of the survey. Available science and management literature demonstrates that, at present, there are no empirical data to demonstrate potential impacts to fish that reach a population-level effect and the information that does exist indicates that seismic surveys would be highly unlikely to result in significant impacts to marine fish or related issues (e.g. impacts to migration/spawning, rare species, fishing). Therefore, it is considered that although the seismic survey may have very localised and adverse impacts on fish in the immediate vicinity of the airgun array, the effect on the resource available to commercial fisheries would be negligible and any effect would be of a short-term nature. This conclusion is particularly relevant to the potential displacement of fish during migration through or adjacent to the survey area and their continued availability with regard to fisheries. In addition to the effects of increased noise levels, other potential impacts on fish may be caused by anchor or cable deployment and the accidental spillage of fuel/oil from vessels.

A standard, coarse filtration system is fitted to the seismic survey vessel to minimise the possibility of entrainment of fish into the seawater intakes. As a result of this measure, although there may still be some entrainment of small, pelagic fish via the seawater uptake, the effects of this on available resources will be negligible. As described below, the proposed survey area lies within offshore waters that, according to the Fishery Agency, do not support occasional commercial marine fishing activities. The few fisheries operating occasionally in the Piltun-Astokh area are of a subsistence nature and are conducted close to shore. The most important subsistence fishery is for salmon and is shore-based, with the majority of the fishing in north-east Sakhalin being undertaken to coincide with the migration of pink and chum salmon during the summer-autumn months. In the north-east of Sakhalin the peak migratory period for pink salmon and therefore the peak of fishing effort in the north-east generally occurs from the end of July to end-August and ends at the middle of September, although some fish may start arriving in offshore waters at the beginning of July (SakhNiro 1998). For chum salmon, there are two migratory movements of fish during the year (summer and autumn). The summer run, which takes place in July, is the minor of the two runs in the north-east with fish being much more abundant during the autumn run. Peak migration activity during the autumn occurs from mid-September to early October, with the beginning of the run occurring in mid-August in the majority of years (SakhNiro 1998). The seismic survey work is proposed to take place during June and possibly into July, over a three or four week period. It thus would occur outside of the main migratory period for pink salmon and would avoid the main autumn, chum salmon run. Potentially, there could be some overlap with the summer chum salmon run and the early part of the pink salmon run. However, it is considered that from a resource perspective that the timing of the survey would, if any disturbance were to occur, leave the majority of the resource and potential fishing effort (i.e. undertaken during the main runs) unaffected. It is also important to note that disturbance to migratory populations of salmon would be highly unlikely to occur during the seismic survey. On this basis, it is considered that given the location and timing of the seismic survey work, that the potential for disruption to migratory salmon populations and the resource available to local people in the north-east of the island is negligible. If the survey were to be delayed until later in the summer, the potential exists for an increased risk of disturbance to migratory fish populations, although as stated previously it is considered that any such effect is unlikely. In this situation, while the level of risk of disturbance may be slightly raised, it would be highly unlikely to be of such extent that local fishermen were not able to realise their subsistence quotas.

Assessment: Unmitigated Impact is deemed to be Minor;

Mitigated Impact is deemed to be Negligible

7.2.2 Damage to Fishing Gear

The seismic survey has the potential to interfere with fishing activities and damage fishing equipment (e.g. nets, lines, fixed gear) in the area. Damage to fishing equipment is a concern from both a safety perspective (i.e. potential risk to personnel on the fishing vessel and the survey vessels) and in terms of adverse reactions/complaints and subsequent compensation claims from fishermen whose equipment has been damaged (i.e. loss of equipment and temporary loss of earnings/livelihood). Where fishing is known to occur, this deploys coastal nets in shallow coastal waters, well outside of the survey area. Given the absence of commercial fishing in the areas, it is considered that the likelihood of significant interaction with fishermen is minor and the unmitigated risk is considered negligible. To avoid any potential conflicts, notifications will be issued prior to the start of the survey to alert any fishermen who may be planning to operate in the vicinity to avoid the survey area during the period of operations. The duration of the surveys (Piltun-Astokh streamer part will be 3 to 4 weeks; Piltun-Astokh OBN part will take a similar or smaller amount of time. (Lunskoye OBN will be 6-8 weeks)) and the limited area coverage indicate that the potential effect on any fishing activity will be short term and confined to a relatively small part of the near-shore fishing area available to local fishermen.

During the streamer part of the survey, in Piltun-Astokh, the scout vessel will be used to alert fishing vessels in the area of the ongoing activity and to remove any fixed fishing gear that

may potentially become damaged or cause damage to the survey equipment. Any compensation claims and conflicts with fishing activities will be resolved by the survey contractor in line with requirements of the Sakhalin Oblast Administration.
Provided these measures are implemented, the likely impact on both the ability of fishermen to realise potential quotas (i.e. maintain fishing effort) and the integrity of their fishing equipment (if present in the survey area) is considered to be of minor significance.

7.3 Impacts on the Local Social Environment, Economy and access to Natural Resources

The seismic survey vessel is expected to depart from its home-port and will travel to the seismic survey site fully supplied to conduct the survey. Contact with local communities is therefore very unlikely, except in the event of an accident or emergency when the vessel may be forced to visit port (likely to be in the south of the island) or personnel are airlifted to suitable facilities on the island for treatment.

The seismic-survey activities are mostly vessel based, therefore stresses to local community infrastructure, health care, and emergency response systems are expected to be negligible; consequently, social systems in these communities would experience no direct disturbance from the staging of people and equipment for the proposed survey. As discussed above, it is also anticipated that there would be a negligible impact on natural resources (i.e. regularly hunted animal species) that local people may target.

7.4 Impacts on Marine Traffic including vessel collision

Due to the meteorological conditions in the region, the majority of ports are located towards the south of Sakhalin Island where they remain free of sea ice for most of the year. For this reason, there are no merchant shipping routes in the vicinity of the Piltun-Astokh area. Levels of marine traffic in these areas are therefore expected be very low, consisting mainly of local fishing boats and some oil-field related traffic. Potential impacts from interactions between the seismic survey vessels and equipment and other marine traffic include:

- Damage to vessels and potential harm to crew
- Pollution from fuel, streamer oil or cargo spillage

All vessels involved in the survey work will adopt standard warning and navigation equipment and procedures in order to reduce the risk of collisions with any other vessels that may be present in the area. These will include the use of radar, foghorns and issuing a Notice to Mariners to warn that the survey is taking place and conveying the limited manoeuvrability of the survey vessel. The scout and guard vessels will also be available to warn marine traffic to keep clear of the seismic survey vessel and associated equipment. Collision risks with other vessels during transit to and from the survey also exist. Although these risks will be controlled by the adoption of standard navigation procedures the unmitigated risk of collisions is considered moderate and the mitigated impact considered Minor.

7.5 Entanglement

Entanglements occur when marine mammals become caught in cables, lines, nets or other objects suspended in the water column. During seismic operations, numerous cables, lines, and other objects primarily associated with the airgun array and hydrophone streamers will be towed behind the survey ship near the water's surface. OBN arrays may pose a risk from cables and marker buoys. Indirect node entanglement risk has arisen in dolphins. There is a case documented of a dolphin entangled in a buoy tether rope attached to a node array in January 2014 in the Gulf of Mexico (Fairfield 2014). Incidents of entanglement by mysticetes in fishing gear are well known. Heyning and Lewis (1990) noted that gray whales were the most frequently entangled species (94% of records) in Southern California. Most of the entangled gray whales were 3 years of age or younger (<10 m in length), and many of the live entanglements were released alive. However, it is unknown whether entanglement has any long-term effects on live-released whales (Moore and Clarke 2002). Visual observations during the proposed survey will monitor the towed array and other equipment. Past experience from surveys has shown that cetaceans tend to avoid the seismic vessel, further lessening the likelihood of any impacts related to entanglement. Onshore observers can monitor for the installation of salmon nets, alerting the authorities if these activities take place. Incidents involving entanglement of pinnipeds in fishing gear and other marine debris are also well known (Arnould and Croxall 1995; Hanni and Pyle 2002; Page *et al.* 2004). Northern fur seals have been particularly susceptible to entanglement. In some years over 50,000 fur seals in Alaskan waters were dying from entanglement in fishing nets and strapping bands (NRC 1995). So great was the mortality of northern fur seals, that their population was deemed directly threatened by entanglement. Adherence to the 2018 Monitoring and Mitigation Plan and 2018 Marine Mammal Protection Plan, for example, through visual observation of the area surrounding the seismic vessel by Marine Mammal Observers and crew during the survey will ensure that any close approaches to the equipment by pinnipeds are monitored and the appropriate action taken to ensure that entanglements do not occur.

The Unmitigated Impact is deemed minor and the Mitigated Impact is deemed Negligible.

7.6 Ship Strikes with Marine fauna

Studies indicate that vessel traffic may have negative impacts on marine mammals, particularly baleen whales, through collisions (e.g., Moore and Clarke 2002; Jensen and Silber 2003). Efforts are usually made by vessel operators to avoid marine mammals; in addition to injury or death of the animal, such collisions can result in damage to the vessel. Many species of baleen whales tend to show avoidance in response to vessels (reviewed in Richardson *et al.* 1995; Macleod *et al.* 2006). However, avoidance does not always prevent collisions, injury, and mortality of whales, especially for the slower-swimming species such as right whales (reviewed in Richardson *et al.* 1995; Jensen and Silber 2003). Collisions between ships and marine mammals occur in many parts of the world and has been summarized by Laist *et al.* (2001) and Jensen and Silber (2003). These datasets indicate that migrating gray whales appear more susceptible to collisions compared to other whale species (Laist *et al.* 2001). In the North Atlantic, endangered right whales are also known to be highly susceptible to vessel collisions, experiencing significant mortality and damage from collisions (Richardson *et al.* 1995; Laist *et al.* 2001; Jensen and Silber 2003). Shipping has been restricted in some areas of the Northwest Atlantic, such as the Bay of Fundy, during times when right whales congregate there. Off the east coast of the U.S., NMFS has recommended vessel routes and vessel speed reductions to reduce the number of collisions. Collisions have also been reported for other species of mysticetes, including humpback, fin, and minke whales (Barlow *et al.* 1994; Richardson *et al.* 1995; Laist *et al*. 2001; Jensen and Silber 2003). Although most whales try to avoid ships, collisions often occur when a whale attempts to flee ahead of the vessel (Richardson *et al.* 1995). Whales to the side or beneath the vessel can also be dragged into the vessel's propeller by the low pressure wave around the vessel (Knowlton *et al*. 1998). The likelihood of collisions increases during darkness and poor weather conditions, particularly fog, thunderstorms, and high seas. Particular care is needed to minimize the chance of collisions during poor visibility. It is unknown whether whales are always killed by such impacts. It also appears likely that most impacts are not reported. For example, large vessels may be unaware that an impact has occurred. Often, impacts are only realized after-the-fact if the whale remains caught on the front of the ship when the vessel enters port. Pinnipeds can probably move quickly enough to avoid collisions with ships. However, when feeding, pinnipeds may be inattentive to vessels. Fur seals are attracted to fishing vessels to feed and some are killed by the propellers (Richardson *et al.* 1995). Sea lions and seals have been seen with wounds and disfigurements caused by the propellers of powerboats. Between 1996 and 2000, two northern elephant seals were struck and killed due to ship strikes off California (Monterey Bay National Marine Sanctuary 2006). Evidence suggests that a greater rate of mortality and serious injury correlates with a greater vessel speed at the time of a ship strike (Laist *et al.* 2001; Vanderlaan and Taggart 2007). Most lethal and severe injuries to large whales resulting from documented ship strikes have occurred when vessels were travelling at 14 knots or greater (Laist *et al.* 2001). Vanderlaan and Taggart (2007), using a logistic regression modelling approach based upon vessel strike records, found that for vessel speeds greater than 15 knots, the probability that a collision will result in a lethal injury (mortality or severely injured) approaches 1. The probability that a collision will result in lethal injury declined to approximately 20 % at speeds of 8.6 knots and to less than 5 % at of 4 knots (Vanderlaan and Taggart 2007). Considering the reduced speed at which seismic survey vessels travel during periods of active seismic surveying (typically 4.5 to 5 knots) plus the extra noise that they emit relative to routine vessel traffic, the risk of lethal injury from a vessel strike, would be limited. A modelling exercise undertaken to assess the monthly risk of collisions along typical Sakhalin Energy vessel routes (e.g. Korsakov to PA-A, Kaigon to PA-A, PA-A to PA-B) suggested a low number of expected monthly ship/whale encounters with Sakhalin Energy vessels in Sakhalin Island waters per route, with a range of 0.00 to 0.10 expected encounters during the June-July time period and a range of 0.00

to 0.20 expected encounters during the August-September time period (Muir *et al.* 2006). To translate expected encounters into expected ship strikes, it is necessary to adjust for evasive action taken by whales and/or vessels prior to a possible encounter. While the model allowed the avoidance and observer variables to be adjusted, these could only be tested as a sensitivity analysis because data were not available to estimate these parameters. There have been no ship strikes associated with the Company's activities in north-east Sakhalin Island. Mitigation measures implemented by Sakhalin Energy and detailed and updated in Sakhalin Energy's 2018 Marine Mammal Protection Plan (App v) appear to have been effective at minimizing the risk. The model does suggest that the risk of ship strikes could increase during periods of low visibility or high sea state and thus additional, enhanced, mitigation measures may be warranted during certain conditions.

The standard mitigation measures described in chapter 9 will be used to reduce the likelihood of ship strikes in all phases of SEIC operations during the early, peak and late seasons of gray whale presence near Sakhalin.

There is an additional risk of collision with marine mammals during the survey simply from the presence and movement of vessels. Collision is deemed unlikely due to the relatively slow operating speed of the vessels associated with the survey. Further, the presence of on-board Marine Mammal Observers substantially minimizes the risk of ship strikes. The Unmitigated Impact is considered Minor and the Mitigated Impact is considered Negligible.

7.7 Effluent Discharge, Emissions and Waste Disposal

Effluent discharges, emissions and disposal of wastes from vessels engaged in survey activities have a range of potential environmental consequences. Potential discharges and impacts include:

- Oil contaminated drainage and sanitary effluent discharges may effect water quality resulting in direct and/or indirect adverse effects on marine organisms;
- Chlorine in discharges from sewage treatment or water generator systems may cause harm to marine organisms;
- Toxic effects on marine organisms in the event of an accidental release of solid or scheduled wastes into the marine environment;
- Physical damage to marine organisms and impacts on water quality and the coastal environment as a result of inappropriate waste management and disposal methods; and
- Short-term localised increases in downwind airborne pollutant concentrations and reductions in local air quality.

7.7.1 Drainage System Discharges

Drainage effluents such as rainwater and sea spray runoff from uncontaminated deck areas will have no effect on the water quality and ecology of the receiving waters. Drainage from cable handling areas, machinery spaces, bilges etc. may be contaminated with oil (e.g. diesel, cable oil, lubrication oil). These drainage fluids will be processed through an oil/water separator prior to discharge in compliance with MARPOL Annex I requirements (maximum discharge concentration of 15 parts per million (ppm)). After processing, the residual hydrocarbons in the effluent discharge will be diluted and disperse rapidly in the receiving waters so that any reduction in water quality will be localised and temporary. The potential effects of mitigated or unmitigated discharge of drainage system waters on marine biota are therefore considered to be negligible.

7.7.2 Sanitary Effluent

Vessel operators are under contractual obligation to meet MARPOL standards on effluents. The discharge of sewage into the sea is prohibited, except when the ship has in operation an approved sewage treatment plant or when the ship is discharging comminuted and disinfected sewage using an approved system at a distance of more than three nautical miles from the nearest land. Sewage which is not comminuted or disinfected may be discharged at a distance of more than 12 nautical miles from the nearest land. The Marine Environment Protection Committee of MARPOL also adopted a standard for the maximum rate of discharge of untreated sewage from holding tanks at a distance of more than 12 nautical miles from the nearest land. No sewage, treated or untreated, will be discharged to the coastal waters by survey vessels.

All solid wastes will be transported to shore for waste disposal and no solid waste will be permitted to be disposed overboard by any vessels. There will therefore be no impact on marine water quality from these sources, mitigated or unmitigated.

7.7.3 Chlorinated Water Discharges

Discharges from vessel service water systems and sewage treatments may contain residual concentrations of chlorine. Typical concentrations are estimated to be approximately 1.0 ppm. Chlorine is harmful to aquatic life even at low concentrations, with toxic thresholds for fish species being in the range of 0.1 to 0.4 ppm (International Hydrological Programme 1979). Following discharge to marine waters, a combination of dilution and dispersion effects will rapidly reduce chlorine concentrations to below potentially harmful levels. Impacts on marine organisms as a result of residual chlorine in effluent discharges are therefore considered to be localised, short term (i.e. will only occur for the duration of the survey works). No chlorinated discharge will be made from the vessels, therefore the impacts are considered as none.

7.7.4 Cooling Water Discharge

Heated engine cooling water from the survey vessels will be discharged to the marine environment, usually after a once-through pass, forming a plume of water with a temperature significantly greater than the ambient water temperature. This heated water will rapidly lose thermal energy to the surrounding water column, reducing the plume temperature, and ensuring that a significant thermal plume cannot form. No impacts are predicted to occur as a result of this discharge. The intake of seawater for cooling purposes and service water use (e.g. potable water production and deck wash down) has the potential to damage and entrain marine biota in the uplift stream. Weakly swimming or free-floating planktonic populations are likely to be affected by the intake, experiencing mortality and injury as a result of mechanical and thermal effects. It is considered that the level of mortality likely to occur would not constitute a significant effect with regard to populations of planktonic and nektonic organisms within the water column. This is largely due to the generally ubiquitous nature and abundance of planktonic organisms in offshore waters, the high level of natural mortality in planktonic populations and the highly localised nature of any impact (i.e. confined to the volume of water in the immediate vicinity of the intake). The overall impact of this effect during the survey is considered therefore to be negligible.

7.7.5 Solid and Scheduled Wastes

Scheduled wastes such as lubrication oil and oily slops generated on the survey vessels will be returned onshore and disposed of at an appropriate facility when the vessels return to port. The handling, management and disposal of these wastes will be conducted in accordance with appropriate legislative requirements and Sakhalin Energy procedures where relevant. Hazardous materials (e.g. lithium batteries) will be stored onboard and recycled or returned to the supplier.

There have been numerous reports of marine life ingesting disposed wastes. It is believed that floating debris is mistaken for food or accidentally ingested as the animals feed on their prey. Pinnipeds, toothed whales, and baleen whales are all known to have ingested plastic products. Foreign objects can obstruct the gastrointestinal tract and cause gastric inflammation, nausea and loss of appetite, which may result in starvation and death. The seismic survey vessel has onboard facilities for the compaction and incineration of solid wastes (including food wastes). Non-combustible wastes and incineration residues will be stored onboard and returned to port for disposal. The waste management procedures in place onboard the survey vessels will be designed to ensure that there will be no fouling or contamination of the marine environment as a result of solid and scheduled wastes generated during survey operations. As long as these procedures are fully implemented there should be no impact from the generation of on board waste.

7.7.6 Air Quality

The principal emission sources from the survey operations will be exhaust gases from vessel propulsion systems and incinerators, power generation equipment, and from the incineration of solid wastes. The primary emissions from these sources will include carbon dioxide (CO_2), carbon monoxide (CO), nitrogen oxides (NO_x), hydrocarbons, sulphur dioxide (SO_2) and particulates. Ozone depleting substances are not expected to be used onboard the vessels but may be used as refrigerants in older vessels where closed recovery systems are in place. No release of ozone depleting substances is therefore anticipated during survey operations. Emissions from the vessel propulsion and power generation systems together

with intermittent releases from the onboard solid waste incinerator will result in slight increases in downwind pollutant concentrations. Exceedance of ambient air quality criteria is not expected to occur. The survey is offshore from a remote part of Sakhalin and so there are no nearby communities. Plus, given the transient nature of the survey operations, the volatility of the air emissions and the generally high winds, emissions would be expected to undergo rapid dispersion resulting negligible impacts upon air quality.
Under Sakhalin Energy's Marine Operating Procedures, Masters of the survey vessels will report the fuel consumption of their vessels and the sulphur content of the fuel used.

7.8 Accidental Spills, Leaks and Dropped Objects

7.8.1 Release of Harmful Substances

During seismic survey work there are several routes via which potentially polluting releases of hydrocarbons, contaminants or other substances to the marine environment could occur. These uncontrolled events or incidents effectively represent acute hazards that may affect marine water quality and biota in a number of ways. Typically, though, such incidents involve the accidental discharge of materials (e.g. oily wastes) that locally may adversely affect environmental conditions, generally over short periods of time. The level of significance depends to a great degree on the scale of the release and also the nature of the substance that is released. Accidental spills and leaks may arise for a variety of reasons including vessel collision (with other vessels, equipment or natural features), poor management of equipment or processes, and natural events. The vast majority of potential accidents, and therefore environmental impacts, can be prevented through the adoption and implementation of appropriate HSE procedures and measures onboard survey vessels during survey operation. The following sections provide an assessment of the potential impacts associated with the most likely sources of spills and leakages.

7.8.2 Streamer Fluid Release

The survey company is contractually obliged to deploy streamers that do not contain liquids or gels harmful to the environment. The selected streamers fulfil that obligation.
In the event of damage to a streamer no fluid is released. The risk associated with release of streamer fluid is therefore considered nil.

7.8.3 Accidental Bunker fuel, Diesel, Lube Oil and Oily Sludge Release

This is the discharge of oily wastes into the marine environment due to minor accidents (e.g. failure of spill containment systems, separation of fuel hoses during bunkering operations) or discharge of bilge water prior to treatment have an impact on water quality and marine ecology. It is managed comprehensively in the Oil Spill Response Manual 2018 SEIC. The impact depends on the type of oil released, the volume of oil, the location of the spill and the prevailing weather and tidal conditions. Larger releases of bunker fuel, diesel or kerosene as a result of vessel grounding, collision or other major accident may have the potential for significant impact, particularly on marine life and, depending on the prevailing weather and coastal conditions, have the potential for affecting nearby coastal areas. As soon as oil is spilled, it starts to spread out over the sea surface, initially as a single slick. The speed at which this takes place depends to a great extent upon the viscosity of the oil. Fluid, low viscosity oils spread more quickly than those with a high viscosity, although generally slicks quickly spread to cover extensive areas of the sea surface. Spreading is rarely uniform and large variations in the thickness of the oil are typical. Slicks tend to break up quite rapidly as a result of wind and wave action and water turbulence and the rate of spreading is also determined by the prevailing conditions such as temperature, water currents, tidal streams and wind speeds. The more severe the conditions, the more rapid the spreading and breaking up of the oil. Lighter components of the oil evaporate to the atmosphere. The amount of evaporation and the speed at which it occurs depend upon the volatility of the oil. Evaporation can increase as the oil spreads, due to the increased surface area of the slick. Rougher seas, high wind speeds and high temperatures also tend to increase the rate of evaporation and the proportion of oil lost by this process. Waves and turbulence at the sea surface can cause all or part of a slick to break up into fragments and droplets of varying sizes. These become mixed into the upper levels of the water column. Some of the smaller droplets remain suspended in the sea water while the larger ones tend to rise back to the surface, where they may either coalesce with other droplets to reform a slick or spread out to form a very thin film. Oil that remains suspended in the water has a greater surface area than before dispersion occurred. This encourages other natural processes such as dissolution, biodegradation and sedimentation to occur. Light refined products, such as diesel, No. 2 fuel oil and kerosene, are narrow-cut fractions that have low viscosity and spread rapidly into thin sheens when in contact with water. They do not tend to form emulsions except under very cold conditions. Evaporation may be relatively rapid and up to 70-100% of volume may be lost within a few days. As low-viscosity, moderately persistent oils, light distillates tend to disperse readily into the water column through even gentle wave action. Thus, they have the highest potential of any oil type for vertical mixing. There is also a greater potential for dissolution to occur, from both surface sheens and droplets dispersed in the water column. The water- soluble fractions are dominated by two- and three-ringed polycyclic aromatic hydrocarbons (PAHs) that are moderately volatile and may, in higher concentrations, affect aquatic biology. Thus, spills of fuel oil and diesel have the greatest risk of impacting water-column resources. These products are not very adhesive; therefore, they do not adhere strongly to sediments or shoreline habitats. Loading levels on the shoreline are relatively low because of the thinness of sheens on the water surface and the low adhesion of stranded oil. The constituents of these oils are light to intermediate in molecular weight and can be readily degraded by aerobic microbial oxidation. Long-term persistence in sediments is greatest under heavy loading and reducing conditions where biodegradation rates for anaerobic bacteria are low. Heavier oil types that could be accidentally released, such as No. 6 fuel oil, bunker oil and heavy sludge oils (heavy fuel oils typically contain between 1 percent and 5 percent sludge or waste oil, which cannot be burned as fuel) lose only up to 10% of their volume via evaporation. Some of these products are so viscous that they cannot form emulsions, but many emulsify shortly after release. They show low natural dispersion because the oil is too viscous to break into droplets. These oils have the lowest water-soluble fraction; thus, loadings to the water column are generally low under slicks. Spills of heavy distillate quickly break up into thick streamers and then fields of tarballs which can be highly persistent. The weathered products of these oil spills can be transported hundreds of miles, eventually stranding on shorelines, where, depending on volume and extent, may pose significant impacts to birds and other marine animals. Because of their high density, these releases are more likely to sink after picking up sediment, either by mixing with sand in the surf zone or after stranding on sandy shorelines.

7.8.4 Potential Effects of Oil Spills

(Ref. Oil Spill Response Manual, 2018 SEIC)

The effects of petroleum hydrocarbons in the marine environment can be either acute or chronic. Acute toxicity is defined as the immediate short-term effect of a single exposure to a toxicant. Chronic toxicity is defined as either the effects of long-term and continuous exposure to a toxicant or the long-term sublethal effects of acute exposure. Oil spills in marine waters can lead to direct mortality of marine organisms, reduce their fitness through sublethal effects, and disrupt the structure and function of marine communities and ecosystems. Such effects have been well established in laboratory studies, but determining the subtler long-term effects on populations, communities and ecosystems at low doses and in the presence of other contaminants is difficult and poses a significant scientific challenge. The most toxic components in oil tend to be those lost rapidly through evaporation when oil is spilt. Because of this, lethal concentrations of toxic components leading to large-scale mortalities of marine life are relatively rare, localised and short-lived. Sub-lethal effects that impair the ability of individual marine organisms to reproduce, grow, feed or perform other functions can be caused by prolonged exposure to a concentration of oil or oil components far lower than will cause death. Sedentary animals in shallow waters such as oysters, mussels and clams that routinely filter large volumes of seawater to extract food are especially likely to accumulate oil components. It should be noted that there is no simple relationship between the amount of oil in the marine environment and the likely impact on wildlife. A smaller spill at a particularly sensitive time/season and in a vulnerable environment may prove much more harmful than a larger spill at another time of the year in another or even the same environment.

In relation to the identified marine ecological interests in the near shore Piltun area, it is apparent that the main groups of organisms that are of interest in relation to potential oil spills are marine mammals, fishes and marine birds. The following text provides a brief summary of the effects of oil spills and contamination of marine waters on these groups. Throughout, the description of potential effects is biased towards the assumption that any spills are likely to be small, the oil involved is likely to be relatively volatile and the effects will be short term. In open waters, fish have the ability to move away from an area of pollution and are therefore either unaffected by oil or affected only briefly. There is no definitive evidence to suggest that fish are affected by oil in the open sea (White and Baker 1998). However, fish can be substantially affected in some circumstances, especially when oil spills into shallow or confined waters. As the oil begins to weather it enters the water column and fish become directly exposed. Fish kills may occur as a result of high exposure to emulsified oil in shallow waters and gross oil pollution may clog fish gills causing asphyxiation. Species at particular risk include bottom-dwelling fish such as flounders that are exposed to sediments that quickly become contaminated with sunken oil. Fish can accumulate hydrocarbons in tissues or body fluids through exposure from contaminated sediment, water or food. The bioavailability of hydrocarbons from sediments and food is less than that from solution in water. If there is widespread dispersal of oil in the water column it may be taken up through their gills or eaten resulting in an accumulation in the stomach, gall bladder and liver. In commercial species this may lead to the flesh having a tainted flavour making it inedible (Clark 1997). Although some hydrocarbons may persist in the body for some time, most are rapidly lost when the fish are no longer exposed to the pollution. Oil poses a much greater threat to fish eggs and larvae that cannot actively avoid or escape a pollution event. As fish eggs and larvae are mostly planktonic they can be affected by all early stages of a spill and many clean-up techniques (IPIECA 2000). These life stages are extremely vulnerable to the toxicity of both oil and chemical dispersants and heavy mortalities often result. Even low concentrations of hydrocarbons can have marked effects on the proportions of eggs that hatch and on the growth rates and development of larvae. Lethal effects on the population as a whole are rare but long term, sub-lethal effects are possible, particularly if a major spawning area is affected. An oil spill can have varying effects on fish populations partly depending on the nature and state of the oil. Light oils such can lead to extensive fish kills in enclosed waters. This is because they are rapidly dispersed into the water column and the fish become exposed to the toxins contained in these oils. Heavy oils are less toxic, and their dispersion into the water column is more gradual causing less dramatic effects. In the open ocean, the concentration of oil below the slick is low, ranging from a few parts per million (ppm) to less than 0.1 ppm (IPIECA 2000). Marine birds and mammals can be affected by oil in the sea through several pathways. As air- breathing organisms that obtain much or all of their food from beneath the surface of the sea, marine birds and mammals must frequently pass through the water's surface. Fouling by oil may affect the insulating characteristics of feathers and fur and lead to death from hypothermia. Most marine mammals are not very susceptible to the effects of oil and hydrocarbon-based fuels. Whales exposed to oil are generally not at risk because they rely on a layer of blubber for insulation and oiling of the external surface does not appear to have any adverse thermoregulatory effects (Geraci 1990; St. Aubin 1990). Preliminary laboratory tests show that gray whale baleen and possibly skin, may be somewhat resistant to damage from short-term exposure to oil (Geraci and St. Aubin 1985; Geraci 1990). However, Hansen (1985) points out that oil or clean up dispersants could have indirect negative effects on gray whales by killing or contaminating their benthic food supply. Whales could ingest oil with contaminated water or food, or it could be absorbed through the respiratory tract. If oil is ingested, it can be voided in vomit or faeces, but some is absorbed and could cause toxic effects (Geraci 1990). However, whales exposed to an oil spill are unlikely to ingest enough oil to cause serious internal damage. Crude oil could coat the baleen and reduce filtration efficiency; however, effects may be reversible within a few days (see Geraci 1990 for a review). Effects of oiling of the baleen on feeding efficiency appear to be only minor (Geraci 1990). Seabirds and pinnipeds may be poisoned when they ingest oil during the course of trying to remove it from their feathers or pelage, or when it adheres to food items. Likewise, marine mammals (and possibly seabirds) may inhale toxic doses of petroleum vapour when at the surface in the vicinity of an oil spill (Geraci 1990; Geraci and Williams 1990), although there appear to be few data indicating that this is an important source of mortality. In some cases, these upper trophic level predators may become exposed to oil by ingesting prey that have oil or its metabolites in their tissues. Seabirds can transfer oil from their feathers to the surface of their eggs during incubation. Depending on the type of oil on the feathers and the presence of toxic components, embryos in the affected eggs may fail to develop. Oil can also indirectly affect the survival or reproductive success of marine birds and mammals by affecting the distribution, abundance or availability of prey (NRC 2003).

In seabirds, ingestion of oil or oil-contaminated prey may lead to immuno-suppression haemolytic anaemia which compromises the ability of the blood to carry oxygen. This effect persists long after the birds appear to have recovered from exposure (Fry and Addiego 1987). Large spills that occur over the deeper ocean in open water that has little bird life will have a lesser effect on seabirds than a small spill in a critical habitat where high numbers of birds are aggregated on the water. The season in which a spill occurs is also critical (Hunt 1987). If the spill occurs when birds are aggregated during breeding or migration, the impact will be much greater than if they are widely dispersed at sea. In addition to the significant evidence for the impact of massive contamination associated with an oil spill, there is increasing evidence that chronic, low-level exposures to hydrocarbons can have a significant effect on the survival and reproductive performance of seabirds and some marine mammals. Sublethal effects of oil on seabirds include reduced reproductive success and physiological impairment, including increased vulnerability to stress (reviewed in Fry and Addiego 1987; Briggs *et al.* 1996). In contrast, in marine mammals, sublethal exposure to petroleum hydrocarbons has been shown to cause minimal damage to pinnipeds and cetaceans (e.g., Geraci 1990; St. Aubin 1990), although sea otters appear to be more sensitive (Geraci and Williams 1990). Because both marine birds and marine mammals have the enzymes necessary for the detoxification and elimination of petroleum hydrocarbons, parent compounds of petroleum hydrocarbons are not accumulated and sequestered in tissues as chlorinated hydrocarbons. Toxic metabolites produced by metabolism of PAHs, however, may accumulate and induce toxic effects.

Bunkering is seen as the major source of risk. All operations are regulated under MARPOL and IMO rules and procedures. Mitigation is further managed via Shipboard Oil Pollution Emergency Planning (SOPEP)

7.8.5 Predicted Impacts from Accidental Release of Harmful Substances

As stated above, marine water quality could be affected by accidentally spilled lubricating oil or diesel fuel from vessels and equipment associated with seismic survey operations. Vessel collisions with ice are not likely to occur, because seismic surveys will be conducted in relatively ice-free conditions. Vessels colliding with each other or equipment-entanglement problems also are unlikely to occur because vessels are required to maintain a minimum separation of at least 15 nautical miles. It is assumed that there would be no unauthorized discharges, such as engine oil, etc., from the seismic vessel or support vessels. Therefore, any effects would be due to accidental discharges, such as a spill of fuel oil during a fuel transfer from a support vessel to a seismic vessel or through accidental release. Such incidents are considered unlikely to occur, but if they do the volume of material released would be small. Small spills of diesel and light fuel oil are likely to undergo rapid evaporation and dilute and disperse rapidly and as such are unlikely to lead to fouling of seabirds or cause internal damage to marine mammals. Some mortality of planktonic fish eggs and larvae would be expected in the immediate vicinity of the spill, but no longer-term chronic effects to fish would be likely to occur. Adult fish would be able to avoid the area of any spill. Due to the effects of evaporation and dispersion it is not predicted that a spill of diesel or fuel oil would cause any effects to shoreline or coastal habitats and species. Although dependent on the extent and location of any release, a small hydrocarbon spill would generally be predicted to have a minor impact with respect to marine water quality and biota.

While large spills of diesel or fuel oil could cause significant mortality to young lifecycle stages of fish, it is unlikely that such a spill would lead to population level effects or longer-term chronic effects. As with smaller spills, it is unlikely that marine mammals and seabirds would be significantly impacted. However, as noted above the effects of the inhalation by marine mammals of oil vapour at the sea surface are largely unknown and in this respect if the spill covers an extensive area and prevents movement of animals away from the affected area the impact could be significant. With light oils the potential for fouling of plumage and the consequent loss of insulation is significantly less than for heavier oils and spillages of diesel and light fuel oil would be unlikely to lead to mortality at a level that would cause concern at the local population level. The timing of the seismic survey during the early summer months falls outside the main period of seabird assemblage in near shore waters. Thus, the potential for a significant impact on seabird populations would be avoided, although it would be expected that some minor impacts on seabirds in the immediate vicinity of the spill would occur.

Spills of heavier oils such as oily sludges, accidentally released during maintenance activities may have a greater residence time in the water column as these substances are less likely to evaporate. As these oils are less likely to be lost through evaporation and have a much greater potential to form emulsions than lighter oils their presence on the water surface may lead to the fouling of seabirds present in the area at the time of the spill

or subsequently in areas to which any oil is transported by waves and currents. Because of their greater residence time in the water, these oil types also have a greater potential to impact upon coastlines, particularly where spills occur in near-shore environments. The potential impacts associated with deposited oil are varied and depends on many factors such as the scale of the spill, nature of the weathered oil and the environmental sensitivity of the receiving coastline. However, it can be anticipated
that the level of impact would range from minor in areas of dynamic open coast with relatively low ecological, environmental and social interests (e.g. coastal fisheries) to major in the event that oil found its way into sensitive lagoon habitats of north-east Sakhalin. Of particular concern in such areas would be the affect that any deposited oil had on salmonid fish (migratory behaviour and potentially spawning), wader and waterfowl populations using coastal habitats and pinniped haul out areas. It is apparent from numerous studies that while the impact of oil spills, even of a relatively small size, can be significant in the short term, full recovery in the medium-long term usually occurs and ecosystem functions are restored. With heavier oils the potential for impact upon coastal and seabed sediments is increased in comparison with lighter oils. In north-east Sakhalin, any impact on areas of sediment that support benthic communities in known feeding areas for gray whales would be considered to be of major adverse impact. Amphipod communities are known to be significantly impacted by oil spills involving heavier oil types and significant mortality can occur. Typically, recovery of these infaunal and epifaunal communities is relatively rapid (1-2 years, as documented for the Sea Empress spill in 1996 [Edwards and White 1998]).
However, recovery would be unlikely to occur during the period in which the whales would be present at the feeding grounds in north-east Sakhalin and, the temporary loss of part of this resource could have significant implications for the gray whales that feeds off north-east Sakhalin. The MMPP and the Oil Spill Response guidance are the two main documents for the avoidance, management and mitigation of the risks from oil spills.
The overall unmitigated risk of a large release of a harmful substance, such as oil or fuel, during the survey is considered negligible.

7.8.6 Impact of Dropped Objects

Any survey equipment lost overboard may foul or create obstructions on the seabed and may act as a future source of pollution. Streamer sections are unlikely to be lost during the course of the survey operations due to automatic devices that inflate when the streamer falls below a certain depth. It is predicted that three plastic ‘birds’ (depth control units) of approximately 1 m in length will be lost over the thirty-day survey period. If solid-filled streamers are used, a small number of lead weight strips used to control buoyancy are predicted to be lost during the course of the survey. All personnel involved in the survey will have been made aware of the Company’s standards, including the Dropped Objects Prevention Standard. These objects are not considered to be a risk regarding the potential for obstruction or release of contaminants and losses of this nature are predicted to have a negligible impact. The loss of larger objects and cargo would be predicted to have a moderate impact (unmitigated) and minor impact (mitigated) on marine organisms or other vessels.

Issue	Impact	Unmitigated Impact	Mitigated Impact
Disturbance and Injury to Marine Mammals			
The effects of noise and physical presence of survey vessels	TTS, PTS and non-auditory physiological effects on all cetaceans and pinnipeds	Moderate	Minor
	Disturbance and short-range avoidance movements in non-endangered baleen whales	Moderate	Minor
	Disturbance and short-range avoidance movements in odontocetes and pinnipeds	Moderate	Minor
	Disturbance and short-range avoidance movements in North Pacific right whales	Moderate	Minor
	Disturbance, short-range avoidance movements and reduced feeding opportunities, possible loss of breeding potential, reduced growth, reduced survival in Gray Whales	Moderate	Minor
	To marine mammals from collisions/entanglement with vessels and deployed equipment	Minor	Negligible
Disturbance and Injury to Fishes			
The effects of noise and physical presence of survey vessels	Injury and fatality from underwater airgun noise	Minor	Minor
	Sea water intake causing entrainment	Negligible	Negligible
	Spawning disturbance or damage to eggs	Minor	Minor
	Behavioural disturbance e.g., dispersal of fish shoals	Minor	Minor
Effluent Discharge, Emissions, and Waste Disposal			
Effluent discharge	Impacts on water quality and marine biota from cooling water and deck-surface runoff (e.g., sea spray and rain water)	None	None
	Impacts on water quality and marine biota from non-accidental release of drainage and sanitary waste water discharges; chlorinated water discharge	Negligible	None
Emissions from combustion & incinerators	Reduction in local air quality	Negligible	Negligible
	Contribution to regional and global atmospheric pollution	Negligible	Negligible
Solid and hazardous waste	Impacts on water quality and marine biota (toxicological effects)	None	None

Table 2a. Comparisons between unmitigated and mitigated impacts

Issue	Impact	Unmitigated Impact	Mitigated Impact
Accidental Spills, Leaks and Dropped Objects			
Spills and leaks	Small release of harmful substances (e.g., wastes, oil, lubricants, streamer fluid) resulting in a decrease in water quality and impact on marine organisms	Negligible	Negligible
	Large release of harmful substances (e.g., wastes, oil, fuel) resulting in a decrease in water quality and impact on marine organisms	Moderate	Minor
Dropped objects	Loss of small objects/equipment	Negligible	Negligible
	Loss of large objects and cargo causing pollution, impact on marine organisms, and obstruction to other vessels	Moderate	Minor
Interaction with Other Users of the Area			
Vessel and equipment interference Use of local resources	Potential for collision or other accident with other vessels, equipment and concomitant injury, loss of human life, vessel damage, loss of property	Minor	Negligible
	Temporary interference with commercial fishing/damage to fishing equipment	Minor	Negligible
	Interference with military use of the area (irony alert)	None	None
	Damage to marine archaeology and cultural heritage	Negligible	Negligible
	Hunting of marine mammals	Negligible	Negligible
	Effects on the local social environment and economy	Negligible	Negligible
	Disturbance or damage to cables and other submarine infrastructure	Negligible	Negligible
	Disturbance to natural resources e.g. regularly hunted animal species	Negligible	Negligible
	Effect on fisheries quotas	Negligible	None

Table 2b. Comparisons between unmitigated and mitigated impacts (continued)

8 Mitigation of Risk to the Whales, Monitoring of the Whales and Social Responsibility during the Survey period

8.1 Mitigation, monitoring and management process

8.1.1 Introduction

Mitigation, monitoring and management of risks to *inter alia* marine mammals from Sakhalin Energy's seismic survey activities are managed through the Health, Safety, Environment and Social Action Plan (HSESAP) and specifically the 2018 Seismic Survey Monitoring and Mitigation Plan (MMP) with SEER approval; the 2018 Marine Mammal Protection Plan (MMPP Appendix iv); the 2018 Marine Mammal Observer (MMO) Onshore and Offshore Manuals; and the 2018 Update of the Maritime HSE Standard http://www.sakhalinenergy.ru/en/media/library/. The whole survey is overseen by an Independent Observer recruited by IUCN on behalf of the WGWAP. The Independent Observer will be based at Seismic Survey Command Centre with the Seismic Survey Central Commander (Ref. Independent Observer ToR App vi). An Advisory Group of WGWAP Members has been established for the 2018 Seismic Survey. The primary purpose of the Group is to be available to provide advice to the Company, if, for example, circumstances lead the Company to consider modifying its MMP at short notice during the survey.

The Independent Observer may also seek formal advice from the Advisory Group should he so wish following a similar process to that detailed below for the Company (Ref. Communications Protocol App vii).

This Health, Safety, Environment and Social Action Plan is developed in accordance with the Russian legislation and international standards, including the policies and directives of the World Bank, the International Finance Corporation standards and other regulations

- provides full information on the measures aimed at negative impact reduction, management, monitoring and other activities in the field of environmental and social responsibility
- applies to all facilities of Sakhalin Energy and to any other activity related to the Company, including contractors' and subcontractors' operations

The HSESAP is agreed under covenant with the project lenders, by whom it is monitored and audited regularly (usually annually). It contains specific commitments and standards in impact management and its monitoring. They are formulated according to the results of the Environmental, Social and Health Impact Assessment. The Plan covers the performance of the Company and its contractors.

The HSESAP contains the Marine Environment Protection Standards (MEPS):

- Marine Environment Protection Standard Overview
- International Requirements for Marine Environment Protection
- Russian Federation Requirements on Marine Environment Protection
- Marine Research Surveys Specification

- Ballast Water Specification
- Marine Mammals Specification
- Offshore Fisheries Specification
- Dredging and Dumping Specification

In the field of social performance, the Plan includes certain standards. The Company's Social Performance Management Standard reviews:

- international requirements for social performance
- Sakhalin indigenous minorities
- cultural heritage
- resettlement management
- public consultation and disclosure
- resolution of grievances
- social investment strategy
- Russian content and employment
- social performance monitoring

However, in the context of the marine environment, two major plans are in place to deal with general protection of marine mammals and risk from a specific activity, such as a seismic survey. The general plan is the Marine Mammal Protection Plan (MMPP) and the activity specific plan for the seismic survey is the MMP (both SEIC 2018).

The original 2018 MMP for this seismic survey was developed in conjunction with the Noise Task Force (NTF) of the WGWAP. However, that 2018 MMP (which is presented in Appendix ii), was subject to revision in the light of the denial of Permit for underwater acoustic monitoring (see Section 5 above) and the Final 2018 MMP, developed consequently in the absence of underwater acoustic monitoring, is presented in Appendix iii (see section 9.2 for further details).

Overall, and notwithstanding the denial of the deployment of underwater noise monitoring devices, the Final MMP adheres rigidly to the principles and practices advocated in ‘Responsible Practices for Minimizing and Monitoring Environmental Impacts of Marine Seismic Surveys with an Emphasis on Marine Mammals’ (Nowacek *et al*. 2013). Further, it incorporates the learning experiences from the 2010 and 2015 seismic surveys’ MMPs. The fundamental mitigation principles established originally in the 2010 MMP remain:

(1) Design ahead of the survey to:

(a) Minimise the area surveyed

(b) Minimise the sound levels reaching the areas of highest expected whale density based on previous experience (i.e. within the Perimeter Monitoring Line (PML) that defines the perimeter of the gray whale inshore feeding ground)

(2) Take measures during the survey to:

(a) Carry out the survey as early in the season as possible, i.e. when fewest whales are expected to be present

(b) Stop the survey when necessary to protect the marine mammals that are present

8.1.2 Timing and duration of the 2018 seismic survey

(1) The seismic survey will commence and be completed as early in the season as technically and logistically possible. Logistics include ensuring that all mitigation and monitoring procedures are in place and implemented. Actual start date is dependent on ice/weather. MMOs will be in the field from 1st June 2018 and will operate according to the SEIC MMO Offshore and Onshore Monitoring and Mitigation Manuals 2018. Survey operations will be able to start from 6th June 2018 but historic data for ice-free conditions gives a range of anytime within 6th to 15th June. The Piltun-Astokh survey is predicted to last for approximately 42 days (+/- 7)

(2) "A-line" segments (i.e. seismic lines that result in so-called A-zones within the gray whale feeding ground as defined in section 9.1.4 below) should be acquired at the earliest possible opportunity given visibility, mitigation and monitoring requirements.

8.1.3 General design and conduct of survey

The most stringent mitigation measures in relation to whales (other than those observed in the exclusion zone around the seismic vessel) should be applied in the so-called "A-zones" as defined section 9.1.4 below. The monitoring measures defined within the MMP must be in place and operational for the acquisition of lines.

8.1.4 Definition of A-zones

(1) The area for which additional mitigation measures will be implemented (A-zone – see also section 9.1.6) is defined by the overlap of the region inshore of the PML and the area bounded by the 156 dB per-pulse SEL isopleth for the current acquisition point (i.e. the zone within the gray whale feeding ground in which noise levels are above 156 dB per-pulse SEL).

(2) The 156 dB per-pulse SEL isopleth will be estimated through numerical modelling of the airgun array acoustic output and the propagation of underwater sound. The numerical models for source levels and propagation have been validated over several previous years of operations and most recently during the monitoring of the 2015 seismic survey, for which many comparison data points are available between pulse levels measured along the PML and their model estimated values. For the 2018 season, improvements have been made to the modelling software and/or its parametrization that intrinsically yield more realistically accurate estimates:

- The bathymetry dataset has been improved from the one used in 2015 pre-field and earlier modelling: additional depth logs from Pacific Oceanological Institute were standardized and incorporated into the earlier bathymetry to improve resolution
- A more advanced version of the AASM airgun array source model, calibrated against a newly available collection of airgun measurement results, was introduced; this produces slightly increased source levels compared to the estimates for the same source used in 2015 and earlier

(3) In the absence of acoustic monitoring data at the PML (due to the Permit Denial – see also section 5 and 9.2 below) that would have allowed a real-time adaptive offset to be applied to the model output to reduce any discrepancy between the model estimates of the sound levels at the PML and the actual field measurement, a fixed precautionary adjustment of +2dB has been applied to the model predictions[7].

(4) The precautionarily adjusted model will be used to generate the estimated 156 dB per-pulse SEL isopleth at each acquisition point as well as its envelope for the complete line. Based on the model predictions, shot line segments for which an overlap is predicted between the 156 dB per-pulse SEL contour and the PML will be classified as A-segments, for which the additional mitigation measures specified below apply.

8.1.5 Measures near the seismic vessel – entire survey

(1) After more than 20 minutes of inactive source, ramp-up procedures will be followed such that the individual air guns will be activated in a progressively larger combination over a period of 20 minutes (6 dB increments every 5 minutes). Ramp-up to full operational power should be achieved as close to the start of the line as possible.

(2) The Senior MMO will initiate source shutdown if a gray whale is observed within the exclusion zone of the source decreed by SEER Conclusion 8th June 2018 as not less than 1000 metres[8] (Table 3 below).

(3) The Senior MMO will initiate a precautionary shutdown if a gray whale is observed to be on a course that will result in its entering the exclusion zone.

[7] The fixed adjustment is applied to ensure that the statistical distribution of the error (expressed as the difference between actual levels and estimated levels) bounds the occurrence of positive values, i.e. underestimation of true levels by the model, to an adequately small percentile. An error analysis based on the comparison of the estimates from the improved modelling for 2018 and the pulse levels measured at the PML during the entire 2015 seismic survey, for all pulses having measured levels above 154 dB per-pulse SEL to focus the analysis on a behaviourally relevant subset, showed the model results to be predominantly conservative (overestimating the measurements), with a residual incidence of 4% of the pulse levels being underestimated by 3dB or more. By adding a fixed precautionary adjustment of +2dB to the model results, the incidence is reduced to 1% of the pulse levels at the PML being underestimated by 2dB or more. This was considered an adequate bound in balancing the opposite risk of excessive overestimation resulting in unnecessary prolonging of the seismic survey.

[8] NB This document focuses on gray whales. It is noted that exclusion zone criteria will also be applied for other species (1000 m for bowhead whale, North Pacific right whale, fin whale, Cuvier's beaked whale; 350m for Steller sea lion). The final exclusion zone confirmed by SEER is to be not less than 1000 metres for gray whales.

(4) Various types of field-tested remote-sensing (non-acoustic) equipment may be installed onboard the seismic vessel to assist in detecting marine mammals at night and/or during periods of poor visibility, recognising that there is no technology that works in fog or heavy rain. The use of such equipment will not be regarded as fully compensatory for the lack of visual monitoring, but instead as uncontrolled field experimentation. This caveat remains until such time as the technology has been proven to be at least as efficient at detecting whales as visual monitoring by experienced MMOs.

8.1.6 Additional considerations for the A-zone

A considered trade-off is required between preventing the disturbance of a smaller number of animals expected to be present early in the season and preventing the disturbance of a larger number of whales expected to be present later in the season if operations are still ongoing due to temporary stoppages early in the season. The following conditions will apply in 2018[9].

(2) For the streamer part of the survey, all reasonable attempts will be made to acquire the A-line segments positioned closest to shore repeating the 2015 acquisition direction during daylight hours in 'good visibility', i.e., the PML must be within the effective sighting range of a shore station or a vessel-based 'distant' monitoring team. If a choice is to be made between postponement (e.g., by two weeks needed to get a feather match between the line to be acquired and the baseline survey) and acquiring the line or segment at night or in poor visibility conditions as defined in Annex D of the MMP, then that choice is made by the Central Commander on the day, after considering all available information. If acquisition is planned to take place at night, then a pre-dusk scan must take place and confirm that no mother-calf pairs are present in the A-zone.

   a. No acquisition will occur if mother-calf pairs are observed (with a 100m radius buffer around geo-referenced positions) in the A-zone. When a mother-calf pair is observed in the A-zone, ongoing acquisition (if any) will be suspended. No acquisition will commence or resume until either (a) the mother-calf pair are outside the A-zone, or (b) at least 3 hours have passed since the pair were last sighted.

(3) For the OBN part of the survey, A-line segments will only be acquired during good visibility (as defined in Annex C of MMP), unless the Central Commander, after consultation with the Company and the WGWAP Advisory Group, decides that

[9] While the decision has been made to suspend operations only if mother-calf pairs are sighted in the A-zone for this 2018 MMP, this condition is not necessarily to be assumed for future MMPs (or to exclude potential measures to protect other critical segments of the population e.g. pregnant females).

complications would lead to prolonged duration of the survey. Paragraph 1(a) above with respect to mother-calf pairs also applies for the OBN segment[10].

Table 3. SEER Conclusion 2018 Exclusion Zones

Status IUCN/МСОП	Status Red Book RF/ Красная книга РФ	Species	Distance
Whales/Китообразные			
Critically endangered	1st Category	Gray Whale/Серый кит	1000m
Endangered	1st Category	Bowhead Whale/Полярный кит	
Endangered	1st Category	Northern Right whale/Южный (Японский) гладкий кит	
Endangered	2nd Category	Fin Whale/Финвал	
Vulnerable	3rd Category	Curvier's Beaked whale/Клюворылый дельфин Кюрвье	
No	No	Other whales and dolphins/прочие киты и дельфины	1000m
Seals/Ластоногие			
Endangered	2nd Category	Sea Lion	350m

8.2 Modification of the 2018 MMP following Denial of Permit for Underwater Monitoring

The final modified Monitoring and Mitigation Plan (MMP) for the 2018 seismic survey (Appendix iii) updates the original 2018 MMP (Appendix ii), itself based on the 2015 MMP (and as developed through NTF-12 and NTF-13 and confirmed at WGWAP-18). This update is in response to the notification of Permit Denial by the Russian authorities with respect to the deployment of devices for underwater acoustics monitoring by Sakhalin Energy's contractors, the National Scientific Centre of Marine Biology and Pacific Oceanological Institute, for the seismic survey (Appendix ii). The key items in the updated MMP are 2.2 and 3.2.1.

8.2.1 Consequences of Denial of Permit

Key changes to the 2010 MMP, that were reflected in the 2015 MMP, related to (i) aspects of the distribution and behaviour monitoring, (ii) addition of information on the command centre, (iii) refinement of the concept of A- and B-zones and (iv) limiting the protection of whales potentially exposed to noise levels above the behavioural threshold prior to 1-Aug 2015 to only mother-calf pairs rather than protecting all whales in this way (see NTF-8 report, Item 5). The initial 2018 MMP (Appendix ii) was developed in conjunction with Sakhalin Energy within the Noise Task Forces 12 & 13, approved by WGWAP-18 in Moscow November 2017 and further refined in NTF-14 March 2018. Following the receipt of the Russian Federation Denial of Permit for the contracted scientists to undertake underwater acoustic monitoring, Sakhalin Energy informed the Panel and IUCN of the situation. This is the first

[10] If such complications would be identified during planning and prior to execution of the OBN survey, then relaxation of this restriction will be discussed and agreed with the Advisory Group. If such complications would arise during execution itself, caused by near-platform or simultaneous operations, then a potential relaxation would be decided by the Central Commander, after considering all available information.

time in the Company's experience that a contractor has been refused a permit after many years of undertaking such monitoring. No explanation for the denial of permit was offered by the Russian authorities and it was interpreted by the Company as final: not subject to negotiation or appeal. The Panel issued a statement (Appendix ii) stressing the importance of acoustic monitoring to the MMP and recommended that Sakhalin Energy and IUCN seek a solution to allow for even some underwater acoustic monitoring to take place during the 2018 seismic survey. The Company agreed with the importance of underwater acoustic monitoring but informed the Panel that neither it nor its Contractors had, at that time, any formal lines of communication for attempting to achieve the recommendation. After further discussions and a presentation to the Panel, the Company released a response (Appendix ii) to the Panel's statement confirming that it would not be able to implement the planned underwater acoustic monitoring and proposing an approach by its acoustical consulting services provider, JASCO, to compensate for lack of field corroboration through adjustments to the modelling based on newly available data and a detailed analysis of the error bounds. That approach, which is now incorporated into the updated MMP, bounds as much as possible the uncertainty in the modelling estimates and applies a precautionary adjustment to minimize the risk of exposure for the whales. The Panel Co-chairs issued an immediate reply (Appendix ii), providing their own interpretation of the circumstances plus their views on how the situation should be handled thenceforth. They were sympathetic to the position in which the Company was placed and recognised the good faith in which each party involved had attempted to resolve the situation. They acknowledged that the Denial of Permit would not be overturned and that underwater acoustic monitoring would not be carried out by the Company in 2018. Although they noted the precautionary adjustments made by JASCO and the Company to the modelled estimates, they pointed out that the effectiveness of the approach could not be confirmed without measurements in the field. The Co-chairs further pointed out that for the 2018 seismic survey to go ahead without underwater acoustic monitoring all other elements of the agreed MMP should be implemented in full and that the situation should not set a precedent for future seismic surveys. Sakhalin Energy appreciates and accepts the points made by the Panel's Co-chairs. The Company agrees that the absence of underwater acoustic monitoring in the 2018 seismic survey does not set a precedent for successive ones. Learning from this unprecedented experience, it will work in future cases with the contracted scientists to jointly engage with the permitting authorities as early as possible to avoid any possibility of a repeat. The updated MMP, with the precautionary modelling approach devised by JASCO, was produced to mitigate this event.

8.3 Vessel Speed Limits and Corridors

Corridors have been established for SEIC vessel traffic along the east coast of Sakhalin Island. Information of survey marine mammals was used for design of vessels traffic routes. All SEIC vessels are required to keep within the designated corridors, unless deviation is essential for safety or else specifically required and authorised. These corridors are:

- Navigational corridors for all vessels transiting from Kholmsk or Korsakov to Lunskoye and/or Piltun

- Crew boat corridors for crew change vessels travelling between Kaigan port and LUN-A, Molikpaq (PA-A) and PA-B platforms. Pipeline Inspection Corridor for all survey vessels involved in offshore pipeline inspection and offshore environmental monitoring. Examples are Dynamic Positioning vessels equipped with sonar and Remotely Operated Vehicle (ROV) – these vessels will follow the established navigational corridors while on transit, and will follow the Pipeline Inspection Corridor during the survey. Other examples include research vessels for monitoring of marine sediments, benthos and seawater.
- In addition to the above-mentioned corridors, a platform safety zone with a radius of 5 km has been identified around all three platforms. Supply vessels and emergency response vessels typically drift or are anchored in this area. Vessels without an affiliation with Sakhalin Energy are not allowed to enter this zone, which is guarded by emergency response vessels.

To prevent vessel strikes of whales or disturbance of feeding whales, all vessel traffic shall comply with these route definitions. Deviation from these routes is allowed only for justifiable safety / emergency reasons, or if specifically authorized. Deviations from the corridors will be recorded as non-compliances and investigated in line with SEIC procedures.

Speed limits for vessels are as follows: the established speed limit is mandatory for all vessels involved in offshore activity of Sakhalin Energy, unless emergency or safety situations require otherwise (Table 4.).

Table 4. Sakhalin Energy Vessel Speed Limits

Speed limits (maximum in knots)	**Crew transfer corridor[11]**	**Within navigational corridors**	**Westward from corridors[12,] within safety zones and in pipeline inspection corridor**
Daylight conditions & visibility≥0.5 n.m.	35 knots	17 knots	10 knots
Visibility <0.5 n.m. km or at night	21 knots[13]	17 knots	7 knots

[11] See Appendix 1 in MMPP for more details concerning the local situation with regard to crew transfer vessels and consequences for speed requirements

[12] Speed limits westward from the corridors (towards areas where encounters with GW are more likely).

[13] The speed limit within the corridors is the same under all conditions under the assumption that the probability of encountering gray whales in these offshore routes is very low

Sudden changes in speed and course should be avoided.
Vessels are forbidden to pursue, intercept or encircle whales and shall not cause groups of whales to separate.
Vessels will not cross directly in front of, or in the immediate vicinity of moving or stationary whales. When moving parallel to whales, vessels will maintain a constant speed and course.
Non-transiting vessels moving with a speed of less than 5 knots shall maintain course and speed unless there is an imminent risk of collision.
Transiting vessels will attempt to maintain a minimum of 1,000 m separation from observed endangered whale species (gray whale, bowhead whale, North Pacific right whale, fin whale and Cuvier's beaked whale) and a 500 m separation for other non-endangered marine mammals. No minimum separation distance is imposed for pinnipeds, but vessels are directed to proceed with appropriate caution if pinnipeds are observed close to the vessel.
If a whale surfaces in the vicinity of, or is heading towards the vessel, appropriate precautionary measures (slow down and change vessel course) shall be taken to avoid striking the whale, until it has been determined that the potential danger to the whale has passed. This might include slow change of course, reduction of speed or full stop of the vessel, if these can be done safely.
All speed exceedances will be considered as non-compliance with Sakhalin Energy's operating standards and rules. Therefore they will be documented by the MMO and investigated by Managers as such.

9 Critical Habitat Assessment

9.1 Discrete Management Units

The following areas have been selected for Critical Habitat Assessment (CHA): coastal north-eastern Sakhalin Island from the northern border of Tropto Bay to the northern border of Central ridge (located to south from Lunskyi Bay) including lagoons; the Coastal Land Zone; Aniva Bay (from the promontory Aniva on the east to the promontory Crillon on the west) and onshore areas from Piltun Bay to Aniva bay. Subsequently, the following are proposed as Discrete Management Units (DMU) for the whole of Sakhalin Island and its inshore waters:

1. The North Marine DMU - part of the marine environment with depths ranging from 0m to 100 m. The 0m to 20 m zone is important for a range of marine organisms. Gray whales congregate there each summer to forage; it is an important site for foraging and roosting seabirds and waders, whose habitat range is considerably spatially limited compared to marine mammals or pelagic fishes (Fig. 7 below)

2. The South Marine (Lagoons) Zone DMU - sites for breeding, rest and foraging for water and wetland birds

3. The Coastal Land Zone DMU – areas between lagoons and the sea are important for nesting birds

4. The Onshore Zone DMU – areas for rare species of plants, animals and birds

Figure 7. Location of North Marine DMU

9.2 Key Species

A Critical Habitat Assessment was conducted, based on the conservation status of the species included in the IUCN Red List and the Russian Federation Red Book (the process is described in detail in Appendix v draft CHA).

Eight key species (deemed Critically Endangered or Endangered in the IUCN Red List) found in or around Sakhalin are proposed for Critical Habitat Assessment: four marine mammal species (gray whale (*Eschrichtius robustus),* bowhead whale (*Balaena mysticetus),* North Pacific right whale (*Eubalaena japonica),* fin whale (*Balaenoptera physalus) (See Table 4 below)* and four bird species (spotted greenshank (*Tringa guttifer),* spoonbill sandpiper (*Eurynorhynchus pygmeus),* Australian curlew *(*Numenius madagascariensis)*,* yellow-breasted bunting (*Emberiza aureola)*.

For the purposes of this document, only the North Marine DMU is appropriate. The other marine DMU, South Marine (lagoons) Zone (effectively, Aniva Bay) is hundreds of kilometres distant and not Critical Habitat for the four key marine mammals. It has therefore been screened out of this process. With seismic survey operations focussed on the sea and the shore-based observers' operations concentrated on set locations and a single access route, any threat or impact on the natural habitat or the four bird species is judged as negligible to none. Regarding the marine mammals, the North Marine DMU includes two species: gray whale and North Pacific right whale (Table 5.). The North Pacific right whale is uncommon off north-east Sakhalin. Two whales were registered travelling together in 2005 in the Lunskoye area. If it is observed during the survey then it automatically falls under the mitigation and protection plans prevailing for the gray whales.

Table 5. (From draft CHA SEIC 2018, Appendix v) Results of Marine Mammal Habitats Assessment of the North Marine DMU, north-eastern Sakhalin Island

	English common name	**Criterion 1**	**Criterion 2**	**Criterion 3**	**Criterion 4**	**Criterion 5**
1	Gray whale	**Tier 1 (a)**	NO	**Tier 2(b)**	YES	YES
2	Bowhead whale	NO	NO	NO	NO	NO
3	North Pacific right whale	**Tier 2 (d)**	NO	NO	NO	NO
4	Fin whale	NO	NO	NO	NO	NO

10 Offsets

10.1 Biodiversity Offsets

In addition to operating a mitigation policy of avoiding then minimising and restoring losses to biodiversity, the Company, under its obligations to the Lenders'/IFC Performance Standard 6, must take the outcome of the qualification of the North-east Sakhalin seas DMU as Tier 1 Critical Habitat (criterion 1a) for North Pacific gray whale and North Pacific right whale and deliver biodiversity offsets. For Natural Habitat, those should be designed and implemented to achieve measurable conservation outcomes that can reasonably be expected to result in no net loss and preferably a Net Gain of biodiversity. However, a Net Gain is required in Critical Habitats. Net Gains are additional conservation outcomes that can be achieved for the biodiversity values for which the Critical Habitat was designated, in this instance gray whales (and bowhead whales should they ever be observed/recorded). Officially, these Net Gains may be achieved through the development of a biodiversity offset and/or, in instances where the client could meet the requirements of paragraph 17 (on Critical Habitats) of the IFC Performance Standard 6 without a biodiversity offset, the client should achieve Net Gains through the implementation of programmes that could be implemented *in situ* to enhance habitat and protect and conserve biodiversity. The Company is aware of the issues of practicality and effectiveness in creating, say, habitat for vagile marine mammals such as gray whales and endeavours to achieve the Net Gains nevertheless. Under the terms of the IFC Performance Standards 2012, simply carrying out industrial activities in Critical Habitat triggers a requirement for Net Gains even if no impact can be observed or measured to the biodiversity values for which the Critical Habitat was designated i.e. Sakhalin gray whales.

10.2 Net Gains

Net Gains can be achieved through the implementation of programmes applied on-the-ground to enhance habitat, protect and conserve the gray whales. Given the caveats on the creation of habitat for vagile marine mammals mentioned above, in that respect, the Company, has been determined and realistic in developing Net Gains. Through its approach and commitment to scientific programmes, environmental management, assurance practices and its willingness to work with experts, Sakhalin Energy has built up enormous experience in carrying out its activities in Critical Habitats. It now has genuine influence and a well-earned reputation, regionally and internationally in the oil and gas sector and among environmental NGOs, particularly for operating in sensitive areas.

10.2.1 Island-wide Biodiversity Action Plan

The Company is developing a Biodiversity Action Plan (BAP). This plan takes an island-wide approach including the marine areas. It will be used to plan, mitigate and manage the Company's activities on the island and offshore for future projects and years. Potential offsets within the BAP include developing or publicising good practice and influencing regulators and averted risk (in this instance, fishing gear). These are practical measures that are difficult to measure or demonstrate, therefore qualitative assessments may be required. These will be developed as part of the BAP and, while not an offset in itself, the Company has contributed to improved knowledge that is vital for the conservation and protection of the Sakhalin gray whales.

10.2.2 Substantial contribution to gray whale scientific knowledge base

A major gain, but not strictly an Offset, is the contribution made by the high quality and volume of new scientific data and information on Sakhalin gray whales generated by the two scientific programmes with which the Company is involved. In the first, the Company independently and solely funds and manages the Whale Programme, which includes the IUCN/WGWAP process. This has led to industry-leading, scientifically-based measures and plans being developed, then applied widespread to avoid and mitigate risk from industrial activities on gray whales and applied to cetaceans more generally worldwide. In the second, the Joint Scientific Programme on Gray Whales with its industry partner, Exxon Neftegas Ltd (ENL), between 2002 and 2018 generated 306 publications (48 of which were presented at International Whaling Commission conferences and workshops) including 51 peer-reviewed papers. The publications covered a wide range of scientific and technical subjects: distribution, feeding, genetics, migration, photo identification, benthos, population dynamics and acoustics. As a result, far more is known now about the gray whales off Sakhalin Island and how to manage their conservation.

10.2.3 Promotion of good practice

A second major gain is the positive influence the Company has in terms of the proactive promotion of good practice to other operators' activities around Sakhalin. This open attitude to sharing experience and practice resulted in two other major operators feeling encouraged enough to make approaches and discuss with the Company the development of Environmental Management Systems (EMS) in the context of their own operations off Sakhalin in the proximity of gray whales. In recent years, awareness of other operators' activity plans, such as for seismic surveys or heavy lifts, reveals close adherence to the Company's standards and practice developed through, for example, the WGWAP process. The WGWAP and IUCN have produced Good Practice guidelines based on this experience https://portals.iucn.org/library/node/46291. The Company does acknowledge that causal-effect on other operators' working practices is difficult or impossible to demonstrate let alone quantify, as is required under PS6. However, this influence has been rewarded and marked in the Russian Federation by several awards and tributes from the agencies, national and regional governments.

10.2.4 Influence on Industry standards within Russian Federation

A third gain is the acceptance of the Company's EMS and standards on Russian Federation's national and local (Oblast) regulatory processes and policies. The Company has observed that the State Environmental Expert Review (SEER) is now advising the deployment of Marine Mammal Observers and the production of Marine Mammal Protection Plans and Monitoring and Mitigation Plans in advice to other operators off Sakhalin. This may be a consequence of the UNDP/GEF project "*Mainstreaming biodiversity conservation into Russia's energy sector policies and operations*" which was initially promoted by the Company, working with the

Ministry of Natural Resources (MNR) and The Russian Environmental Protection Agency (RPN) to inform the SEER and Interdepartmental Working Group (IWG) on managing risk and impacts on the environment from the oil and gas industry in the Russian Federation. However, at a regional (Sakhalin Oblast) level, the Company's Biodiversity Strategy has largely informed the Sakhalin Biodiversity Action Plan and given rise, for example, to the genetic conservation of Taimen project.

10.2.5 Reduction in risk to gray whales from Fishing Gear

A fourth gain is the reduction in direct risk from fishing gear to gray whales (and other marine mammals) in the Sea of Okhotsk. Whether the fishing gear is in operation or abandoned, it is the activity presenting the highest risk of injury and death to gray whales (especially mother-calf pairs at Sakhalin) in the North Pacific. The Company has highlighted the risk of fishing gear to the fisheries and environment authorities in Sakhalin Oblast allowing them to re-examine licensing agreements, fishing practices and fishing locations.

10.2.6 Development of Marine Mammal Rescue Response

The Company sponsors 'Club Boomerang' which is a group, created for youths and lead by adults with specialist experience, investing in activities and training to bring societal and environmental gains to Sakhalin. Specifically, it has an ongoing training plan, with the involvement of local veterinarians and visiting experts, for producing personnel with expertise in marine mammal rescue response. One particular aspect of this activity is gaining expertise in the removal of dangerous fishing gear from the nearshore to avoid entanglement with gray whale adults and calves. They have also trained in techniques for removing fishing gear from live animals.

11 Cumulative Impacts

Critical Habitat designation is actually an assessment of biodiversity importance of an area, based on the biodiversity values and not the potential project or activity impacts. If there are no project/activity impacts, the fact that a species or habitat qualifies the area for designation as Critical Habitat does not necessarily mean that it will require any specific mitigation. However, where potential for impacts do occur, PS6 requires project proponents to 'fully exercise the mitigation hierarchy', with an emphasis on measures aimed at avoiding and minimising impacts. The receptors potentially at risk of cumulative impacts off north-east Sakhalin are primarily marine mammals. The sources of these potential cumulative impacts for marine mammals include entanglement with operating or abandoned fishing gear; within year and year-on-year noisy activities (not just seismic sources but also large operations such as heavy transportation and landing activities, dredging and pile driving); general or increased vessel movements. Within the Company and often between the Company and its industry scientific joint programme partner, cumulative impacts are discussed and addressed through project planning and within the HSESAP. In the course of carrying out its activities over the past 18 years, the Company has not observed or measured an impact on gray whales or any other marine mammals. This does not mean that there are no impacts and within the PS 1 and PS6 processes, actual impact is not necessary for action to be taken, potential for impact is enough. Much of that potential impact is managed. So, although describing cumulative impacts is problematic when none has been observed or measured, the assumption is taken that risk still has to be averted. The Company achieves the management of that potential risk in the ways mentioned above but it also looks at factors such as timing of an activity or linking activities to biodiversity strategy plans. The 2015 seismic survey undertaken when ENL was also carrying out a seismic survey is a good example of pragmatic management of potential risk based on previous guidance from the WGWAP and knowledge accrued from previous experience.

11.1 Further mitigation

11.1.1 Entanglement with fishing equipment

The Company's influence has been two-fold: first, it has highlighted the risk of fishing gear to the fisheries and environment authorities in Sakhalin Oblast allowing them to re-examine licensing agreements, fishing practices and fishing locations; and second, the Company sponsors 'Club Boomerang' which is a group, created for youths and lead by adults with specialist experience, that invests in activities and training to bring societal and environmental gains to Sakhalin. Specifically, it has an ongoing training plan, with the involvement of local veterinarians and visiting experts, for producing personnel with expertise in marine mammal rescue response. One particular aspect of this activity is gaining expertise in the removal of dangerous fishing gear from the nearshore to avoid entanglement with gray whale adults and calves. They have also trained in techniques for removing fishing gear from live animals.

11.1.2 Positive dissemination of good practice within the industry

The Company's open attitude towards sharing experience and practice resulted in two other major operators feeling encouraged enough to make approaches and discuss with the Company the development of Environmental Management Systems (EMS) in the context of their own operations off Sakhalin in the proximity of gray whales. In recent years, awareness of other operators' activity plans, such as for seismic surveys or heavy lifts, reveals close adherence to the Company's standards and practice developed through, for example, the WGWAP process.

11.1.3 Source reduction for future surveys

The Company intends carrying out source reduction tests during the 2018 seismic survey period. The aim of the tests is to identify to what extent nominal source volume can be reduced while still achieving effective data and information coverage of the fields.

11.1.4 Support for Range-wide Initiatives by International Whaling Commission (IWC)

This is a mechanism by which the Company would seek to support the aims of the IWC in order to help address cumulative impacts on gray whales throughout their range.

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