LOWER COOK INLET GEOHAZARD SURVEY

ENVIRONMENTAL EVALUATION DOCUMENT

Revision 1

Submitted:

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SUBMITTED TO:

Bureau of Ocean Energy Management
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ACRONYMS

2D	two-dimensional
3D	three-dimensional
AAC	Alaska Administrative Code
ADCP	Acoustic Doppler Current Profiler
AMHS	Alaska Marine Highway System
AQCR	Air Quality Control Region
BIA	Biologically Important Areas
BMP	Best Management Practice
BOEM	Bureau of Ocean Energy Management
CAA	Clean Air Act
CFR	Code of Federal Regulations
cm	centimeter(s)
CO	carbon monoxide
dB	decibel(s)
DGPS	Differential Global Positioning System
DPS	Distinct Population Segment
EED	Environmental Evaluation Document
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
EZ	exclusion zone
ft	feet
GAPS	Gyro-Acoustic Positioning System
GNSS	Global Navigation Satellite System
HF	high frequency
Hilcorp	Hilcorp Alaska LLC
hrs	hours
Hz	hertz
INS	Inertial Navigation System
ITR	Incidental Take Regulations
J	joule
kHz	kilohertz
kJ	kilojoule
km	kilometers
KPB	Kenai Peninsula Borough
LF	low frequency

LOA	Letter of Authorization
m	meters
MBES	Multibeam Echosounder
mbps	megabits per second
mph	miles per hour
M-UHRS	Multichannel ultra high resolution system
NAAQS	National Ambient Air Quality Standards
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NTL	Notice to Lessees
O_3	ozone
OCS	Outer Continental Shelf
$PM_{2.5}$ and PM_{10}	particulate matter
PSO	Protected Species Observer
Q105	Qualifier 105
R/V	Research Vessel
SO_2	sulfur dioxide
SSS	side scan sonar
SSV	sound source verification
SVP	sound velocity profiling
USBL	ultra-short base line
U.S.C.	United States Code
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service

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1. INTRODUCTION

Hilcorp Alaska LLC (Hilcorp) is proposing to conduct a geohazard survey in the lower Cook Inlet leases in spring 2020. The survey will be conducted in federal Cook Inlet Outer Continental Shelf (OCS) waters of the Bureau of Ocean Energy Management (BOEM) Cook Inlet Planning Area.

Hilcorp acquired 14 lease blocks in the BOEM OCS Lease Sale 244 held on June 21, 2017. An airborne gravity and magnetic survey was conducted over all 14 lease blocks in the summer of 2018 and a three-dimensional (3D) seismic survey was conducted over eight of the lease blocks in fall of 2019. Hilcorp proposes to conduct a geohazard survey over 11 lease blocks and the surrounding area to determine the location of shallow drilling hazards and archaeological resources. This information will be used to support a proposed exploration drilling program.

1.1 Purpose and Organization of this Document

This Environmental Evaluation Document (EED) was developed to provide information specific to resources that may be impacted as a result of the proposed geohazard survey; to describe the potential adverse environmental effects of the proposed activities; to identify mitigation measures proposed to eliminate these effects on the marine, coastal, and human environment as required by Title 30 of the Code of Federal Regulations (CFR) 550.208(a)(4); and to assist BOEM in their review and approval process as required by the National Environmental Policy Act.

The following elements are included in this EED:

- Project description, including vessel information, description of operations, location and timing of operations
- Baseline information about the physical, biological, and socioeconomic environment in the area of the proposed survey
- Environmental consequences of the proposed surveys
- Mitigation measures proposed by the applicant
- References

1.2 Permits and Lease Stipulations

The primary permits that Hilcorp is required to obtain to perform the proposed geohazard survey are provided in Table 1-1.

Table 1-1 Permits Required for the 2020 Lower Cook Inlet Geohazard Survey

Agency	Permit	Status
BOEM	Permit for Geophysical Exploration (off-lease activities)	To be submitted with EED
	Ancillary Activities Notice (on-lease activities)	Submitted February 5, 2020
National Marine Fisheries Service (NMFS)	Incidental Take Regulations (ITR) Petition/Letter of Authorization (LOA)	ITR Final Rule issued July 31, 2019 LOA issued July 31, 2019
United States Fish and Wildlife Service (USFWS)	ITR Petition/LOA	ITR Final Rule issues August 1, 2019 LOA application submitted January 10, 2020

1.3 Notices to Lessees and Operators

Notices to Lessees and Operators (NTLs) are documents from BOEM that provide guidance or interpretation of a regulation, OCS standard, special lease stipulation, or regional requirement. There are three Alaska-specific NTLs:

- NTL 2005-A01 – Shallow Hazards Survey and Evaluation for OCS Exploration and Development Drilling
- NTL 2005-A02 – Shallow Hazards Survey and Evaluation for Alaska OCS Pipeline Routes and Rights-of-Way
- NTL 2005-A03 – Archaeological Survey and Evaluation for Exploration and Development Activities

The purpose of the proposed geohazard survey is to gather information to meet the requirements outlined in NTLs 2005-A01 and 2005-A03 for a proposed exploration drilling program. No pipelines are proposed as part of the exploration drilling program, therefore NTL 2005-A02 is not applicable.

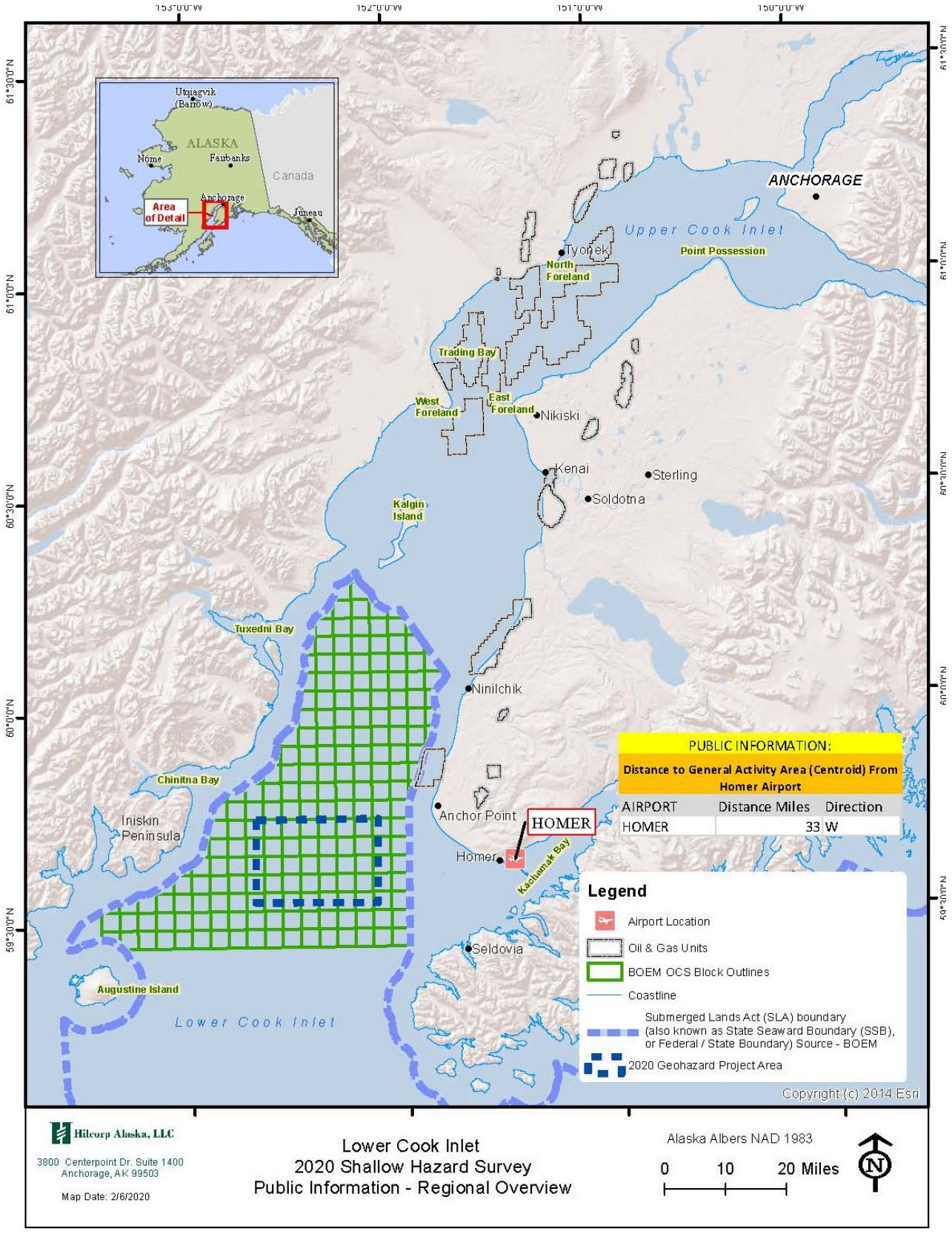
2. PROJECT DESCRIPTION

The scope of this EED evaluates the potential impacts of the proposed geohazard survey. This survey will occur in proximity of Hilcorp's leases in lower Cook Inlet, which is the area south of the Forelands and west to southwest of Homer. The geohazard survey is required to comply with relevant NTLs, lease stipulations, and permit requirements prior to conducting exploration drilling activities.

Two surveys areas are anticipated as presented in Figure 1:

- Blackbill-Steller target area – approximately 180 square kilometers (km^2), covering four identified surface locations.
- Tetra target area – approximately 48 km^2 covering a single location.

Figure 1 Proposed Geohazard Survey Area



Activities are expected to be conducted between approximately April and June 2020 and would take about 30 days. The geohazard survey typically covers less than one lease block in a day.

If a sound source verification (SSV) is required to establish distances for specific project environmental parameters for this survey, it will be conducted immediately following vessel mobilization and sea trials, prior to starting the geohazard survey. The SSV would require one day to perform.

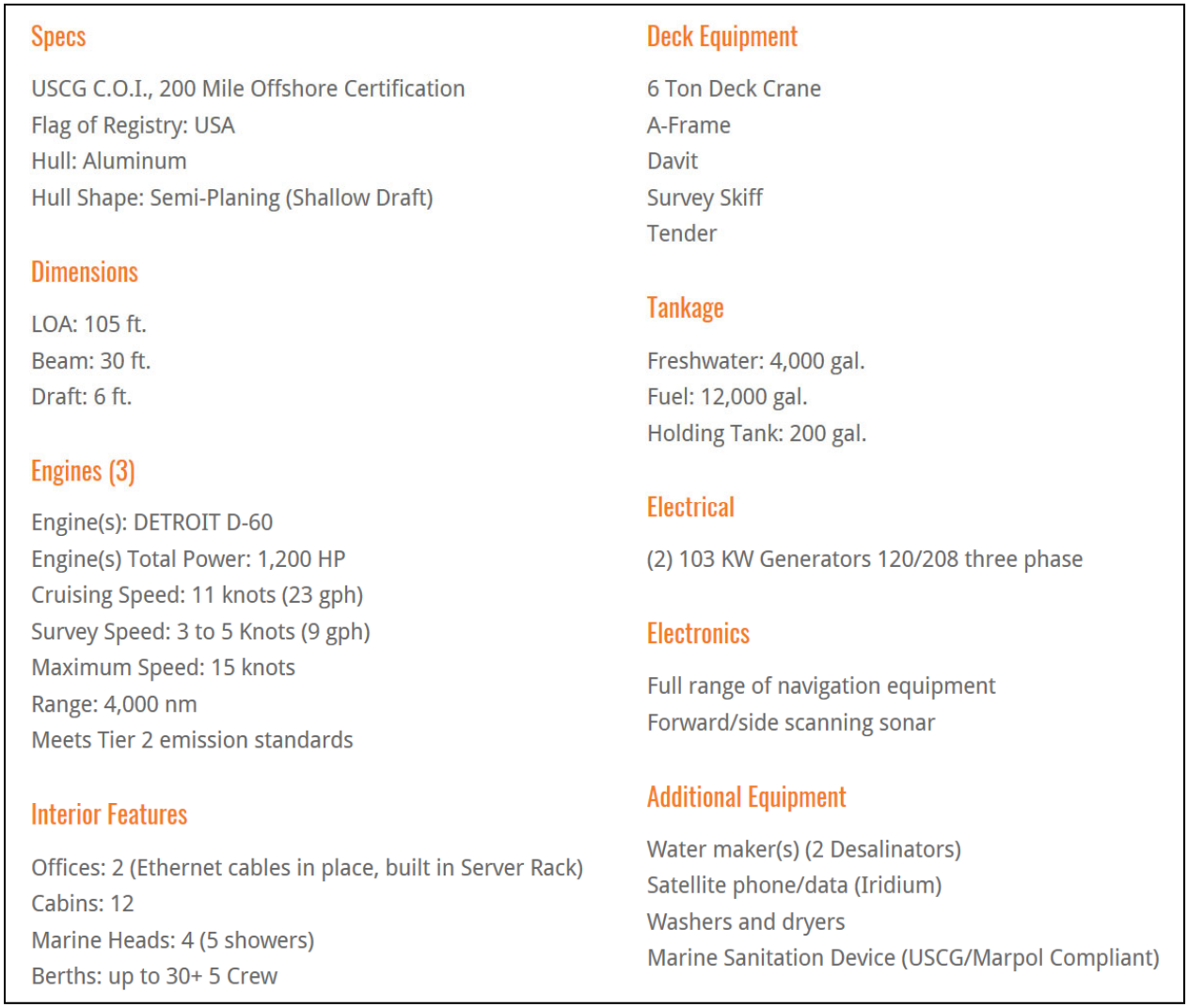
2.1 Geohazard Survey Vessel

Shallow hazard survey equipment is generally hull mounted or towed behind a single vessel. The ship will travel at 3-4.5 knots (5.6-8.3 km/hour [hr]) collecting data. The vessel that will be used to conduct shallow hazard surveys will be identified upon completion of contracting with the selected firm. A vessel that is typical for this type of work is the *Research Vessel (R/V) Qualifier 105* (*Q105*) (Figure 2), owned and operated by Q105, LLC and homeported in Homer, Alaska.

A custom mounting arm built specifically for surveying with multibeam sonars is currently installed aboard the *R/V Q105* featuring a hydraulic actuator which allows the sonar to be safely deployed and recovered with minimal effort. Specifications of the *R/V Q105* are depicted in Figure 3.

Figure 2 ***R/V Q105***

Figure 3 ***R/V Q105* Specifications**



Specs

USCG C.O.I., 200 Mile Offshore Certification
Flag of Registry: USA
Hull: Aluminum
Hull Shape: Semi-Planing (Shallow Draft)

Dimensions

LOA: 105 ft.
Beam: 30 ft.
Draft: 6 ft.

Engines (3)

Engine(s): DETROIT D-60
Engine(s) Total Power: 1,200 HP
Cruising Speed: 11 knots (23 gph)
Survey Speed: 3 to 5 Knots (9 gph)
Maximum Speed: 15 knots
Range: 4,000 nm
Meets Tier 2 emission standards

Interior Features

Offices: 2 (Ethernet cables in place, built in Server Rack)
Cabins: 12
Marine Heads: 4 (5 showers)
Berths: up to 30+ 5 Crew

Deck Equipment

6 Ton Deck Crane
A-Frame
Davit
Survey Skiff
Tender

Tankage

Freshwater: 4,000 gal.
Fuel: 12,000 gal.
Holding Tank: 200 gal.

Electrical

(2) 103 KW Generators 120/208 three phase

Electronics

Full range of navigation equipment
Forward/side scanning sonar

Additional Equipment

Water maker(s) (2 Desalinators)
Satellite phone/data (Iridium)
Washers and dryers
Marine Sanitation Device (USCG/Marpol Compliant)

2.2 Alternative Geohazard Survey Vessel

If the *R/V Q105* is not available, an alternative vessel is the *R/V Norseman II* (Figure 4), owned and operated by Support Vessels of Alaska. The *R/V Norseman II* is homeported in Homer, Alaska. The *R/V Norseman II* has a large aft A-Frame, Aft crane, large deck space, bow thruster and deep draft. It has a custom mounting arm built specifically for surveying with multibeam sonars currently installed. Specifications of the *R/V Norseman II* are depicted in Figure 5.

Figure 4 ***R/V Norseman II***

Figure 5 ***R/V Norseman II*** **Specifications**

Norseman Maritime

NORSEMAN II

115 ft. Research Vessel

DIMENSIONS & REGULATORY INFORMATION					
Length:	115 ft.	**Beam:**	28 ft.	**Draft:**	13ft.
Gross Tons:	194	**Deck Levels:**	3		
Documentation:	United States				
Sewage Treatment System:	Type II MSD Coast Guard Approved				

PERFORMANCE & PROPOLSION	
Speed:	10 Knots
Endurance:	90+ Days
Range:	10,000 Miles
Propulsion:	850 HP Cat Diesel
Fuel Consumption: (@ 8 knots)	450 Gallons per Day

MACHINERY	
Electric Generators:	1-NL 55 KW 1-CAT 90 KW 1-CAT165 KW
Electric Power:	110 Volt AC 208 Volt AC 3 Phase 480 Volt AC 3 Phase

CAPACITY	
Fuel Capacity:	44,000 gal.
Fresh Water Making:	13,500 gal.
Fresh Water Holding:	1,200 gal., per day
Walk in Cooler:	400 cu ft.
Walk in Freezer:	300 cu ft.
Open Deck Area:	1,420 sq. ft.

ACCOMODATIONS	
Berths:	5 researcher cabins capable of sleeping 20, plus separate quarters for 8 crew
Bathrooms:	7 units each with toilet, shower, and vanity
Dinning:	Separate guest and crew messes

SPECIAL FEATURES	
Hydraulic Boom Crane:	10,500 lbs., @ 20' 5,000 lbs., @ 40'
Stern Mounted A-Frame:	11,000 lbs., @ 13' 17,00 lbs., @ 10'
Hydraulic Winch:	2,000 lbs., line pull 1,000 ft., 9/16 wire
Anchor Winch:	115 Fathoms Ground Gear
Small Boat Launching Ability:	Up to 23' Rigid

SAFETY FEATURES
2 - 25 Person Solas A Pack Life raft
1 – 10 Person Solas A Pack Life raft
Survival suites of various sizes
Automatic External Defibrillator
Medical Oxygen
Medicine and First Responder Kit
Marine Medical Access Service via George Washington University

7683 SE 27th St., Suite 476 Mercer Island, WA 98040 – Ph: (206) 403-3630

www.norsemanmaritime.com – email: info@norsemanmaritime.com

2.3 Communication and Positioning Systems

2.3.1 Off-Vessel Communication

The vessel chosen will be outfitted with a broadband satellite communication system. The communication equipment will allow emails and data to be sent and received while working offshore. The system employed will have a 3.0 megabits per second (mbps) download and 0.7 mbps upload speed. There will also be a separate satellite phone system for backup communications.

2.3.2 Vessel Positioning Systems

The geophysical survey vessel will be equipped with positioning systems that provide high accuracy positioning for vessel mounted, surface towed, and subsurface towed geophysical systems.

For altitude and heading determination, an Applanix POS MV Inertial Navigation System (INS) is proposed. The POS MV utilizes a high-quality Inertial Measurement Unit coupled with dual Global Navigation Satellite System (GNSS) receivers to provide accurate attitude corrections. With a two or four-meter (m) antenna separation (baseline) heading accuracies between 0.01 and 0.02 degrees (°) can be achieved. Specifications for the INS are provided in Table 2-1.

Table 2-1 Applanix POS MV 320 Specifications for Real Time and Post Processed Datasets

Applanix POS MV 320				
Performance Type:	Position:	Roll & Pitch:	Heading:	Heave/True Heave
Differential Global Positioning System (DGPS)	0.5 - 2 m2	0.02°	0.01° (4 m baseline)	5 cm or 5%
			0.02° (2 m baseline)	2 cm or 2%
POSPac MMS PPP	Horizontal: < 0.1 m	< 0.01°	0.01° (4 m baseline)	N/A
	Vertical: < 0.2 m		0.02° (2 m baseline)	

A Hemisphere V113 or V111 DGPS will be used as a secondary positioning system. This DGPS will allow real time quality control of the primary INS position and heading during mobilization and survey.

2.3.3 Equipment Positioning

An Ultra-Short Base Line (USBL) acoustic positioning system will be used to position towed sensors. An iXBlue Gyro-Acoustic Positions System (GAPS) unit will be installed on a retractable sonar pole. The GAPS system has been selected due to its reputation for accuracy and reliability.

2.4 Geohazard Survey Equipment

The geohazard survey will be conducted to provide information on drilling hazards down to 600 m below the seabed. The suite of equipment used and their frequency ranges is provided below and summarized in Table 2-2.

- Multi-beam echosounder – provide water depths and seafloor morphology
- Sound velocity profiler – measures the speed of sound throughout the water column to support accuracy of bathymetric data
- Side scan sonar – provides acoustic images of the seafloor

- Two sparker-type sources – one will penetrate the shallow subsurface section and the second would penetrate the deeper subsurface section.
- Magnetometer – detects ferrous items and may also be used.

Table 2-2 Frequency Ranges for Geohazard Survey Equipment

Equipment	Frequency Range
Reson SeaBat T50 Multibeam Echosounder	200 - 400 kHz variable
Teledyne RapidCAST Sound Velocity Profiler	N/A
EdgeTech 4200 Side Scan Sonar EdgeTech 4205 (possible option)	300 & 600 kHz 230 & 540 kHz
GeoMarine Survey Systems Dual Geo-Source 2000	500 – 3,000 Hz
GeoMarine Total Spread 48 kJ Triple Sparker System	200 – 1,500 Hz
Geometrics G882 marine magnetometer	N/A
Teledyne Workhorse Mariner Acoustic Doppler Current Profiler (ADCP)	300 kHz

2.4.1 Multibeam Echosounder

The proposed multi-beam echosounder (MBES) is Teledyne Reson T50-R MBES for bathymetric and backscatter data acquisition. The T50 system produces 512 beams per ping and is fully frequency agile from 200 to 400 kilohertz (kHz). Backscatter and bathymetry will be recorded simultaneously. Based on identified water depths, the MBES will be operated at approximately 400 kHz for higher resolution. The MBES will be mounted to the survey vessel on a custom sonar pole. Specifications for MBES are provided in Table 2-3.

Table 2-3 Multibeam Echosounder Specifications

Reson SeaBat T50	
Swath	Up to 220°
Frequency	200 - 400 kHz variable
Number of beams	20 - 512 user selectable
Along-track transmit bandwidth	1.0° at 400 kHz
Across-track receive bandwidth	0.5° at 400 kHz
Pulse Length	30 – 300 µs (CW), 300 – 5000 µs (FM)
Max Ping Rate	50 Hz
Max Power	220 decibel (dB)

2.4.2 Sound Velocity Profiler

Sound velocity profiles in this portion of Cook Inlet are highly dynamic and will require frequent measurements to maintain high accuracy bathymetric data. Depending on conditions on site, the cast-interval is expected to be between 0.5 and 1.5 hrs. Furthermore, sound velocity profiles must be recorded without slowing or stopping the vessel when performing simultaneous operations with towed geophysical systems.

In order to meet these criteria a Teledyne RapidCAST underway profiling system located onboard the survey vessel will be used. The system is composed of a sound velocity sensor connected to a computer-controlled line pay-out system. The line pay-out system uses a precision tension control that eliminates the effects of vessel speed and heave, allowing the free-falling probe to have a target depth accuracy of five percent.

A Valeport RapidSV or RapidCTD sensor will be used as the sound velocity profiling (SVP) device. Real-time surface sound speed will be monitored constantly, with an alarm set to sound in response to deviations between its reading and the last SVP value at the same depth. If the deviation exceeds the acceptable threshold, a new SVP cast will be taken. All sound velocity corrections will be applied to the bathymetric data in post processing.

2.4.3 Side Scan Sonar

The proposed side scan sonar (SSS) system for seabed imaging is an EdgeTech 4200 SSS. Another option would be the EdgeTech 4205 SSS. The side scan data is primarily used to examine the seafloor for archaeological features but also aids in hazard identification. The SSS operates with simultaneous dual channels of 300 and 600 kHz; the high frequency will be operated with a range of 100 m, and the low frequency will be operated with a range of 200 m. These settings allow for coverage of the nadir gap at low frequency, while still achieving greater than 100 percent coverage with the high frequency channel. Specific accuracies and specifications for the SSS can be seen in Table 2-4.

Table 2-4 Side Scan Sonar Specifications

EdgeTech 4200 Side Scan Sonar	
Frequency	300 & 600 kHz
Horizontal Beam Width	0.28° at 300kHz, 0.26° at 600 kHz
Vertical Beam Width	50°
Resolution Across Track	3.0 cm (300 kHz), 1.5 cm (600 kHz)
Additional Sensors	Pitch, Roll, Heading, Pressure (Depth)

The SSS will be towed at an altitude above the seafloor that is 10 percent to 20 percent of the high frequency range setting. Therefore, the SSS altitude will be 10 m to 20 m above the seafloor except in areas where it may be unsafe to do so. These areas could include steep slopes, seafloor features, shipwrecks, fishing equipment, etc.

2.4.4 Multichannel Ultra High Resolution Survey

Two sparker systems will be used to collect the required data: a shallow two-dimensional (2D) system with a penetration depth of approximately 150 m and a deep 2D system with a penetration depth of at least 600 m.

Shallow 2D Survey

A 2D Multichannel Ultra High Resolution System (M-UHRS) system will be used to image the subsurface to a depth of 150 m or greater. The specific system proposed is a GeoMarine Survey Systems Dual Geo-Source 2000.

GeoMarine's Dual Geo-Source (up to 2 kilojoule (kJ), sparker) is an innovative "negative discharge" technology. This system generates an extremely repeatable acoustic pulse with a broad spectrum. The acoustic pulse consists typically of a very short, initial High Frequency (HF) pulse, which provides the ultra-high resolution in the upper strata, followed by a longer, Low Frequency (LF) pulse, which achieves substantial penetration in the deeper subsoil. A 48-channel Geo-Sense Multichannel Streamer and the Multi-Trace Acquisition provides continuous 10 kHz sampling and no limitations in trace length or shooting rate. This streamer is specially designed to capture the full spectrum of the Geo-Source sparkers. Details of the selected source and receiver are listed in Table 2-5.

Table 2-5 Shallow 2D Source and Receiver Specifications

GeoMarine Geo-Spark 2D UHRS	
Source Parameters	
Source Type	Sparker
Number of Tips	400
Power Supply	Geo-Spark 2 kJ
Receiver Parameters	
Achievable Vertical Resolution	< 30 cm
Multichannel Streamers	Geo-Sense Light-Weight UHRS - 48 channel
	3 elements per channel
	0.5 m group length
	1 m group spacing (channel 1 - 24), 2 m group spacing (channel 25 - 48)
	AQ2000 Hydrophone per channel, Freq response 1 Hz to 10 kHz
	72 m active length
	25 m armored deck lead, 75 m towleader, 12.5 m stretch at front and rear of active
MC positioning	Dual DGPS lead-in and tail buoys
Sampling Interval	0.1 m
Peak Sound Source Level	229 - 234 dB at 1 m

The vertical resolution and depth penetration will be achieved by tuning on the HF mode with the electrodes at 30 centimeters (cm) below sea and limiting the energy to < 10 joule (J) per electrode, plus (and if needed) the LF mode with electrodes at 80-100 cm below sea surface and by increasing the energy > 10 J per tip. The HF pulse will achieve penetration of 200 m – 400 m in "ordinary" marine sediments with a resolution of around 10 cm in the shallow layers and 20 – 25 cm in the deeper layers. The LF pulse can reach up to 800 m penetration with a resolution of around 50 cm in the deeper layers. The combined HF and LF pulses of source signals will achieve the desired resolution and penetration depth.

The M-UHRS source and streamer are surface towed using an outrigger to ensure the hydrophones are not disturbed by the vessels propwash. Precise positioning of the streamer and the depth control are realized through use of a lead-in buoy and tail buoy system. Each buoy has a dual GNSS antenna and communicates with the data acquisition unit via a long range WiFi link.

Deep 2D Survey

A 48 kJ M-UHRS system may be used to image the subsurface for the Tetra prospect area to a depth of at least 600 m. This system consists of a triple sparker spread source and 48 channel streamers with DGPS positioning (Table 2-6) and provides high resolution and deep penetration. The vertical resolution and depth penetration (minimum of 600 m below the seabed) can be achieved by tuning on the HF and LF pulses.

Table 2-6 Deep 2D Source and Receiver Specifications

GeoMarine Total Spread 48 kJ Triple Sparker System	
Source Parameters	
Source Type	Sparker
Number of Tips	800
Power Supply	Geo-Spark 48 kJ
Receiver Parameters	
Multichannel Streamers	Geo-Sense Streamer – 48 channel
	3 elements per channel
	0.5 m group length
	3.125 m group spacing
	AQ2000 Hydrophone per channel, Freq response 1 Hz to 10 kHz
	150 m active length
	50 m armored LAN to PC of Multi-Trace recording unit, 75 m towleader, 25 m stretch at front and rear of active
MC positioning	Long range WiFi DGPS lead-in and tail buoys
Sampling Interval	0.1 ms

2.4.5 Magnetometer

A marine magnetometer will be used for the detection of magnetic deflection generated by geologic features and buried or exposed ferrous objects which may be related to archaeological artifacts or modern manmade debris. A Geometrics G882 marine magnetometer is proposed to be used to detect ferromagnetic objects on or below the seabed. Specifications are shown in Table 2-7. The magnetometer will be towed in tandem behind the SSS. This ensures the magnetometer is close to the seafloor without requiring an additional winch and operator.

Table 2-7 Magnetometer Specifications

Geometrics G882 Magnetometer	
Sensor Type	Cesium Vapor
Operating Range	20,000 - 100,000 nT
Sensitivity	0.004 nT/√Hz
Sampling rate	Up to 20 Hz

2.4.6 Acoustic Doppler Current Profiler

Extreme tidal fluctuations in Cook Inlet and resultant high current velocities may have implications for survey operations. An ADCP will be used to measure current velocities and direction through the entire water column. This data is used to help mitigate project risk through informed operational planning. A hull mounted Teledyne Workhorse Mariner ADCP is proposed; the specifications for the ADCP are provided in Table 2-8.

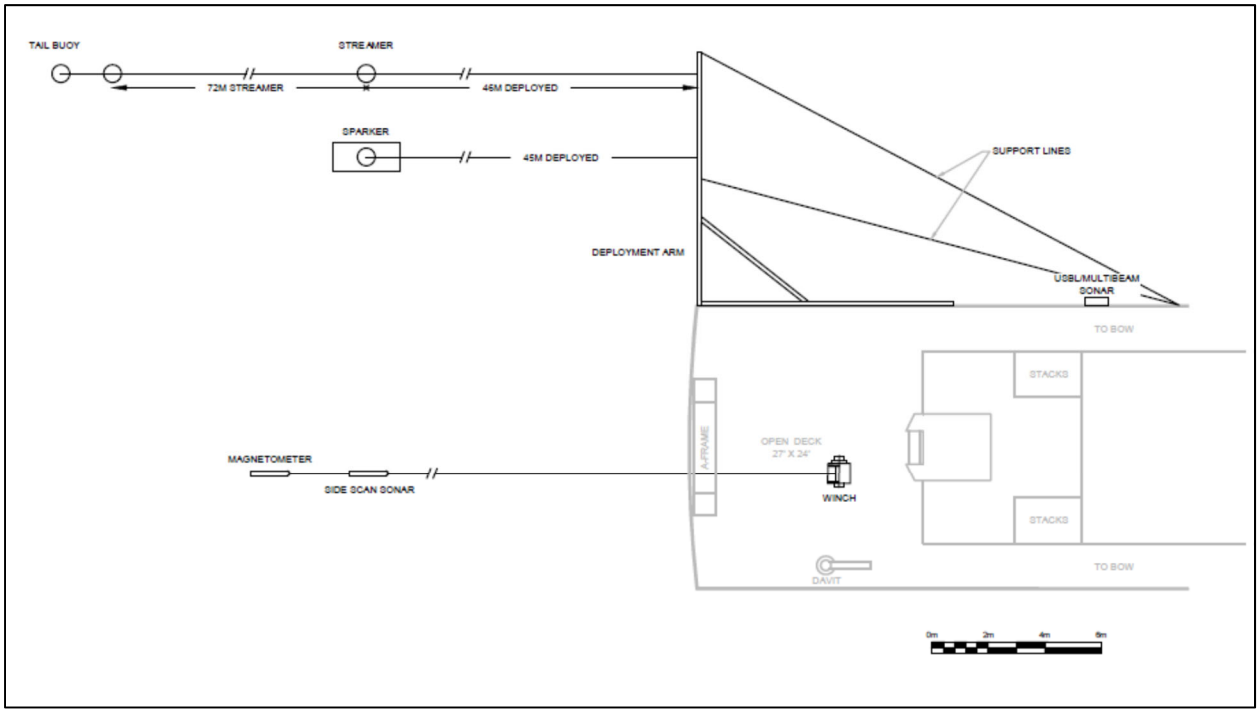
Table 2-8 Acoustic Doppler Current Profiler Specifications

Teledyne Workhorse Mariner ADCP	
Frequency	300 kHz
Vertical Resolution	2 m
Range	93 m
Std. Dev	7.0 cm/s

2.4.7 Vessel Layout

Geohazard survey operations require the use of both vessel mounted and towed systems. A preliminary layout based upon ensuring the quality of data and safety of operations is presented in Figure 6. The USBL and multibeam sonar will be mounted on a retractable sonar pole on the port side while the SSS will be towed midships through the existing A-frame. The M-UHRS will be towed using a retractable davit on the port side of the vessel.

Figure 6 Geophysical System Layout



2.5 Reporting and Assessment

2.5.1 Report and Assessment

The geohazard survey will be conducted to support the development of a shallow hazard report and a shallow hazards assessment to be submitted as part of the Exploration Plan requirements (30 CFR 550.214(e) and (f). These are two distinct, but related evaluations which will be conducted to identify seafloor and subseafloor features that may adversely affect or be adversely affected by proposed exploration activities. They will provide a comprehensive geological description by evaluating the area around the surface location of each proposed drill-site.

To ensure the shallow hazards report meets BOEM's needs under 30 CFR 550.214, the shallow hazard report will provide at a minimum, the components recommended in NTL 2005-A01 as a guide for targeting technical work. The geohazard survey will be performed in accordance to NTL 2005-A01 and NTL 2005-A03, provide information about the seabed, and identify shallow hazards so they can be avoided. Qualified and experienced personnel will perform the field survey, process and analyze data, and prepare the shallow hazards report and shallow hazards assessment. The guidelines in the draft NTL 2017 will also be reviewed, and where practical, Hilcorp will attempt to meet these guidelines.

2.5.2 Survey Results Analysis

Upon completion of the survey, a site evaluation will be conducted to obtain a detailed interpretation of the data to identify possible seabed risks related to unstable soil, steep slopes, or surface faults. This evaluation will identify the risk of possible scour around legs of jackup or soil failure if near a submarine channel with steep banks, risk of shallow gas to a depth of at least 200 m below the surface casing, and provide other information required to locate a jackup rig in a safe and environmentally sensitive manner, comply with requirements as outlined by BOEM NTLs and regulations, and comply with typical requirements for the underwriters of jackup drilling rigs.

2.5.3 Archaeological Studies

The archaeological study will be conducted in accordance with NTL 2005-A03 to evaluate the existence and location of any archaeological resources which may be impacted by proposed operations. This survey must be performed if the Regional Director determines that submerged archaeological resources may exist on or near lease areas under BOEM authority. On September 13, 2019 BOEM submitted notification to Hilcorp in accordance with regulations in 30 CFR 550.194(a) that BOEM has reason to believe that an archaeological resource may exist in the area where the geohazard survey is proposed. Therefore, the archaeological survey in accordance with NTL 2005-A03 would need to be conducted and an archaeological report must be submitted with the Exploration Plan.

The archaeological survey will be conducted as part of the high-resolution geophysical survey conducted to evaluate the area for shallow hazards. Data from this survey, primarily from multibeam and sidescan sonar, will be evaluated by an archaeologist that meets the requirements of Section 112(a)(1) of the National Historic Preservation Act. A survey geologist will be present during field operations to ensure quality of data collection.

2.6 Support Operations

2.6.1 Fueling Operations

The survey vessel will take on fuel at commercial fueling operations (likely Homer fuel dock) prior to initiating the survey and as necessary during survey activities. All fueling would occur in accordance with applicable United States Coast Guard (USCG) regulations. Personnel associated with fuel delivery, transfer, and handling will be knowledgeable of industry Best Management Practices (BMPs) related to fuel transferring.

2.6.2 Waste Management

All recyclables, hazardous and non-hazardous solid waste, and municipal solid waste will be stored, transported, and disposed of in accordance with local, state, and federal regulations.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section describes the potentially affected physical environment, biological environment, and socioeconomic resources in the vicinity of Hilcorp's proposed geohazard survey and the potential impacts associated with the survey program. Resource descriptions and potential impact analyses are based, in part, on information presented in various documents, including Cook Inlet Planning Area Oil and Gas Lease Sale 244 Environmental Impact Statement (EIS) (BOEM, 2016a), the petitions for ITR and ITRs (Hilcorp 2019a, Hilcorp 2019b, & USFWS 2019), Geological and Geophysical Exploration Environmental Assessment, 2019-035 (BOEM, 2019), and the 2019 Lower Cook Inlet 3D Seismic Survey EED (Hilcorp, 2018).

3.1 Physical Environment

3.1.1 Climate and Meteorology

Lower Cook Inlet is located within the continental subarctic climate, which is characterized by cold temperatures in winter and cool temperatures in summer (BOEM, 2016a). Climate in the Cook Inlet is influenced by the regulating effect of nearby ocean waters, and the seasonal distribution of sea ice. Locations under the predominant influence of the sea are characterized by relatively small seasonal temperature variability, with high humidity. Temperatures are typically coldest in January and warmest in July, with highs in the 60's during summer, and lows in the teens during winter (NCDC, 2015).

Wind speeds and wind directions in the Cook Inlet vary by season (Olsson and Liu, 2009; NCDC, 2015; BOEM, 2016a). Prevailing winds in Cook Inlet are from the south in summer months and are otherwise from the north and northeast. Monthly winds in Homer average 1.2 miles per hour (mph) in July and reach an average annual maximum in November of 27.6 mph.

Cook Inlet experiences annual precipitation averaging 42 cm (16.6 inches) in the north, to an annual average of approximately 2 m (78.0 inches) in Kodiak (BOEM, 2016a). Snowfall typically occurs from October through April but may occur as early as September and as late as May. The majority of snowfall occurs from November through February.

Potential Effects on Climate and Meteorology

The geohazard study is proposed to occur between April and June, outside of the fall and winter storm season. No impacts to climate and meteorology are expected as part of the proposed project.

3.1.2 Oceanography and Bathymetry

Cook Inlet is an approximately 210-mile-long (338-km-long) extension of the Gulf of Alaska (LGL, 2000). It is characterized by its shallow depth, complex circulation associated with variability at tidal, seasonal, annual and interannual time scales, and extreme tides (Musgrave and Statscewich, 2006). In general, water depth increases from north to south, with an area weighted mean depth of 146.7 feet (ft) (44.7 m), though there are depths of 695.5 ft (212 m) in south Cook Inlet (Zimmermann and Prescott, 2014).

The bathymetry of lower Cook Inlet OCS is configured as a two-tiered plateau: the shallower northern portion is less than 90 m (295 ft) deep while the deeper southern portion is greater than 90 m deep (BOEM, 2016a). The northern portion of the lower Cook Inlet is divided by a deep valley and has thick deposits of glacial, glaciofluvial, and glaciomarine strata.

The Cook Inlet region has the fourth largest tidal range in the world, the circulation is dominated by tidally driven flows, with current speeds of up to three m/s (6 knots) (Musgrave and Statscewich, 2006). The general circulation pattern of lower and middle Cook Inlet is that denser, saltier water flows northward along the east shore, and fresher, silty outflowing water flows southward along the west shore (BOEM, 2016a; Wapora Inc., 1979 in LGL, 2000).

The amount of sea ice in Cook Inlet varies annually and may consist of pack ice, shorefast ice, stamukhi (i.e. layered ice cakes formed by stacking of ice floes on shorefast ice over multiple high tides), and estuarine/river ice. Sea ice is rarely present in the lower Cook Inlet OCS. First year ice with 80 to 100 percent cover is historically found north of 60°30'N from December to late March (BOEM, 2016a).

Potential Effects on Oceanography and Bathymetry

The geohazard study is proposed to be completed between April and June, after sea ice has receded in the region. No impacts to oceanography or bathymetry are expected as part of the proposed project.

3.1.3 Air Quality

The nation's air quality is regulated under the Clean Air Act (CAA). The State of Alaska, the United States Environmental Protection Agency (EPA), and BOEM implement air quality programs in Alaska and on the OCS that are designed to carry out the goals of the CAA and the Outer Continental Shelf Lands Act over land and water. In areas of the Cook Inlet OCS, EPA maintains jurisdiction to control air pollution from OCS sources located within 25 nautical miles of the state seaward boundary [CAA Sec. 328(a) and 43 United States Code (U.S.C.) 7627]. Within this area, EPA must attain and maintain federal and state ambient air quality standards and comply with the provisions of Sec. 328 of the CAA (Title 42 of the U.S.C. 7627).

The CAA requires the EPA to set National Ambient Air Quality Standards (NAAQS). The NAAQS are limits, or criteria, for ambient air concentrations of six "criteria" pollutants. The EPA

NAAQS are as follows: Nitrogen Dioxide (NO_2), Carbon Monoxide, Particulate Matter ($PM_{2.5}$ and PM_{10}), Sulfur Dioxide (SO_2), Ozone (O_3), and Lead (EPA, 2018). The EPA designates geographic areas on land considered to have air quality as good as or better than the NAAQS as attainment areas, while those that do not meet the NAAQS are designated as nonattainment areas.

The project is located on the OCS with the nearest onshore area (the Cook Inlet Interstate Air Quality Control Region [AQCR]) classified as a Class II region that is in attainment or unclassifiable with the NAAQS. The Cook Inlet AQCR includes all of the Greater Anchorage Area Borough, the Kenai Peninsula Borough (KPB), and the Matanuska-Susitna Borough. Background concentrations in the Cook Inlet OCS area and surrounding coastal area in comparison to the NAAQS and State of Alaska air quality standards are shown in Table 3-1.

Table 3-1 Background NAAQS Concentrations in Area of Survey

Pollutant	Averaging Period	Primary National Ambient Air Quality Standard	Alaska Ambient Air Quality Standard	Alaska LNG – Nikiski, Alaska	Percentage of the Standard
NO_2	1 hour	188 µg/m^3	188 µg/m^3	30.6 µg/m^3	16.3
	Annual	100 µg/m^3	100 µg/m^3	2.6 µg/m^3	2.6
SO_2	1 hour	196 µg/m^3	196 µg/m^3	4.3 µg/m^3	2.2
	3 hours	NA	1,300 µg/m^3	NA	NA
	24 hours	NA	365 NA	NA	NA
	Annual	NA	80 NA	NA	NA
PM_{10}	24 hours	150 µg/m^3	150 µg/m^3	30.0 µg/m^3	20.0
$PM_{2.5}$	24 hours	35 µg/m^3	35 µg/m^3	12 µg/m^3	34.3
	Annual	12 µg/m^3	12 µg/m^3	3.7 µg/m^3	30.8
CO	1 hour	40,000 µg/m^3	40,000 µg/m^3	1,145 µg/m^3	2.9
	8 hours	10,000 µg/m^3	10,000 µg/m^3	1,145 µg/m^3	11.5
O_3	8 hours	140 µg/m^3	140 µg/m^3	94.0 µg/m^3	67.1

Source: 2015 AK LNG, Nikiski. ADEC Industrial Data Summary, 22 May 2018.
https://dec.alaska.gov/media/9162/industrial-data-summary052218.xlsx

The air quality within the lower Cook Inlet OCS area does not exceed federal guidelines defining good air quality. The existing condition of air quality in the vicinity of the Proposed Survey is largely a function of the few emission sources on the east and west coastline of the lower Cook Inlet, and the complex interactions between meteorological conditions, mainly wind, and the topographical features of the basin. The wind conditions over the lower Cook Inlet, together with the relatively few pollutant sources onshore or offshore, cause the quality of the air over the area to be consistently better than required by federal standards (EPA, 2013).

Potential Effects on Air Quality

The survey will be performed from an on-water vessel and will occur during a relatively short period (approximately 30 days). Any impacts to air quality are associated with emissions from engines associated with the vessel. The mobile nature of the vessels combined with the short duration of the survey would prevent/minimize transport of emissions to a single onshore location. The lower Cook Inlet regularly has dozens of vessels transiting around every day throughout the summer season. The amounts of emissions released as a part of this survey are expected to be similar to the everyday emissions from vessels regularly operating in the area. The resulting air quality impact would be localized to the immediate area and would last only for the duration of the survey. Within hours of the completion of the survey, the air quality would recover and return

to pre-survey levels. It is unlikely that during any point of the survey (before, during, or after), the amounts of air pollution in the area would result in an exceedance of national air quality standards. Therefore, the survey would have a negligible effect on air quality.

3.1.4 Water Quality

Cook Inlet is a high-energy environment with strong tidal currents which are extraordinarily complex and energetic. This coupled with other forces such as wind results in strong vertical mixing. Cook Inlet has marine connections with Shelikof Strait and the Gulf of Alaska with multiple freshwater river sources which transport a large variety of naturally occurring inorganic and organic compounds into Cook Inlet. These substances are dispersed by tidal currents and winds. Nutrient concentrations (inorganic nitrogen and phosphate) and dissolved metals concentrations tend to be below National Oceanographic and Atmospheric Administration threshold values. However, concentrations of nickel, arsenic, and copper are above some guidelines and concentrations of mercury are higher than reported in studies of other areas of southern Alaska (BOEM, 2016a). Suspended sediment concentrations in rivers draining into Cook Inlet are highly variable, with most sediment being transported in the spring. Concentrations of suspended sediment in Cook Inlet are higher in the northern, more stream-influenced end of the inlet and decrease through the lower Cook Inlet.

The water quality of lower Cook Inlet is generally good, with water quality meeting Alaska Water Quality Standards criteria for all marine water uses and the criteria for the protection of marine life according to Section 403 of the Clean Water Act. No waterbodies directly draining into the lower Cook Inlet area are identified as impaired by the State of Alaska (ADEC, 2013). While contaminants have been reported, many are attributed to erosion of the local soils, rocks, and ores. Concentrations of hydrocarbons are comparable to background hydrocarbons in other coastal Alaska waters (BOEM, 2016a).

Potential Effects on Water Quality

The survey will be performed from a marine vessel which will adhere to state, federal, and international requirements regarding vessel discharges. The ship will travel within the survey area collecting data during a relatively short period, resulting in discharges being well dispersed over the area. Therefore, the impact to water quality associated with the surveys are considered to have a negligible impact.

3.1.5 Acoustic Environment

Both natural and anthropogenic activities contribute to the acoustic environment of Cook Inlet. The dominant natural sound sources are typically physical mechanisms from wind and wave activity at or near the ocean surface, geological noise from earthquakes and volcanic activity, and noise from sea ice movement (BOEM, 2016a). Cook Inlet is a high-energy, dynamic environment with large tides, strong currents, natural seismic activity, and seasonal sea ice cover, which contributes to a generally high-noise environment when compared to open-ocean habitats. Biological noise, sounds created by animals, such as marine mammals, crustaceans, and fish can generate noise that effectively changes the dominant characteristics of an acoustic environment. (BOEM, 2016a).

Cook Inlet has several active ports and harbors, as well as commercial and recreational fishing activities, and an on-water tourism industry. Anthropogenic sound sources in Cook Inlet include noise from vessel traffic, aircraft (sea planes and traffic at airports with runways near coastal waters of Cook Inlet), and oil and gas activities (BOEM, 2016a). Other sources of anthropogenic noise include ships using dynamic positioning, dredging, and pile driving. Due to the seasonal nature of activity in Cook Inlet and the inflow of ice into the region during winter, there is a seasonal intensity of anthropogenic noise during the summer months from all sources. In addition, ice interaction during extreme tidal fluctuations may produce high-intensity, broadband sounds throughout Cook Inlet but only during specific winter conditions (BOEM, 2016a).

Potential Effects on the Acoustic Environment

The primary noise generated as part of the geohazard survey will be vessel noise and noises from survey equipment. The survey will be performed from a marine vessel which will operate within the survey area for approximately 30 days. The activities associated with the geohazard survey will introduce a relatively small amount of noise into Cook Inlet over a relatively short period of time. Noise levels will return to ambient conditions upon completion of the project and there will be no permanent impact on the acoustic environment in Cook Inlet from the geohazard program.

3.2 Biological Environment

3.2.1 Benthic Communities

The benthic zone is the lowest level of a water body. Several distinct benthic habitats have been identified in lower Cook Inlet based on ice formation, intertidal and subtidal inundation, and substrate type (e.g. rock, cobble, sand, silt, mud, and/or shell debris). The benthic habitat in the deeper waters of Cook Inlet are characterized by unconsolidated sediments with a smooth bottom and strong tidal currents. The benthic communities include two major infaunal groups: deposit feeders in muddy substrata and suspension feeders in sandy substrata. Subtidal infaunal organisms are important trophic links for crabs, flatfishes, and other common Cook Inlet organisms (BOEM, 2016a).

Nutrient supply and the flora and fauna that depend on organic material decline as the distance from shore increases. As a result, the benthic community decreases in the deep subtidal zones. Some species do exist in these areas including mollusks, polychaetes, and bryozoans (BOEM, 2016a) but not in abundance.

Potential Effects on Benthic Communities

Any impacts from the geohazard survey to the benthic communities are expected to be localized and temporary from vessel transit and discharges. The ship will travel within the survey area collecting data during a relatively short period, resulting in discharges being well dispersed over the area. Therefore, the impact to benthic communities are expected to be negligible.

3.2.2 Fish and Invertebrates

Various species of fish and invertebrates are present and are important in Cook Inlet. They serve as important prey for marine mammals, birds, and other fish, subsistence, and economic resources. Fish and invertebrate communities live in the water column or are found on or close to the seafloor.

The Cook Inlet Lease Sale 244 EIS (BOEM, 2016a) provides more details about fish and invertebrate species, ecological roles, and marine habitats.

Plankton blooms occur in the open water habitat of Cook Inlet during the spring and summer months. These plankton blooms are prey for higher predators like fish and bird species. Supply from this pelagic area influence those lower trophic seafloor communities.

Fish species include anadromous and pelagic fish, groundfish, and shellfish. Many species of fish are targeted for commercial, sport, or personal use (discussed in Section 3.3.5.). Common forage fish species include herring, walleye Pollock, sandlance, capelin, and eulachon. The greatest density of these schooling forage fish occur during early summer (BOEM, 2019).

There are numerous anadromous fish found in Cook Inlet, including hooligan (also known as eulachon), all five species of Pacific salmon (i.e., Chinook [King], coho [silver], pink, chum, and sockeye [red]), Dolly Varden, and steelhead trout. Hooligan are seasonally abundant and are a subsistence resource. They gather in large schools off the mouths of spawning streams and rivers and are an easy prey source for marine mammals.

Spawning and juvenile Chinook salmon enter Cook Inlet in early May. Adult sockeye salmon return yearly in late June to the freshwater system where they spawn. The run continues through early August. These fish are important to recreational, subsistence, and commercial fisheries. Dolly Varden are abundant locally in Cook Inlet; steelhead trout use Cook Inlet as a migratory corridor and are not evenly distributed.

Pelagic fish inhabit the water column of coasts and open oceans and include forage fish which are a critical food source to multiple marine mammal, seabird, and larger fish species (NOAA, 2018).

Cook Inlet is home to many commercial groundfish species including Pacific halibut, Pacific hake, Pacific cod, Pacific ocean perch, walleye Pollock, and sablefish. Not as commercially popular, other groundfish found in Cook Inlet include arrowtooth flounder, black rockfish, Atka mackerel, lingcod, yellowfin sole, sculpin, starry flounder, and flatfish. Most groundfish are found in the same habitat area, and are often food sources for birds, fish, and mammals. Groundfish remain near the seafloor, but spawning and early life stages may occur in pelagic waters.

Cook Inlet is home to a number species of shellfish, including shrimp, scallops, clams, crab, and octopus. Shrimp inhabit varying depths and habitat types, while scallops and clams prefer seafloors of sand, gravel, mud, and rock. They are usually sensitive to changes in water quality. Crab species include king (red and golden) and Dungeness crab. King crab range from 600 ft to 1300 ft deep, while Dungeness crabs are found at depths up to 600 ft. Octopus are considered shellfish under state regulations and are found in Cook Inlet. A Cook Inlet Area Octopus Management Plan allows octopus as bycatch, but it does have an annual limit in the commercial fishery (5 Alaska Administrative Code (AAC) 38.360).

Potential Effects on Fish and Invertebrates

Some activities related to the planned geohazard survey may adversely affect fish and invertebrates, however, any effects are expected to be localized and temporary. Potential vessel discharges and deck runoff from the vessels may cause temporary water quality degradation at localized sites. Some eggs and larvae may be exposed to detrimental but non-lethal sound levels

from the sonar activities and fish may be temporarily displaced from the area where it is used. Overall, effects on fish and invertebrates are expected to be negligible due to the small area to be surveyed, the widespread nature of fish and invertebrates, and the highly localized and temporary nature of the activities.

3.2.3 Marine Mammals

The marine mammal species known to occur in the Hilcorp geohazard survey area, including their conservation status, are listed in Table 3-2 and described below. The information found in this section is taken from Hilcorp's ITR petitions submitted to NMFS and USFWS, unless otherwise indicated (see also NOAA 2019g, USFWS 2019).

A number of these marine mammals are listed as endangered or threatened under the Endangered Species Act (ESA). Four endangered marine mammals may be found in the lower Cook Inlet: Cook Inlet beluga whale (*Delphinapterus leucas*), fin whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), and Steller sea lion (*Eumetopias jubatus*). The Northern sea otter (*Enhydra lutris kenyoni*) is listed as threatened.

Table 3-2 Marine Mammals found in the Geohazard Survey Area

Species	Conservation Status	Stock	Minimum Population Estimate
Beluga whale (*Delphinapterus leucas*)	ESA – Endangered	Cook Inlet Stock	279[4]
Fin whale (*Balaenoptera physalus*)	ESA – Endangered	Northeastern Pacific Stock	2,554[1]
Gray whale (*Eschrichtius robustus*)	ESA – Not Listed	Eastern Pacific Stock	26,960[3]
Humpback whale (*Megaptera novaeangliae*)	ESA – Endangered	Western North Pacific Stock	865[1]
Killer whale (*Orcinus orca*)	ESA – Not Listed	Alaska Resident Stock	2,347[1]
Killer whale (*Orcinus orca*)	ESA – Not Listed	Alaska Transient Stock	587[1]
Minke whale (*Balaenoptera acutorostrata*)	ESA – Not Listed	Alaska Stock	1,233[2]
Dall's porpoise (*Phocoenoides dalli*)	ESA – Not Listed	Alaska Stock	83,400[1]
Harbor porpoise (*Phocoena phocoena*)	ESA – Not Listed	Gulf of Alaska Stock	31,046[1]
California sea lion (*Zalophus californianus*)	ESA – Not Listed	U.S. Stock	233,515[3]
Steller sea lion (*Eumetopias jubatus*)	ESA – Endangered	Western U.S. Stock	53,624[1]
Harbor seal (*Phoca vitulina*)	ESA – Not Listed	Cook Inlet/Shelikof Stock	28,411[1]
Northern sea otter (*Enhydra lutris kenyoni)*	ESA – Threatened	Southwest Alaska Stock	45,064
	ESA – Not Listed	Southcentral Alaska Stock	18,327

Notes: [1]Muto et al., 2019; [2]Zerbini et al., 2006; [3]Carretta et al. 2019; [4]Shelden et al., 2019

Cook Inlet Beluga Whale

Beluga whales are found in the United States in Alaska and globally throughout the Arctic Ocean. They are common in Alaska, Russia, Canada, and Greenland. Beluga whales can move between fresh and salt waters, and return to their birth areas to hunt, breed, and calve. They are found in shallow coastal waters during the summer months, and during other seasons are found in deeper waters. They seasonally inhabit estuaries and large river deltas and can adapt to cold oceans and warm freshwater habitats. The beluga whale diet consists of octopus, squid, shrimp, crab, snails, clams, and sandworms. They also eat fish including cod, sole, herring, flounder, smelt, and salmon (NOAA, 2019c).

The Cook Inlet beluga whale Distinct Population Segment (DPS) is a small geographically isolated and genetically distinct population separated by the Alaska Peninsula, and is listed as endangered under the ESA. The population has nearly declined by 75 percent since 1979, from approximately 1,300 individuals to around 300 individuals. Critical habitat areas and Biologically Important Areas (BIAs) encompass all marine waters north of the line connecting Point Possession and the mouth of Three Mile Creek. This is important habitat during ice-free months (April through November). The proposed geohazard survey would not occur in beluga whale Critical Habitat.

Cook Inlet beluga whales exhibit seasonal shifts in distribution and habitat within Cook Inlet, but they stay in the inlet throughout their lives. In June, July, and August the majority of the whales are found near or in river mouths along the northern shores of upper Cook Inlet. They rarely occur in the central and southern portions of the inlet. During the spring and summer, they are generally found in the warmer waters by the mouths of rivers where more prey is available. In the winter months, they shift to middle and lower Cook Inlet. They mostly calve between mid-May and mid-July and breed concurrently. The summer range is usually silty due to glaciers feeding into upper Cook Inlet, which limits visibility. They have an adept use of sound essential for communication, for locating prey, avoiding predators, and navigation (NOAA, 2019c).

Fin Whales

Fin whales are the second largest species of whale and found throughout the world's oceans. These baleen whales feed on krill, small schooling fish (herring and capelin), and squid in the summertime, and fast in the winter while they migrate to warmer waters (NOAA, 2019d). Three stocks of fin whales are recognized in the United States Pacific waters: Alaska (Northeast Pacific), California/Washington/Oregon, and Hawaii. The Northeast Pacific Stock is listed as threatened under the ESA. No critical habitat has been designated or proposed for fin whales in the North Pacific at this time.

Most fin whales migrate from the Arctic and Antarctic feeding areas in the summer to tropical breeding and calving areas in the winter. In the United States Pacific waters, fin whales are found seasonally in the Gulf of Alaska, Bering Sea, and the northern Chukchi Sea (Muto et al., 2016). They are rarely observed in Cook Inlet, and most sightings occur near the entrance of the inlet.

Gray Whales

The Eastern Pacific Stock of gray whales can be found in the vicinity of the proposed survey. Gray whales were once common throughout the Northern Hemisphere, but now they are only found in the North Pacific Ocean areas. Gray whales migrate through the Gulf of Alaska region via shallow coastal routes, BIA boundaries for the migratory corridor are defined by the continental shelf. Gray whales can be found near the area of the proposed geohazard survey in late March through November/December, migrating past the mouth of Cook Inlet to and from northern feeding grounds. Some whales stay and feed in coastal areas along Cook Inlet, including near Kachemak Bay, and north of Anchor Point.

Gray whales are primarily bottom feeders and feed on a range of benthic and epibenthic invertebrates. They suck sediment and food from the sea floor and filter their food through baleen plates. This feeding behavior can leave long trails of mud behind also known as "feeding pits."

Humpback Whales

The humpback whale is distributed worldwide in all ocean basins. Currently there are three management units/populations recognized in the North Pacific. There is distributional overlap in the stocks that use Alaska, but the whales found seasonally in lower Cook Inlet are most likely from the Central North Pacific stock, which is listed as endangered under the ESA.

The Central North Pacific stock of humpback whales winters in Hawaii and summers from British Columbia to the Aleutian Islands. These whales are found close to shore and are commonly active on the water surface as they filter feed on small fish and crustaceans. In the summer, humpback whales are regularly present and feeding in the Cook Inlet region, including Shelikof Strait, Kodiak Island bays, and the Barren Islands. Humpbacks could occur in the area of the proposed geohazard survey at any given time (BOEM, 2019).

Killer Whales

Killer whales are found in all oceans. They are most abundant in colder waters but are also found in tropical and subtropical waters. There are eight recognized stocks of killer whales within the Pacific United States Exclusive Economic Zone. Two of these stocks inhabit the Cook Inlet area including the Alaska Resident stock and the Gulf of Alaska, Aleutian Islands, Bering Sea Transient stock.

Very few killer whales, if any, are expected to approach or be near the survey area, but those that are, are believed to be a mix of both Alaska stocks. They rely on underwater sound to feed, navigate, and communicate. The Resident stock exclusively eats fish (salmon), and the transient stock primarily eats marine mammals and squid. They are considered top predators and use coordinated hunting strategies and work as a team to catch prey. Killer whales that have been observed in lower Cook Inlet are those belonging to resident groups found in Kenai Fjords and Prince William Sound.

Minke Whales

Minke whales are part of the baleen family and are the smallest of the rorquals. They are opportunistic feeders, and eat plankton, and small schooling fish. Most minke whales in Alaskan waters are migratory. Northern Minke whale ranges extend from the ice edges of the Arctic in the summer to the equator in winter. They are considered cosmopolitan because they can occur in polar, temperate, and tropical waters in most of the seas in the world. They become scarce in the vicinity of the proposed survey in the fall and are thought to leave the region in October. This species is unlikely to be seen in upper Cook Inlet but may be encountered in the mid and lower Cook Inlet.

Dall's Porpoise

Dall's porpoise are common in the North Pacific Ocean and are found off the United States coast from California to the Bering Sea. The range of the Dall's porpoise in Alaska extends to the southern portion of Cook Inlet and are present year-round throughout their range in the northeast and occasionally in Cook Inlet. They have also been observed in lower Cook Inlet and around Kachemak Bay and could be seen in the area of the proposed survey.

Dall's porpoise generally feed at night when their prey is closer toward the surface and dive up to 1,640 ft to feed on small schooling fish, smelts, cephalopods, and some crustaceans. They are found in groups averaging between two and 12 but can have groups even larger than that. They are attracted to fast moving vessels to bowride beside the boat.

Harbor Porpoise

Harbor porpoise are often seen in groups of two to three and prefer coastal areas; they are commonly found in bays, harbors, estuaries, and fjords. There are three stocks of harbor porpoise in Alaska, including Bering Sea, Gulf of Alaska, and Southeast Alaska. The range of the Gulf of Alaska Stock includes the entire Cook Inlet, Shelikof Strait, and the Gulf of Alaska, mainly in Chinitna and Tuxedini Bays on the west side of lower Cook Inlet. They are found in the inlet during spring hooligan and summer salmon runs.

Harbor porpoise mainly eat schooling fish, with the occasional squid or octopus. Most of their movements are based on presence of ice and prey availability. They generally do not approach vessels to bow ride (NOAA, 2019a).

California Sea Lions

California sea lions are eared seals native to the West Coast of North America. They live in coastal waters and on beaches, buoys, jetties, and docks. California sea lions are distributed along the North Pacific waters from central Mexico to southeast Alaska (NOAA, 2019b). There is limited information on the presence of California sea lions in Alaska, but they are found in Alaska during all seasons, mostly occurring during the spring. From 1973 to 2003, a total of 52 California sea lions were reported in Alaska, with sightings increasing in the later years. They are not usually observed farther north than southeast Alaska, and they are very rare in Cook Inlet.

California sea lions prefer sandy beaches or rocky coves for breeding and haul out locations. They feed mainly offshore in coastal areas and they eat a variety of prey in upwelling areas including mackerel, squid, rockfish, anchovies, and sardines.

Steller Sea Lions

The Steller sea lion is the largest member of the eared seals. They prefer colder temperate subarctic waters of the North Pacific Ocean and are distributed mainly around the coasts along the North Pacific Ocean rim from northern Japan through Kuril Islands and Okhotsk Sea, the Aleutian Islands, and Bering Sea. Steller sea lions are opportunistic predators, and forage and feed primarily at night. Their diets change depending on the time of year, distribution, and abundance of prey. In Cook Inlet their summer prey consists of walleye Pollock, salmon, and arrowtooth flounder and their winter diet consists of walleye Pollock and Pacific cod. They tend to forage near shore and in open waters. Steller sea lions need both terrestrial and aquatic habitats, because they mate and give birth on land. There are two population segments of Steller sea lions, the western and eastern DPS. Only the western population is listed as endangered under the ESA (NOAA, 2019e).

The Western DPS stock decreased from an estimated 220,000 to 265,000 animals in the 1970s to less than 50,000 in 2000. Although the population has been increasing slowly since 2003, it is still declining quickly in larger areas of its range. The center of abundance for the Western DPS of Steller sea lions extends from Kenai to Kiska Island. Steller sea lions do occur in Cook Inlet but south of Anchor Point around the offshore islands and along the west coast of the upper inlet.

The range of Steller sea lions includes 38 rookeries and hundreds of haul out sites. The critical habitat designation includes a 23-mile (37-km) buffer around all major haul out and rookery locations, as well as associated terrestrial, atmospheric, and aquatic zones, and three offshore foraging areas. The closest to the area of the proposed survey are located approximately 50 miles southwest at Sugarloaf Island and Ushagat Island, in the Alaska Maritime National Wildlife Refuge.

Harbor Seals

Harbor seals are one of the most common marine mammals along the United States West and East coasts. They are very common in Alaskan waters, making up 12 separate stocks. The Cook Inlet/Shelikof stock ranges from Anchorage, along the southside of the peninsula, to Unimak Pass. They are found throughout the entire lower Cook Inlet coastline in a variety of habitats including both freshwater and saltwater, and can be found hauled out on beaches, islands, mudflats, and at the mouths of rivers, where they commonly whelp their young and feed. Harbor seals are not considered a migratory species and generally stay within 15 to 35 miles from home. They can dive shallow or deep to retrieve their prey (typically fish, shellfish, and crustaceans) and have the ability to sleep underwater and come up for air every 30 minutes. Harbor seals would likely be encountered in the survey area.

Northern Sea Otters

The Northern sea otter is the smallest marine mammal species. They forage in nearshore waters and are predators for coastal benthic ecosystems. Sea otters feed on benthic invertebrates including crab, urchins, clams, mussels, and sea cucumbers. Their distribution in Cook Inlet is generally in lower Cook Inlet (south of the Forelands to Homer), where they occur year-round. Two distinct stocks occur in lower Cook Inlet: the Southwest Alaska Stock and the Southcentral Alaska Stock. The Southwest Alaska Stock is listed as threatened under the ESA. The non-listed Southcentral Alaska Stock extends from Cape Yakataga to the eastern shoreline of lower Cook Inlet, this includes Prince William Sound, Kachemak Bay, and the Kenai Peninsulas coastline. Very few otters from this stock occur north of Anchor Point.

The Southwest Alaska Stock ranges along the western shore of lower Cook Inlet and throughout the Alaska Peninsula and Bristol Bay coasts, as well as the Aleutian, Barren, Kodiak, and Pribilof islands (USFWS, 2014b). A 15,164 km^2 critical habitat area was designated for the Southwest Alaska DPS in 2009 (74 Federal Register [FR] 51988). The area of the proposed survey does not overlap the Southwest Alaska DPS critical habitat area.

Potential Effects on Marine Mammals

Anticipated impacts from the proposed geohazard survey would be from vessel noise, vessel presence, prey reduction, and noise as a result of the survey activities. The aspect with the greatest potential to impact marine mammals is the introduction of noise into the environment.

Noise

For noise to directly impact a marine mammal, an animal must first be able to hear the frequency. NMFS does not consider sounds over 200 kHz to be harmful to marine mammals. Generalized hearing ranges of marine mammals that could be present in the area of the proposed survey (BOEM, 2019) are provided below in Table 3-3. Only geohazard survey equipment that generates

sound in these ranges have the potential to impact marine mammals; therefore, only equipment that produces noise in this range are used to evaluate potential acoustic harassment of marine mammals. The frequency ranges for geohazard survey equipment proposed to be used for the survey is presented in Section 2.4, Table 2-2.

Table 3-3 Marine Mammal Hearing Groups

Hearing Group	Generalized Hearing Range
Fin, humpback, gray, and minke whales	7 Hz to 35 kHz
Beluga and killer whales	150 Hz to 160 kHz
Dall's and Harbor porpoises	275 Hz to 160 kHz
Harbor seals	50 Hz to 86 kHz
Steller sea lions and Northern sea otters	60 Hz to 39 kHz

Note: Note: Frequency ranges follow those identified in NMFS (2016a) found in BOEM 2019.

The effects of sound on marine mammals could include tolerance, masking of natural sounds such as marine mammal communication, behavioral disturbance, and temporary or permanent hearing impairment or non-auditory physical effects. The behavioral response of marine mammals to the operation of the geohazard survey equipment may be different based upon species: the odontocetes are likely to avoid the noise-making activity, especially the naturally shy harbor porpoise, while the harbor seals might be attracted to them out of curiosity. However, because the survey equipment would be operating from a moving vessel, the area and time that this equipment would be affecting a given location is very small.

It is unlikely that survey equipment would produce sound levels strong enough to cause hearing impairment or other physical injuries even if an animal that is (briefly) in a position near the source. The likelihood of marine mammals moving away from the source make if further unlikely that a marine mammal would approach close enough to cause hearing impairment.

Most of Cook Inlet is a poor acoustic environment due to its shallow depth, soft bottom, and high background noise from currents and glacial silt reducing the distance sound travels. To further minimize effects of noise associated with activities, Hilcorp will implement mitigation and monitoring measures as discussed in Section 4.

Due to relatively low sound levels, a short period of time the louder activities would occur over the entire project, and with mitigation measures implemented (Section 4), it is unlikely there would be any temporary or especially permanent hearing impairment, or non-auditory physical effects on marine mammals. Some marine mammals may exhibit minor, short-term disturbance responses, but any potential effects would be localized within the activity area and would not result in population level effects.

Vessel collisions

Although rare, vessel collisions could happen due to hearing impairment, or fast-moving vessels. Some marine mammals may exhibit minor, short-term disturbance responses to vessel traffic, but any potential effects would be localized within the vicinity of vessel traffic and would not result in population level effects. To minimize the likelihood of vessel collisions, course alteration and vessel speed reduction will be considered as a mitigation measure when safety to implement. Hilcorp will implement mitigation and monitoring measures as discussed in Section 4.

Prey Reduction

Survey activities can temporarily displace prey for marine mammals such as fish (see Section 3.2.2), which has the potential to result in temporary displacement of prey. Potential effects would be localized and would not result in population level effects. No adverse impact on zooplankton or benthic populations would be expected due to large reproductive capacities and naturally high levels of predation and mortality rates of these populations.

Conclusion

The proposed geohazard survey will be performed over approximately 30 days between April and June of 2020. It is expected these surveys will result in an increase in noise in the area during activities. Impacts from the active sound sources (e.g., geohazard survey, vessel traffic) will cease as soon as the surveys are complete and full recovery of the acoustic environment to pre-survey conditions is expected. Vessel movements would be comparable to the noise from existing vessel movements and human activity in Cook Inlet and are not expected to result in increased impacts to marine mammals. Temporarily displaced prey would be localized and would not have any population level effects.

3.2.4 Coastal and Marine Birds

Over 450 species of birds are found in Alaska, and many spend time in the Cook Inlet area, either as residents or migrating through. These include passerines, raptors, seabirds, waterfowl, and shorebirds (ADNR, 2018). Cook Inlet provides an important resting and staging area for migrating birds, as well as breeding and nesting habitat for over 100 species of marine and coastal birds (waterfowl, shorebirds, and seabirds). Two species of birds listed under the ESA may be present in the lower Cook Inlet region: the short-tailed albatross, which is endangered; and the Alaska breeding population of the Steller's eider which is listed as threatened (BOEM, 2016a).

Large numbers of waterfowl and shorebirds use Cook Inlet coasts as stop-over areas. During migrations, large numbers of birds arrive typically in early May and depart in mid-to-late May. Bird density is lower in summer because most shorebirds and waterfowl continue to summer nesting grounds. Bird densities increase during the fall migration; however, there are approximately half those during the spring migration (BOEM, 2016a).

Common seabird species found in marine waters of lower Cook Inlet that may be encountered in the area of the proposed survey, include common murre, black-legged kittiwake, pelagic cormorant, and fork-tailed storm-petrel. Glaucous-winged gull, tufted puffin, and black-legged kittiwake have some of the most abundant colonies in the vicinity. Marbled murrelet and Kittlitz's murrelet also regularly use pelagic and nearshore waters of Cook Inlet (BOEM, 2016a). Only the black-legged kittiwake, pelagic cormorant, and Glaucous-winged gull could likely be present during survey activities, because they are more likely to be found over the water. Shore-based birds (common murre, fork-tailed storm-petrel, tufted puffin, marbled murrelet, and Kittlitz's murrelet) will be less likely to be encountered.

Short-tailed albatross are listed as endangered throughout their range under the ESA and are also listed as an endangered species by the State of Alaska (ADF&G, 2019d). They are a long-winged pelagic seabird that spends most of their life at sea and breed on very few islands in the North Pacific (BOEM, 2016a). Non-breeding short-tailed albatross frequent western United States waters

during the winter and spring and can occur in the survey area, but they are not expected to. They feed at the water's surface on squid, crustaceans, and fish.

The Steller's eider is a diving sea duck that breeds inland and spends the rest of the year in marine coastal waters. They forage by diving or dabbling in shallow water on insect larvae, aquatic plants, small fish, invertebrates, and echinoderms (ADF&G, 2019e). Critical habitat was designated in southwest Alaska; however, no critical habitat has been designated near the lower Cook Inlet. (BOEM, 2016a). In Alaska, Steller's eiders move to primarily nearshore marine waters in the vicinity of the Alaska Peninsula to molt beginning in late July and then winter over from late August to April. Steller's eiders are present in Cook Inlet from late July to late April, with numbers reportedly peaking in January through February (BOEM, 2016a).

Potential Effects on Birds

There is a potential to impact some birds for brief periods as a result of the survey program during the spring migration (i.e., early May); however, impacts are expected to be temporary and limited and therefore minor.

Sources of potential impacts include underwater noise from survey activities, vessel traffic, and light attraction and collision hazards. Impacts from artificial light sources to birds offshore is expected to be minor. Birds may be attracted by artificial light sources such as those on the vessels, which could cause birds to collide with vessels. These sources may include navigational lighting and work area safety lights. The proposed project may result in minor impacts to seabirds and waterfowl that can be found in the area during survey activities; however, impacts are expected to be temporary and limited. With activities occurring more than three miles from shore, it is unlikely that any land birds, shorebirds, raptors, or owls would be impacted by vessel survey activities. Seabirds will likely avoid the area

Support activities, such as near shore vessel transit have the potential to impact any land birds, shorebirds, raptors, water birds or owls that are near vessel travel lanes, however this will be limited to vessels transiting to and from the survey area. The effects of the proposed project on birds as a result of increased marine traffic are expected to be negligible. Overall, impacts to birds are expected to be limited due to the short duration of the survey activities, low chance of encounter, the tendency and opportunity of birds to move away from the survey vessels, and distance from shore.

Surveys are planned to be conducted in waters between 100 ft (30 m) and 280 ft (85 m) deep, reducing the likelihood of Steller's eiders being in the survey area. Since both species of threatened and endangered birds (Steller's eiders and short-tailed albatross) are rarely found in the area and are mostly just passing through, the effects are expected to be negligible to these two species.

Overall, Cook Inlet bird populations are not expected to experience more than temporary and localized minor impacts.

3.2.5 Sensitive Biological Resources

This section describes Sensitive Biological Resource Areas. These habitats or resources include essential fish habitats (EFH), refuges, preserves, special management areas, sanctuaries, rookeries, and calving areas. A number of sensitive biological resource areas can be found within Cook Inlet

and surrounding the survey area and there are numerous marine mammals and birds that can be found in or migrate through the area. However, there are no critical habitat areas or BIAs within the survey area. Plants, fish, shellfish, marine mammals, and birds that may be affected are discussed in Sections 3.2.1 through Section 3.2.4.

Essential Fish Habitat

Under the Magnuson-Stevens Fishery Conservation and Management Act of 1976, NMFS is required to designate and conserve EFH for species managed under an existing Fishery Management Plan. BOEM provided an EFH assessment to NMFS regarding the potential effects on EFH for Cook Inlet Lease Sale 244. The EFH consultation included the area of the current Proposed Survey; NMFS did not provide any conservation recommendations as part of the consultation (BOEM, 2019).

Potential Effects on Sensitive Biological Resources

Impacts related to the geohazard survey program are expected to be localized around the proposed activities and will be temporary in nature. Overall, effects on EFH are expected to be negligible due to the size of the survey, the range of the fish and shellfish in Cook Inlet, and the localized and temporary nature of the activities associated with the survey program. Effects to all other sensitive biological resources are expected to be negligible.

3.3 Socioeconomic Resources

3.3.1 Communities

The nearest governmental jurisdiction is the KPB, which includes several smaller administrative jurisdictions. The KPB encompasses 42 communities (DCCED, 2019a) of which six are incorporated as cities: Homer, Kachemak City, Kenai, Seldovia, Seward, and Soldotna. While unincorporated communities lack official local government, the KPB recognizes Tyonek, Port Graham, and Nanwalek as locally governed through Advisory Planning Commissions (KPB, 2017; 2019a). Approximately 35 percent of the KPB's population lives within the boundaries of an incorporated city (DCCED, 2019b; KPB, 2017). The largest concentration of the area's population resides in the Kenai-Soldotna area northeast of the proposed geohazard survey area. The west side of Cook Inlet is sparsely inhabited and includes the small communities of Beluga and Tyonek, two national parklands, and other protected state-owned lands.

Alaska Native Communities

The Cook Inlet region was first populated by the Dena'ina and Aleut peoples, but now they are a minority in the region. The population of KPB is 84 percent white, eight percent Alaska Native, and eight percent all other races, including people who identify as two or more races (KPB, 2017). Alaska Natives live throughout the region; however, some communities are identified as Native based on their ethnic and cultural composition. The Native communities in lower Cook Inlet near the program area include: Nanwalek, Ninilchik, Port Graham, and Seldovia Village. The closest communities to the proposed survey are Nanwalek and Port Graham.

Potential Effects to Communities

In general, effects to communities are expected to be negligible. Overall, there would be little to no positive or adverse effects on the population of the KPB and its communities. Specific effects to communities are addressed under other socioeconomic sections.

3.3.2 Land Use and Infrastructure

Hilcorp's lower Cook Inlet geohazard survey program is located in federal waters of lower Cook Inlet, where there is no existing infrastructure. The land neighboring Hilcorp's project falls within the KPB. Most of borough's population and infrastructure is on the Kenai Peninsula, east of the proposed survey area, including the cities of Homer, Kenai, Seward, and Soldotna. KPB includes numerous communities not on the road system; accessible only by water or air such Seldovia, Nanwalek, Port Graham, Tyonek, and Halibut Cove (KPB, 2017).

Potential Effects to Land Use and Infrastructure

No impacts on land use and infrastructure are expected from Hilcorp's proposed geohazard survey. Survey vessels will embark from and dock at existing infrastructure (likely port of Homer). No land use or infrastructure changes are expected from this program.

3.3.3 Economy

The KPB has a diverse and somewhat seasonal economy, with total employment increasing during summer months, reflecting increased activities in tourism and hospitality, commercial fishing, construction, and other industries that operate seasonally. The top industries for total employment are health care and social services, local government, retail, accommodations and food service, and commercial fishing. The top industries for employee wages are utilities, oil gas and mining, securities and investments, heavy construction, and federal government. Approximately 10 percent of KPB residents have incomes below the poverty level, including 6.4 percent of families, and many more are above this threshold but struggle to make ends meet (KPB, 2017).

Average annual unemployment rates in the KPB showed a slight decrease in recent years. In 2010, the average unemployment rate was 10 percent, whereas in 2013, it was eight percent, and in 2016, 8.6 percent. The highest rates of unemployment occur during the months of January through March (ADLWD, 2016).

Alaska Native communities within the KPB, like many of those in the state, have a mixed economy – one that depends on both cash and subsistence. Subsistence is not only of economic importance, but also of cultural importance to these communities as it forms an essential aspect of their identity. Subsistence is addressed in Section 3.3.6.

Potential Effects to Economy

Hilcorp's proposed lower Cook Inlet geohazard survey is expected to have negligible effects on the KPB economy. While there may be some employment opportunities and some increased revenues accruing from lodging, food, and sales taxes, the proposed activities are short-term, temporary, and localized.

3.3.4 Marine Traffic

The majority of vessel traffic is along the eastern side of Cook Inlet, and includes a combination of industrial activities, such as fishing, cargo, oil and gas production/transportation, ferries, and cruise ships, as well as personal vessels. In 2014, approximately 1,600 marine vessels that were over 28 ft in length were based and operated in Cook Inlet. East-west vessel traffic across lower Cook Inlet in the vicinity of the proposed geohazard survey area is predominately to Williamsport on the west shore of Iliamna Bay and primarily occurs between June and October when the Pile Bay Road is open (Cape International, Inc., 2012).

Potential Effects to Marine Traffic

The proposed geohazard survey's impacts on marine traffic will be negligible. The additional survey vessel will result in a minor increase in marine traffic over approximately 30 days. Adverse effects are expected to be temporary and localized.

To reduce potential conflict with other user groups, such as marine traffic users, in the lower Cook Inlet area, Hilcorp implemented a Stakeholder Engagement Program. Through the program, Hilcorp will notify interested parties about the proposed project and work with stakeholders to mitigate impacts. Hilcorp intends to work with the USCG to publish a Notice to Mariners of the exploration activity to ensure there are no conflicts with local vessels while the survey takes place.

3.3.5 Fishing

Fishing has a substantial presence in Southcentral Alaska. Over 20 communities in Southcentral Alaska receive economic benefits from the industry – contributing to the lives of tens of thousands of residents (McDowell Group, 2015). Robust commercial, personal use, sport fishing, and subsistence fisheries are present in lower Cook Inlet.

Commercial Fishing

Commercial fishing represents one of the main economic sources in the KPB with the salmon being the major revenue generating fishery in the Cook Inlet, followed by halibut (KPB, 2017; McDowell, 2015). Over 65 percent of the revenue generated by Kenai fisherman is from salmon and halibut (KPB, 2017). In the lower Cook Inlet, commercial salmon fishing generally opens on or after June 1st and is closed as late as mid-September [5 AAC 21.310(b)]. The proposed geohazard survey is located within Pacific Halibut Regulatory Area 3A, which typically provides more halibut than any other Pacific halibut regulatory area (IPHC, 2018a). The halibut season is generally March to November.

In addition to salmon and Pacific halibut, herring, hooligan, and numerous groundfish species are commercially harvested during Hilcorp's proposed geohazard survey (April 1 – June 30) (BOEM, 2016a; ADF&G, 2018a, 2019c). Commercial herring harvests occur typically from mid-April through May. The commercial harvest of Pacific cod in state waters from March to August overlaps the project's timeframe. Rockfish can be commercially harvested by catch only from January through June (ADF&G, 2019a; BOEM, 2016a).

Sports Fisheries

A number of sport fishing opportunities are available in the lower Cook Inlet including rockfish, halibut, and salmon trolling. Sport fishing occurs during seasonal salmon migrations as well as year-round in the nearshore waters of Kachemak Bay and east Cook Inlet (BOEM, 2019). The sport fisheries in lower Cook Inlet are primarily accessed along the Sterling Highway. A number of small communities have many supporting sport fishing including motels, bed and breakfasts, restaurants, private and public camping, boat launches, and parking areas. Access to remote fisheries is possible via boat, water taxi, and small plane charters (ADF&G, 2018c).

Personal Use Fisheries

In Alaska, "personal use" is a regulatory category of fishery defined as "the taking, fishing for, or possession of finfish, shellfish, or other fishery resources, by Alaska residents for personal use and not for sale or barter" (ADF&G, 2018b). Several personal use fisheries are in the lower Cook Inlet, but only a few are located near the proposed geohazard survey area and are open during the proposed activities. Cook Inlet hooligan may be taken from salt waters from April 1 to May 31. Herring may be harvested north of Anchor Point from April 1 through May 31, and south of Anchor Point, year-round.

Potential Effects on Fishing

Impacts to commercial, sport, and personal use fish harvests are expected to be short-term and localized. The timing of the geohazard survey may overlap with commercial fishing for a variety of species, and could have short term effects, including space-use conflicts. Most sports fishing occurs from mid-June through September, thus sports fishing could overlap with the survey. The primary potential impact would be from the localized and short-term displacement of fishing boats and charters from fishing grounds during survey operations.

Effects on fishing could also result from the effects on the fisheries resources, such as changes in the distribution of the resources (BOEM, 2016a). Overall, effects on fish and shellfish are expected to be minor due to the small area to be surveyed, the widespread nature of fish and shellfish, and the highly localized and temporary nature of the activities (See Section 3.2.2).

To mitigate potential impacts, Hilcorp has implemented a stakeholder engagement program with which Hilcorp will communicate schedules and timing of activities with fishing stakeholders. Communication will minimize or prevent space-use conflicts.

3.3.6 Subsistence

In the lower Cook Inlet, the primary subsistence harvesters are residents from Port Graham, Seldovia, and Nanwalek (BOEM, 2019). Important subsistence resources to these communities that may be found within the area of the proposed geohazard survey are the five species of Pacific salmon, Pacific halibut, and invertebrates (such as octopuses) (Jones and Kostick, 2016). While most subsistence harvest activities occur within 20 miles of shore (BOEM, 2016a), there remains a substantial amount of subsistence fishing that occurs 20 to 40 miles from shore (BOEM, 2019).

Many rural residents depend on subsistence hunting and fishing for nutrition (ADF&G, 2019c). Native Alaskan communities exhibit a disproportionately higher dependence on subsistence foods

– fish and wildlife than other Cook Inlet communities. While residents of the region participate in subsistence hunting of land mammals, only marine mammal subsistence and subsistence fishing may potentially be affected by Hilcorp's proposed shallow hazard survey (BOEM, 2016a).

Subsistence Use of Marine Mammals

Of the marine mammal species, Port Graham, Seldovia, and Nanwalek residents most commonly harvest sea otters, Steller sea lions, and harbor seals (ADF&G, 2018d). Overall, sea otter subsistence activity is currently low (approximately one otter per year) (USFWS, 2014a), and generally occurs less than two to three miles offshore, well away from the proposed survey area. Harvest of harbor seals and Steller sea lions is also typically coastal, south of the geohazard survey area with relatively low takes.

Subsistence Fisheries

Subsistence fishing is important to Cook Inlet communities with salmon being important for all communities (BOEM, 2016a). Subsistence fishing generally takes place in spring and summer. The closest subsistence fisheries to Cook Inlet's major population centers include the Tyonek Fishery on the west side of Cook Inlet and the Seldovia fishery in Kachemak Bay. Halibut may also be caught by residents of rural communities through the federal subsistence halibut program. Other subsistence fisheries include herring, bottomfish, and shellfish. Additional fisheries that occur outside the non-subsistence use areas include whitefish in the Tyonek River, as well as several locations for Dolly Varden and smelt. The subsistence fisheries around the communities of Nanwalek, Port Graham, and Seldovia, and within Kachemak Bay are the closest to the survey area.

A substantial amount of subsistence fishing occurs 20 to 40 miles offshore inside the lower Cook Inlet. Beginning in mid-June and extending through September, residents of Seldovia fish for salmon in marine waters (BOEM, 2019).

Subsistence Use of Aquatic Plants

In the Lower Cook Inlet, subsistence harvest of kelp along the lower Cook Inlet shoreline is allowed along the lower Kenai Peninsula (ADF&G, 2007; Morris, 2015), approximately 20 miles away from the proposed geophysical survey area. Subsistence collection of seaweed is allowed year-round.

Potential Effects to Subsistence

Effects on subsistence marine mammal hunting, and gathering of invertebrates, and gathering of kelp and other seaweeds are expected to be negligible. Because these subsistence activities occur near shore, space-use conflicts would be limited to near shore vessel traffic.

Minor effects to subsistence fishing may result from alterations in fishing activities, such as avoidance of survey activities or the temporary displacement of resources caused by vessel noise. The survey is proposed to take place between April and June, which may overlap with the beginning of subsistence fishing (mid-June). The impacts on offshore subsistence fishing are expected to be short-term and localized.

3.3.7 Recreation and Tourism

The Cook Inlet area is used extensively for recreation, and recreation is a main element attracting both in-state and out-of-state tourists to the Cook Inlet area (BOEM, 2016a; ADNR, 2018, DOG, 2018). Popular offshore recreational activities include fishing, bird watching, wildlife viewing, camping, hiking, ocean kayaking, and power boating (BOEM, 2016a). Additionally, many visitors to Alaska travel by cruise ship or take day cruises. Recreation and tourism in the Cook Inlet area is the greatest during the summer months.

Two types of large passenger vessels support recreation and tourism in the region: the Alaska Marine Highway System (AMHS) ferry and cruise ships. The AMHS ferry operates year-round, connecting ports of Homer, Seldovia, Kodiak, and the Aleutian Island chain. Cruise ships dock at Anchorage and Homer. Smaller vessels also provide recreational and tourism support to the region, especially in lower Cook Inlet. These vessels include tour boats and water taxis. Tourists visit a variety of locations throughout Kachemak Bay to view wildlife and scenery. Popular locations are Yukon Island, Tutka Bay, Moosehead Point, and Gull Island (BOEM, 2016a).

Potential Effects to Recreation and Tourism

Hilcorp's lower Cook Inlet geohazard survey would result in negligible impacts to recreation and tourism. Most recreation and tourism activities occur at the shoreline or near shore; and recreational activities in the vicinity of the geohazard survey are unlikely to create space-use conflicts.

3.3.8 Archaeological and Historical Resources

Material evidence of human activity that is 50 years old or older are considered archaeological and historical resources. Offshore archaeological and historic resources include archaeological sites on submerged paleo-landforms, shipwrecks, downed aircraft, and submerged or other offshore infrastructure 50 years of age or older. Little baseline information exists for submerged resources in Cook Inlet, as well as all the waters surrounding Alaska. Not only is a basic inventory of resources limited, but so is the understanding of the decay processes, corrosion, and biotic relationships in cold water environments of Alaska (McMahan, 2007).

No historic resources have been identified in Hilcorp's lease blocks; however, the potential presence of submerged historic resources cannot be ruled out. Historic resources within Cook Inlet waters may include shipwrecks, lost aircraft, other structures - such as oil and gas infrastructure, and artifacts- such as items lost off barges - that are 50 years of age or older. In April 2019, TerraSond discovered a possible shipwreck in Lease Block 6504, southwest of the Hilcorp lease blocks. Age and identity of this possible wreck could not be determined by the initial notification (Swanson, 2019).

BOEM provided an analysis of potential and known historic resources (shipwrecks and obstructions) and identified 63 known historic shipwrecks near the Lease Sale 244 (See Table 3.3.8-2 in BOEM, 2016a). BOEM advised the actual number of wrecks in the Cook Inlet is much greater, but they have gone unrecorded due to lack of survivors and witnesses (BOEM, 2016a). Exact locations for only a few of these wrecks are known, such as the Corea, Agram, SS. Farallon, Kandu, and Torrent (OHA, 2019a; Lloyd, 2008, 2019; NOAA, 2019f).

Potential Effects to Archaeological Resources

Hilcorp's geohazard survey is not expected to impact archaeological and historic resources since it does not include any disturbance of the sea bottom. However, the survey is intended to locate archaeological or historic resources potentially in the project area, providing Hilcorp information and the ability to plan future activities such that they adequately avoid mitigation impacts on the resources.

The archaeological study will be conducted in accordance with NTL 2005-A03 and is required by the Regional Director if determined that submerged archaeological resources may exist on or near lease areas under BOEM authority. On September 13, 2019 BOEM submitted notification to Hilcorp in accordance with regulations in 30 CFR 550.194(a) that BOEM has reason to believe that an archaeological resource may exist in the area where this geohazard survey is proposed. Therefore, the archaeological survey needs to be conducted and an archaeological report must be submitted.

3.3.9 Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (59 FR 7629), requires agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its actions on minority populations, low-income populations, or Indian tribes. The order's intent is to achieve environmental justice for all communities, regardless of their race, national origin, or income. In this document, Alaska Native communities near the proposed geohazard survey area is considered a potential Environmental Justice population.

Potential Effects to Environmental Justice Populations

Hilcorp's proposed geohazard survey will not have a disproportionately high and adverse impact on environmental justice communities. Minor short-term effects to environmental justice communities may result. Subsistence is a central element of the Alaska Native way-of-life and of consideration when evaluating affects to these communities. Effects to subsistence are expected to be short-term and minor, as addressed in Section 3.3.6.

3.4 Analysis of Accidental Oil or Hazardous Material Spills

The vessel conducting the geohazard survey will have spill prevention and response plans consistent with international, national, and state standards. The regulations require vessels to report incidents of pollution to state and federal authorities, carry onboard spill response equipment, conduct periodic training exercises for dealing with oil pollution, and demonstrate financial responsibility should an incident occur.

Although the project vessel will comply with these regulations, a spill may still occur. Fueling will take place at port facilities. The most likely release would be fuel directly to the waters of Cook Inlet. Generally, the project vessels proposed for use, and those of similar size, use diesel. In the event of a release of diesel, immediate notification and response actions would occur.

4. MITIGATION MEASURES

Hilcorp has developed and will implement a robust program to mitigate impacts from the proposed geohazard survey program. Measures to mitigate impacts may include those required by agencies as part of permit issuance and lease requirements (permit and lease stipulations) and those that have been identified and implemented by Hilcorp. General mitigation measures are outlined in Section 4.1 and mitigation measures that have been included in the NMFS and USFWS-approved Marine Mammal Monitoring and Mitigation Plan for the 2020 Shallow Hazard Program are outlined in Section 4.2.

4.1 General Mitigation Measures

These mitigation measures include general activities and will be conducted in accordance with the stipulations outlined in the applicable authorizations and permits (Table 1-1). Additional mitigation measures were developed to avoid or minimize potential negative effects of the proposed geohazard survey. A list of these mitigation measures is provided below.

- Survey activities will be conducted between April 1 and mid-June when beluga whales are are expected to be outside the survey area. Lease Stipulation 7 – Protection of Beluga Whales prohibits on-lease seismic surveys between November 1 and April 1 because this is the time period when beluga whales are most likely to be in the area. Although the proposed geohazard survey is not a seismic survey, Hilcorp will voluntarily follow these timing restrictions.
- Existing onshore support facilities will be used, avoiding impacts associated with development of new support facilities.
    - Vessel support will be based at Offshore Systems Kenai dock in Nikiski or a dock in Homer.
    - Fuel will be provided by commercial tank farms in Nikiski, Kenai, or Homer.
- Fueling and material handling will be conducted in a manner to minimize the risk of spills.
    - Fueling will be conducted by personnel familiar with and in accordance with industry BMPs.
    - All diesel fired equipment will use ultra low sulfur diesel.
- Hilcorp will take the following actions to ensure that other users in lower Cook Inlet are aware of the activities and that there are no conflicts while operations take place:
    - Work with USCG to publish a Notice to Mariners
    - Monitor for any local traffic in vicinity of activities and use radio communications to notify other users (e.g., recreational boaters and sport fishing charters) about ongoing activities
- To ensure the proposed activities provide economic and social benefits to area residents, Hilcorp will work with local vendors and service providers to provide economic opportunity.
- Hilcorp has implemented a Stakeholder Engagement Program that will help minimize conflicts with other user groups in the lower Cook Inlet such as subsistence users, port authorities, fishing organizations, and interested individuals. Hilcorp will coordinate with these groups to avoid conflicts to the maximum extent practicable.

4.2 Agency Approved Marine Mammal Mitigation

Hilcorp has established and will implement procedures to mitigate impacts to wildlife as outlined in the Marine Mammal Monitoring and Mitigation Plan for the 2020 Shallow Hazard Program and approved by NMFS and USFWS. The following mitigation was approved:

- A SSV will be conducted for equipment that emits noise within the hearing range of marine mammals (sparker systems; see Table 2-2 and Section 2.4.4) to characterize the sound levels, propagation characteristics, calculate distances to the appropriate thresholds, and to verify the monitoring zones. The results of the SSV will be submitted to NMFS and USFWS within 72 hrs of completion with the request for modification of the Level A and B distances, if warranted.
- Exclusion zones (EZs) will be established based on the project activity and marine mammal hearing group. The EZ is defined as the area in which all operations are shut down in the event a marine mammal enters or is about to enter this zone based on distances to Level A or what can be effectively monitored for the species. Because of the low numbers of allowable Level B "takes" by harassment due to their critically endangered status, Hilcorp will implement stringent monitoring and mitigation measures to minimize the likelihood of exposure of beluga whales to sound exceeding Level B levels.
- Prior to the start of the survey for the day, or when activities have been stopped for longer than 30 minutes, the Protected Species Observer (PSO) will clear the EZ for a period of 30 minutes. Clearing the EZ means no marine mammals have been observed within the EZ for that 30-minute period. If any marine mammals have been observed within the EZ, ramp up cannot start until the marine mammal has left the EZ or has not been observed for a 30-minute period.
- During periods of low visibility (e.g., nighttime, fog, inclement weather), the use of sparkers is not allowed if the EZ is not visible. Operations may continue if already operating when the fog/weather came in.
- A shut down occurs when all sparker activity is suspended. If a marine mammal approaches the EZ, the sparker will be shut down completely. This shut down procedure takes up to a minute.
- Following a shut down, sparker activity will not resume until the marine mammal has cleared the EZ. The animal will be considered to have cleared the EZ if:
    - The marine mammal is visually observed leaving the EZ, or
    - If the marine mammal has not been seen within the zone for 15 minutes for pinnipeds and harbor porpoises, or
    - If the marine mammal has not been seen within the zone for 30 minutes for cetaceans and sea otters.
- Nighttime operations involving sparkers are not allowed.
- Communication methods and protocols for implementing the mitigation measures will be established between the PSOs, vessel crew, and any other relevant personnel before any activities commence.
- Project vessels will operate in a manner to minimize potential impact to marine mammals. Vessel mitigation will include:
    - Maintaining watch to avoid vessel strikes.
    - Avoid approaching within 100 m of marine mammals.

- Avoid placing the vessel between members of a group of marine mammals that may cause separation of individuals in the group.
- If the vessel approaches within 1.6 km of observed whales, except in emergency situations, the vessel operator will take reasonable precautions to avoid potential interaction with the whales by taking one or more of the following actions, as appropriate:
    - Steering to the rear of the direction of travel of the whale(s) to avoid causing changes in their direction of travel.
    - Maintaining vessel speed of 10 knots or less when transiting to minimize the likelihood of lethal vessel strikes.
    - Reducing vessel speed to less than 5 knots within 274 m of the whale(s).
    - Taking reasonable steps to alert other vessels in the vicinity of whale(s).
    - Not purposely approaching within 3 nautical miles (5.5 km) of major Steller sea lion rookeries or haulouts, where vessel safety requirements allow and/or where practicable.
    - Not allowing tow to remain in the water, and no trash or other debris will be thrown overboard.
    - Implementing measures to minimize risk of spilling hazardous substances.

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