Alaska Outer Continental Shelf

OCS EIS/EA
BOEM 2022-061

Cook Inlet Planning Area

Oil and Gas Lease Sale 258
In Cook Inlet, Alaska

Final Environmental Impact Statement

Chapters 1–5
Appendix A and Appendix B

Prepared by
Bureau of Ocean Energy Management
Alaska OCS Region

Estimated Lead Agency

Total Costs Associated with
Developing and Producing this EIS:
$734,323.21

BOEM
Bureau of Ocean Energy Management

U.S. Department of the Interior
Bureau of Ocean Energy Management
Alaska OCS Region

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COVER SHEET

Cook Inlet
Lease Sale 258
Final Environmental Impact Statement

Draft ( ) **Final (X)**

Type of Action: Administrative (X) Legislative ( )

Area of Potential Effect: Offshore marine environment, Cook Inlet region, and the Kenai Peninsula Borough of Alaska.

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Prepared by:

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Cooperating Agency

Bureau of Safety and Environmental Enforcement

Participating Agency

National Park Service

ABSTRACT:

This Final Environmental Impact Statement (EIS) assesses an oil and gas lease sale in the 2012–2017 Outer Continental Shelf (OCS) Oil and Gas Leasing Proposed Final Program for the Cook Inlet Planning Area. This document is expected to be used to inform the lease sale process for Cook Inlet Oil and Gas Lease Sale 258, which BOEM is required to hold by the end of December 2022, as directed in the Inflation Reduction Act of 2022 (Pub. L. No. 117-169, enacted Aug. 16, 2022). While BOEM has no discretion on whether to hold the sale, BOEM has prepared this Final EIS to follow its normal leasing process to the fullest extent possible. This Final EIS contains analyses of the potential environmental impacts that could result from a Cook Inlet lease sale. BOEM's announcement of Cook Inlet Lease Sale 258 will be made in a Final Notice of Sale and Record of Decision.

BOEM has completed this Final EIS process by publishing a Draft EIS, holding public hearings, conducting government-to-government consultations, and providing a public comment period following publication of the Draft EIS. BOEM received 26 individual testimonies during the public hearings, and 75 comment submissions, including two form letters with 216 and 306 letters each, respectively. BOEM has considered and responded to these comments.

The Proposed Action (to conduct proposed Lease Sale 258) includes consideration of 224 unleased OCS blocks in the northern portion of the Cook Inlet Planning Area, covering about 1.09 million acres (442,875 hectares), representing approximately 20 percent of the total Cook Inlet Planning Area. For each alternative, the Final EIS evaluates the effects to the human, physical, and biological resources from routine activities and from the unlikely chance of a large oil spill. In addition to the Proposed Action, other alternatives include Alternative 2 (No Lease Sale), which means cancellation of the sale; two alternatives (Alternatives 3 and 4), which would exclude blocks overlapping with critical habitat for beluga whales (Alternative 3A) or northern sea otters (Alternative 4A) from leasing, or provide mitigation for critical habitat (Alternatives 3B and 4B) or for beluga whale feeding areas near anadromous streams (3C); and Alternative 5, which includes mitigation to reduce interactions with the gillnet fishery. A cumulative effects analysis evaluates the environmental effects of the Proposed Action with those of past, present, and reasonably foreseeable future activities.

EXECUTIVE SUMMARY

INTRODUCTION

The U.S. Department of the Interior (USDOI), Bureau of Ocean Energy Management (BOEM), is preparing to conduct an oil and gas lease sale on the Alaska Outer Continental Shelf (OCS) in the northern portion of the Cook Inlet Planning Area (lease sale area). This document is expected to be used to inform the lease sale process for Cook Inlet Oil and Gas Lease Sale 258, which BOEM is required to hold by the end of December 2022, as directed in the Inflation Reduction Act of 2022 (IRA) (Pub. L. No. 117-169, enacted Aug. 16, 2022). While BOEM has no discretion on whether to hold the sale, BOEM is preparing this FEIS to follow its normal leasing process to the fullest extent possible. The entire planning area encompasses approximately 2.1 million hectares (ha) (~5.3 million acres (ac)). The lease sale area (Area ID) includes 224 OCS blocks that encompass approximately 442,537 ha (1.09 million ac).

PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of the Proposed Action is to offer for lease certain OCS blocks located within the federally owned portion of Cook Inlet that may contain economically recoverable oil and gas resources. The need for the Proposed Action is to meet the purposes of the Outer Continental Shelf Lands Act of 1953 (OCSLA), as amended (43 United States Code (USC) 1331 *et seq.*) and support development of domestic energy resources in an environmentally and economically responsible way. Lease Sale 258 may lead to oil and gas exploration, development, and production. Oil and gas from the Cook Inlet OCS could help meet regional and national energy needs and lessen the need for imports.

REGULATORY AND ADMINISTRATIVE FRAMEWORK

The OCS Oil and Gas Leasing Program is established by OCSLA, and the implementing regulations promulgated by BOEM pursuant to its OCSLA authority. Oil and gas activities on the OCS must also comply with other federal, state, and local laws and regulations. Compliance with all applicable laws and regulations is assumed for all action alternatives considered.

PUBLIC INVOLVEMENT

The Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) was published in the Federal Register on September 10, 2020 (85 FR 55861).[1] Publication of the NOI opened a scoping period that extended through October 13, 2020. Opportunity for public input was provided throughout the scoping period via a BOEM Virtual Meeting Room (https://www.boem.gov/ak258-scoping), four live virtual meetings (held September 29, October 1, and two on October 8, 2020), and through submittal of comments via https://www.regulations.gov.

The Notice of Availability of the Draft EIS was published in the Federal Register on October 29, 2021 (86 FR 60068), beginning a 45-day public comment period that ended December 13, 2021. BOEM received a total of 92,907 public comment submissions (Federal e-Rulemaking Portal http://www.regulations.gov, docket BOEM-2020-0018). Following the close of the public comment

[1] BOEM has prepared this EIS under NEPA (1970) (P.L. 91–190, 42 USC 4321 *et seq.*), and Council on Environmental Quality (CEQ) regulations at 40 CFR Parts 1500–1508 (1978, as amended in 1986 and 2005). Because the NEPA process for this action began prior to September 14, 2020, this EIS does not apply updated CEQ regulations published in the Federal Register Notice of Final Rule (85 FR 15179) on July 16, 2020, effective September 14, 2020 (see 40 CFR 1506.13).

period, BOEM assessed and considered comments received and responded by revising the EIS as appropriate. Detailed responses to comments received are provided in Appendix B.

PROPOSED ACTION AND ALTERNATIVES

The following alternatives were identified for detailed analysis:

Proposed Action. The Proposed Action would offer for lease all available OCS blocks in the northern portion of the Cook Inlet Planning Area. The lease sale area covers approximately 442,537 ha (1.09 million ac), representing approximately 20 percent of the total Cook Inlet Planning Area (224 OCS blocks).

Alternative 2 – No Action. The "No Action" alternative is equivalent to cancellation of the Proposed Action. Under this alternative, Lease Sale 258 would not occur.

Alternative 3A – Beluga Whale Critical Habitat Exclusion. Under this alternative, the 10 OCS blocks that overlap with beluga whale critical habitat at the northern tip of the lease sale area would be excluded from the lease sale.

Alternative 3B – Beluga Whale Critical Habitat Mitigation. Under this alternative, all available blocks in the lease sale area would be offered for lease. The 10 OCS blocks that overlap beluga whale critical habitat at the northern tip of the lease sale area would be included in the lease sale; however, no on-lease seismic surveys or exploration drilling would be conducted between November 1 and April 30, when beluga whales are most likely to be present. This timing window reflects a minor change from the DEIS, which evaluated a timing window for Alternative 3B that restricted these activities from November 1 through April 1.[2]

Alternative 3C – Beluga Whale Nearshore Feeding Areas Mitigation. Under this alternative, all available OCS blocks would be offered for lease with seasonal mitigation to protect beluga whales. On all blocks offered for lease, no on-lease seismic surveys would be conducted between November 1 and April 1; on blocks within 10 miles of major anadromous streams, no on-lease seismic surveys would be conducted between July 1 and September 30.

Alternative 4A – Northern Sea Otter Critical Habitat Exclusion. Under this alternative, the 7 OCS blocks that overlap with critical habitat of the southwest Alaska Distinct Population Segment of the northern sea otter would be excluded from the lease sale.

Alternative 4B – Northern Sea Otter Critical Habitat Mitigation. Under this alternative, all available OCS blocks would be offered for lease. On the 14 OCS blocks that either contain northern sea otter critical habitat or are located within 1,000 meters of northern sea otter critical habitat, the discharge of drilling fluids and cuttings and seafloor-disturbing activities would be prohibited.

Alternative 5 – Gillnet Fishery Mitigation. Under this alternative, all available OCS blocks would be offered for lease. On the 117 whole or partial blocks north of Anchor Point, no on-lease seismic surveys would be conducted during the drift gillnetting season as designated by the Alaska Department of Fish

2 This change was based on new information received from the National Marine Fisheries Service (NMFS), after the close of the comment period for the DEIS, indicating that recent aerial surveys show beluga whale use of this area extending into the month of April (Gill, Shelden, and Sims, 2022; Gill and Seymore, unpub. data, 2022). After carefully considering this information, BOEM determined that it did not warrant supplementing the EIS because the impacts of on-lease seismic surveys, exploration drilling, and other activities on beluga whales were considered in the analysis of the Proposed Action in the DEIS.

and Game (ADF&G) (approximately mid-June to mid-August); and, United Cook Inlet Drift Association must be notified of any temporary or permanent structures planned during the drift gillnetting season.

Alternative 6 – Preferred Alternative. After considering public comments on the Draft EIS, BOEM developed the Preferred Alternative, which combines the two critical habitat exclusion alternatives with three mitigation alternatives: Alternative 3A (Beluga Whale Critical Habitat Exclusion), Alternative 3C (Beluga Whale Nearshore Feeding Areas Mitigation), Alternative 4A (Northern Sea Otter Critical Habitat Exclusion), Alternative 4B (Northern Sea Otter Critical Habitat Mitigation), and Alternative 5 (Gillnet Fishery Mitigation).

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

The Affected Environment describes the physical environment, biological environment, socioeconomic, and sociocultural systems that could be affected by the Proposed Action. The following resources are included: air quality; water quality; coastal and estuarine habitats; fish and invertebrates; birds; marine mammals; terrestrial mammals; recreation, tourism and sport fishing; communities and subsistence; economy; commercial fishing; archaeological and historic resources; and environmental justice.

This Final EIS also includes an expanded greenhouse gas (GHG) analysis and, in accordance with recent Executive Orders, BOEM also provides an analysis of monetized impacts from these estimated GHG emissions (even though the National Environmental Policy Act (NEPA) does not require such an analysis in the absence of a cost-benefit analysis). Chapter 4.3.5 provides the methodology and results of BOEM's greenhouse gas analysis and the results are summarized in Table ES-2.

Table ES-1: Summary of GHG Emissions Results

Components of Analysis*	Lifecycle Stages	Scenarios	GHG Emissions (in millions of metric tons, CO^2e)
Domestic	Full Lifecycle	Leasing	87.06
Domestic	Full Lifecycle	No Leasing	78.82
Domestic	Full Lifecycle	Incremental emissions from Leasing	8.24
Domestic	Full Lifecycle	Incremental emissions as percent of No Leasing	10.45
Foreign	Downstream (oil consumption) only	Incremental emissions from Leasing	14.54

*Note: Domestic refers to emissions from oil and gas produced and/or consumed in the U.S. Foreign refers to energy production or consumption that occurs outside the U.S. and is not produced or consumed in the U.S.

A detailed hypothetical Exploration and Development (E&D) Scenario was prepared to provide the framework and assumptions for an impact analysis. The results of the impact analysis for the Proposed Action are summarized in Table ES-2. Impacts on each resource category were rated as negligible, minor, moderate, or major using impact scale definitions based on the context and intensity of the impact. Impacts of post-lease activities ranged from negligible to moderate for all resources, with most resources experiencing minor impacts.

Over the life of the hypothetical exploration, development, and production that could follow a lease sale, other effects are possible from unlikely events such as a large, accidental oil spill or natural gas release. One large spill of crude, condensate, or refined oil is assumed to occur during development and production activities. This assumption is based on considerable historical data that indicate large OCS spills ≥1,000 bbl could occur during these activities (ABS Consulting, 2016). This assumption is also based on statistical estimates of the mean number of large spills (0.21) from platforms and pipelines, the number and size of large spills on the OCS, and project-specific information in the E&D Scenario.

Additionally, although unlikely, BOEM assumes a gas release will occur. For purposes of this environmental document, one loss of well control or one pipeline rupture (offshore or onshore) is assumed over the 32 years of gas production releasing 20–30 million cubic feet of natural gas over one day. The impact conclusions, when a large spill is considered, would range from minor to major (Table ES-2). Impacts from a large gas release would range from negligible to moderate, with minor impacts for most resources and moderate impacts for air quality.

Table ES-2: Summary of Potential Impacts of the Proposed Action

Resource	Impacts of the Proposed Action	Post-Lease Activities[1]	Large Spill[2]
Air quality	Impacts from emissions during surveys, exploration, and production operations.	Minor[3]	Minor to Moderate
Water quality	Increase in total suspended solids (TSS) from construction activities; discharge of exploration and delineation well rock cuttings and fluids, and other operational discharges; petroleum hydrocarbon contamination could persist in sediments or ice and be reintroduced into the water column.	Minor	Moderate
Coastal and estuarine habitats	Impacts from seafloor-disturbance activities, discharges, pipeline landfalls, and onshore construction.	Minor	Major
Fish and invertebrates	Impacts from noise, habitat alteration and disturbance due to platforms and vessels.	Minor	Moderate
Birds	Vessel operations or marine habitat alterations could displace birds or interfere with foraging, and some waterbird populations could experience impacts lasting beyond a single season. Bright artificial lighting or gas flaring from vessels and platforms could cause collisions of migrating birds.	Minor to Moderate	Minor to Major
Marine mammals	Impacts could result from noise associated with seismic airguns and pile-driving, habitat alteration, and vessel strikes.	Negligible to Minor	Minor to Moderate
Terrestrial mammals	Most impacts would be localized to the site of the project infrastructure offshore, geographically distant from terrestrial habitats.	Minor	Minor
Recreation, tourism, and sport fishing	Impacts would primarily arise from disturbance in the form of space-use conflicts. Access to some sport fishing areas may be temporarily limited and some short-term displacement of populations of sport species such as salmon and halibut may result.	Minor	Moderate
Communities and subsistence	Short-term and localized impacts would include changes in availability of subsistence resources and space-use conflicts.	Minor	Major
Economy	Economic impacts related to employment, wages, and revenues would be closely tied to the size of a resource discovery – the larger the discovery, the greater the impact.	Negligible to Moderate	Minor
Commercial fishing	Impacts could include displacement of targeted fish species and localized disturbance of fishing activities. For some fisheries, such as salmon gillnetting, impacts could be moderate due to space-use conflicts.	Minor to Moderate	Major
Archaeological and historic resources	Impacts include potential damage or destruction of resources from seafloor and ground disturbance, or offshore discharges.	Negligible to Minor	Moderate
Environmental justice	No major impacts for subsistence activities and harvest patterns, air quality, water quality, or the biological resources harvested for subsistence.	No Disproportionate Effects	Disproportionate Effects

Notes: TSS = total suspended solids
1 Post LS 258 activities described in the E&D Scenario (DEIS Section 4.1) and small spills (DEIS Section 3.1.1).
2 Large spill described in DEIS Section 3.1.2.
3 Impact Scale described in DEIS Section 4.2.

Table ES-3 compares the impacts of the No Action Alternative and Alternatives 3 through 5 relative to the Proposed Action. The overall impact ratings (i.e., negligible, minor, moderate, major) did not differ among action alternatives for any resource, with the exception of commercial fishing.

Table ES-3: Comparison of Impacts Relative to the Proposed Action

Alternative	Positive Impacts	Negative Impacts
2 – No Action	• Avoids all negative environmental impacts of the Proposed Action.	• Environmental impacts may occur from the likely substitutes for the lost oil and gas production, though not necessarily in the lease sale area. • Economic benefits from the Proposed Action would be precluded or delayed.
3A – Beluga Whale Critical Habitat Exclusion	• Avoids most impacts on beluga whales and beluga whale critical habitat in 10 OCS blocks. • May slightly reduce interactions with drift gillnet fishers at northern edge of lease sale area. • Reduction in impacts from seismic sounds would benefit anadromous fish, including salmon species and commercial salmon fisheries. Impact level for commercial fishing would be slightly reduced from minor-to-moderate to minor. • Eliminates impacts to birds while they are present in the exclusion area.	• The 10 OCS blocks that overlap with beluga whale critical habitat would be excluded from the lease sale. Potential for resource development would be lost on 10 OCS blocks along with associated economic benefits.
3B – Beluga Whale Critical Habitat Mitigation	• Reduces impacts on beluga whales and beluga whale critical habitat in 10 OCS blocks. • Eliminates impacts from on-lease seismic surveys and exploration drilling between November 1 and April 30 when beluga whales are most likely to be present. • Reduction in impacts from seismic sounds would benefit anadromous fish, including salmon species and commercial salmon fisheries. Impact level for commercial fishing would be slightly reduced from minor-to-moderate to minor. • A few impacts would be eliminated for wintering birds.	• The 10 OCS blocks that overlap with beluga whale critical habitat would restrict on-lease seismic surveys or exploration drilling between November 1 and April 30 potentially having negative economic impacts to lessees.
3C – Beluga Whale Nearshore Feeding Areas Mitigation	• Reduces impacts from on-lease marine seismic surveys on all blocks between Nov. 1 and April 1 when beluga whales are most likely to be present and distributed across lower Cook Inlet. • Reduces impacts on beluga whale nearshore feeding areas in 146 OCS blocks located wholly or partially within 10 miles of major anadromous streams. • Eliminates or reduces impacts of noise between July 1 to September 30 when beluga whales are migrating to and from their summer feeding areas. • Reduction in impacts from seismic sounds would benefit anadromous fish, including salmon species and commercial salmon fisheries. Impact level for commercial fishing would be slightly reduced from minor-to-moderate to minor. • Provides some additional protections from underwater noise, vessel disturbance, and collision risk for some wintering marine birds.	• No on-lease seismic surveys would be permitted between November 1 and April 1 on all 224 OCS blocks. Additionally, for the 146 OCS blocks located wholly or partially within 10 miles of major anadromous streams, lessees would be prohibited from conducting on-lease seismic surveys between July 1 and September 30. These restrictions could result in a negative economic impact to lessees.

Alternative	Positive Impacts	Negative Impacts
4A – Northern Sea Otter Critical Habitat Exclusion	• Avoids most impacts on sea otters and sea otter critical habitat in 7 OCS blocks. • Would eliminate impacts for marine birds while they are foraging in the 7 OCS blocks.	• The 7 OCS blocks that overlap with northern sea otter critical habitat would be excluded from the lease sale. Potential for resource development and associated economic benefits would be lost on these 7 OCS blocks.
4B – Northern Sea Otter Critical Habitat Mitigation	• Reduces impacts on sea otters and sea otter critical habitat in 14 OCS blocks that contain or are located within 1,000 m of sea otter critical habitat. • Would benefit benthic habitat and reduce impacts to benthic-foraging birds.	• On the 14 OCS blocks that contain or are located within 1,000 meters of northern sea otter critical habitat, discharge of drilling fluids and cuttings and seafloor-disturbing activities (including anchoring and placement of bottom-founded structures) would be prohibited. • These restrictions could result in a negative economic impact to lessees.
5 – Gillnet Fishery Mitigation	• Reduces risk of interactions with drift gillnet fishers by prohibiting on-lease seismic surveys on 117 whole or partial OCS blocks during the drift gillnet season and by requiring notification of and coordination with gillnet fishers. • Reduces impacts on beluga whales during important summer feeding and rearing times. • Decrease of impacts to commercial drift gillnet fishery because no space-use conflicts or impacts to the targeted fishery would occur from seismic surveys. Overall impact level for commercial fishing would be slightly reduced to minor.	• No on-lease seismic surveys would be permitted during the drift gillnetting season in State of Alaska waters as designated by ADF&G (approximately mid-June to mid-August) on the 117 whole or partial OCS blocks north of Anchor Point. This alternative could result in a negative economic impact on lessees.

CUMULATIVE EFFECTS

Cumulative effects were analyzed in the EIS by considering the incremental environmental impacts of the Proposed Action added to environmental impacts from past, present, and reasonably foreseeable future actions. The cumulative effects analysis considered impacts of other oil and gas activities, mining projects, harvest activities, residential and community development, scientific research and survey activities, military and homeland security activities, and climate change. In general, impact conclusions ranged from negligible to moderate. With the addition of a large spill, negligible to major impacts would be expected.

VERY LARGE OIL SPILL: ≥120,000 BBL

Although very unlikely and not part of the Proposed Action (i.e., not authorized or permitted) or any alternatives, the potential effects of a Very Large Oil Spill (VLOS) were also analyzed in this Draft EIS as a low-probability, but high-impact event. BOEM relied on the analyses completed for the LS 244 Final Environmental Impact Statement (BOEM, 2016). The scenario examined a hypothetical release of 120,000 bbl of oil resulting from a loss of well control over 80 days. Should a VLOS occur in the lease sale area, all the resources analyzed in the Draft EIS could be affected, and impacts could range from minor to moderate for a few resources and to major for most resources.

CONSULTATION AND COORDINATION

BOEM has engaged in a number of consultation and coordination processes with federal agencies, Tribes, and Alaska Native Claims Settlement Act (ANCSA) Corporations regarding proposed activities under Lease Sale 258. Below is a brief summary of how BOEM has satisfied, or will satisfy, its consultation obligations under the applicable statutory requirements.

TRIBAL AND ANCSA CORPORATION CONSULTATIONS

BOEM initiated opportunities for Government-to-Government tribal consultations with Tribes, ANCSA Corporations, Tribal entities and local governments in the Cook Inlet and Kodiak Island region whose members could be affected by activities related to LS 258. Additionally, to maintain an active relationship with, each Tribe, ANCSA Corporation and Tribal entity, BOEM provided regular notices and updates regarding the pending Cook Inlet LS 258. Additional outreach efforts included Federal Register Notices, BOEM website updates, press releases to local and statewide media, paid display ads in several newspapers, and several broadcast interviews. BOEM received input from the Seldovia Tribe regarding sensitive areas that were considered during the development of this EIS. BOEM also engaged in a Government-to-Government consultation with the Kenaitze Tribe at their request.

SECTION 7, ENDANGERED SPECIES ACT CONSULTATION

BOEM is consulting with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) (the “Services”) concerning potential impacts to listed species and their designated critical habitat. BOEM consults with the Services to ensure that activities under any leases issued in Cook Inlet will not result in jeopardy to a listed species or cause adverse modification of designated critical habitat. BOEM is requesting incremental step consultation for Lease Sale 258. Consultation for the first incremental step will assess whether early lease activities (seismic surveying, ancillary activities, and exploration drilling) would result in jeopardy to a listed species or cause adverse modification of designated critical habitat. BOEM would reinitiate consultation for any proposed development and production activities.

ESSENTIAL FISH HABITAT CONSULTATION

BOEM prepared an Essential Fish Habitat (EFH) Assessment that identified adverse effects to designated EFH from potential oil and gas exploration activities in the Lease Sale 258 Area. This assessment was provided to NMFS on January 20, 2022. NMFS responded via letter dated February 24, 2022, submitting two EFH Conservation Recommendations related to the evaluating greenhouse gases on EFH and Alaskan Fisheries and requiring operators to adopt best management practices for reducing methane emissions. While BOEM shares NMFS’ concerns about the potential long-term impacts of climate change on fish species and habitats in Alaska, due to limitations of technology, data, modeling, and methods, it is not presently possible to predict the precise geographical changes to species distributions and habitats that may occur over long time scales as the result of climate change. Consequently, it is not possible to analyze, with any degree of confidence, the potential effects of the increased GHG emissions from a single lease sale on local Alaskan fisheries. However, BOEM and NMFS have agreed to collaborate on studies to address impacts to fish in Cook Inlet. Regarding NMFS’ concern about methods for facilities to reduce methane emissions, lessees are already subject to regulations that require adherence to best management practices at their facilities.

SECTION 106, NATIONAL HISTORIC PRESERVATION ACT CONSULTATION

On September 23, 2020, in a letter to the Alaska State Historic Preservation Officer (SHPO) BOEM explained that it recognizes that a lease sale constitutes an undertaking under Section 106 of the National Historic Preservation Act (NHPA) (Title 54, USC 306108) and the implementing regulations at 30 CFR 800 *et seq*. but is not the type of activity that has the potential to cause effects on historic properties. Thus, the lease sale would not require formal SHPO consultation. SHPO agreed with BOEM in an email dated November 16, 2021. Subsequent project- and site-specific consultations will occur if they are a type of activity that has the potential to cause effects on historic properties for any proposed exploration, development, and production activities.

APPENDICES

Appendix A – Oil Spills and Gas Release Analysis. This appendix discusses the technical information used to estimate numbers and volumes of spills assumed to occur over the life of the E&D Scenario. It provides an analysis of the impacts of small spills, a large spill or gas release, spill drills, and response activities on each physical, biological, sociocultural, and economic resource.

Appendix B – Response to Public Comments. This appendix provides detailed responses to specific issues and comments that were received during the public comment period (October 29–December 13, 2021). Comments and responses were categorized and grouped into approximately 50 issues for efficiency and convenience.

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Appendices

List of Acronyms and Abbreviations

2D....................two dimensional
3D....................three dimensional
AAAQS.............Alaska Ambient Air Quality Standards
ac.....................acres
ADF&G.............Alaska Department of Fish and Game
ANCSA.............Alaska Native Claims Settlement Act
APDES.............Alaska Pollutant Discharge Elimination System
AQCR...............Cook Inlet Intrastate Air Quality Control Region
ASAP................Alaska Stand-Alone Natural Gas Pipeline
AWQS..............Alaska Water Quality Standards
bbl....................barrels
Bbbl..................billion barrels
Bcf....................billion cubic feet
BLM..................Bureau of Land Management
BOE..................barrels of oil equivalent
BOEM...............Bureau of Ocean Energy Management
B.P....................before present
BSEE................Bureau of Safety and Environmental Enforcement
CAA..................Clean Air Act
$CaCO_3$..............calcium carbonate
CEQ..................Council on Environmental Quality
CFR..................Code of Federal Regulations
CH_4...................methane
CINGSA............Cook Inlet Natural Gas Storage Area
CO....................carbon monoxide
CO_2...................carbon dioxide
CO_2e.................carbon dioxide equivalent
CSIS.................Community Subsistence Information System
CWA.................Clean Water Act
cy.....................cubic yards
dB_{RMS}................Decibels Root Mean Square
DPP..................Development and Production Plan
DPS..................distinct population segment
E&D..................Exploration and Development
EDPS................Eastern Distinct Population Segment
EFH..................essential fish habitat
EIA....................U.S. Energy Information Administration
EIS....................environmental impact statement
EJ.....................Environmental Justice
EO....................Executive Order

EP....................Exploration Plan
EPA .................U.S. Environmental Protection Agency
ERA ....environmental resource area
ESA ....Endangered Species Act
EVOS ....*Exxon Valdez* Oil Spill
FAA ....Federal Aviation Administration
FEIS ....Final Environmental Impact Statement
ft ....foot/feet
FR....................Federal Register
G&G ....geological and geophysical
GDP.................Gross Domestic Product
GHG ....greenhouse gases
GIUE................Government Initiated Unannounced Exercise
GLS ....grouped land segment
GOA ....Gulf of Alaska
ha ....hectares
Hg....................mercury
Hilcorp ....Hilcorp Alaska, LLC
Hz....................hertz
IBA...................Important Bird and Biodiversity Area
IRA ....Indian Reorganization Act
ITL ....Information to Lessees and Operators
IWG ....Interagency Working Group on the Social Cost of Greenhouse Gases
JBER ....Joint Base Elmendorf-Richardson
km....................kilometers
KPB ....Kenai Peninsula Borough
LNG ....liquefied natural gas
LS ....lease sale or land segment
LS 258.............Lease Sale 258
m ....meters
Mat-Su.............Matanuska-Susitna
Mbbl.................thousand barrels
MGS ....Middle Ground Shoal
mi.....................miles
MMbbl..............million barrels
MODU ....mobile offshore drilling unit
mmBOE...........millions of barrels of oil equivalent
MMPA..............Marine Mammal Protection Act
N/A ....not applicable
N_2O..................nitrous oxide
NAAQS............National Ambient Air Quality Standards
NEMS ....National Energy Modeling System

NEPA................National Environmental Policy Act
NHPA ....National Historic Preservation Act
NMFS ....National Marine Fisheries Service
nmi...................nautical mile
NOAA ....National Oceanic and Atmospheric Administration
NOI ....Notice of Intent
NO_2/NOx ....nitrogen dioxide / oxides of nitrogen
NPDES ....National Pollutant Discharge Elimination System
NPV ....net present value
NPP ....National Park and Preserve
NTL..................Notice to Lessees and Operators
O^3 ....ozone
OCD ....Offshore and Coastal Dispersion Model
OCS..................Outer Continental Shelf
OCSLA ....Outer Continental Shelf Lands Act of 1953
OECM...............Offshore Environmental Cost Model
OSRA ....oil spill risk analysis
Pb ....lead
$PM_{2.5}$.................particulate matter equal to or less than 2.5 micrometers
PM_{10} ....particulate matter equal to or less than 10 micrometers
ppm ....parts per million
PSD ....Prevention of Significant Deterioration
PSO ....protected species observer(s)
ROD ....Record of Decision
RSLP................Regional Supervisor, Leasing and Plans
SHPO ....State Historic Preservation Office
SO ....Secretarial Order
SO_2..................sulfur dioxide
SOA..................State of Alaska
SOx ....oxides of sulfur / sulfur oxides
SSB ....State Seaward Boundary
TSS ....total suspended solids
USACE.............U.S. Army Corps of Engineers
USC..................United States Code
USCG...............U.S. Coast Guard
USDOI ..............U.S. Department of the Interior
USFWS ............U.S. Fish and Wildlife Service
VLOS................very large oil spill
VOC..................volatile organic compound(s)
WDPS...............Western Distinct Population Segment

CHAPTER 1: PURPOSE AND NEED FOR THE PROPOSED ACTION

The U.S. Department of the Interior (USDOI), Bureau of Ocean Energy Management (BOEM), is preparing to conduct an oil and gas lease sale on the Alaska Outer Continental Shelf (OCS) in the northern portion of the Cook Inlet Planning Area (lease sale area). The entire planning area encompasses approximately 2.1 million hectares (ha) (~5.3 million acres (ac)) (Figure 1-1). The lease sale area (Area ID) includes 224 OCS blocks that encompass approximately 442,537 ha (1.09 million ac).

This document is expected to be used to inform the lease sale process for Cook Inlet Oil and Gas Lease Sale 258, which BOEM is required to hold by the end of December 2022, as directed in the Inflation Reduction Act of 2022 (IRA) (Pub. L. No. 117-169, enacted Aug. 16, 2022). While BOEM has no discretion on whether to hold the sale, BOEM is preparing this FEIS to follow its normal leasing process to the fullest extent possible. This FEIS contains analyses of the potential environmental impacts that could result from a Cook Inlet lease sale. BOEM's announcement of Cook Inlet Lease Sale 258 will be made in a Final Notice of Sale and Record of Decision.

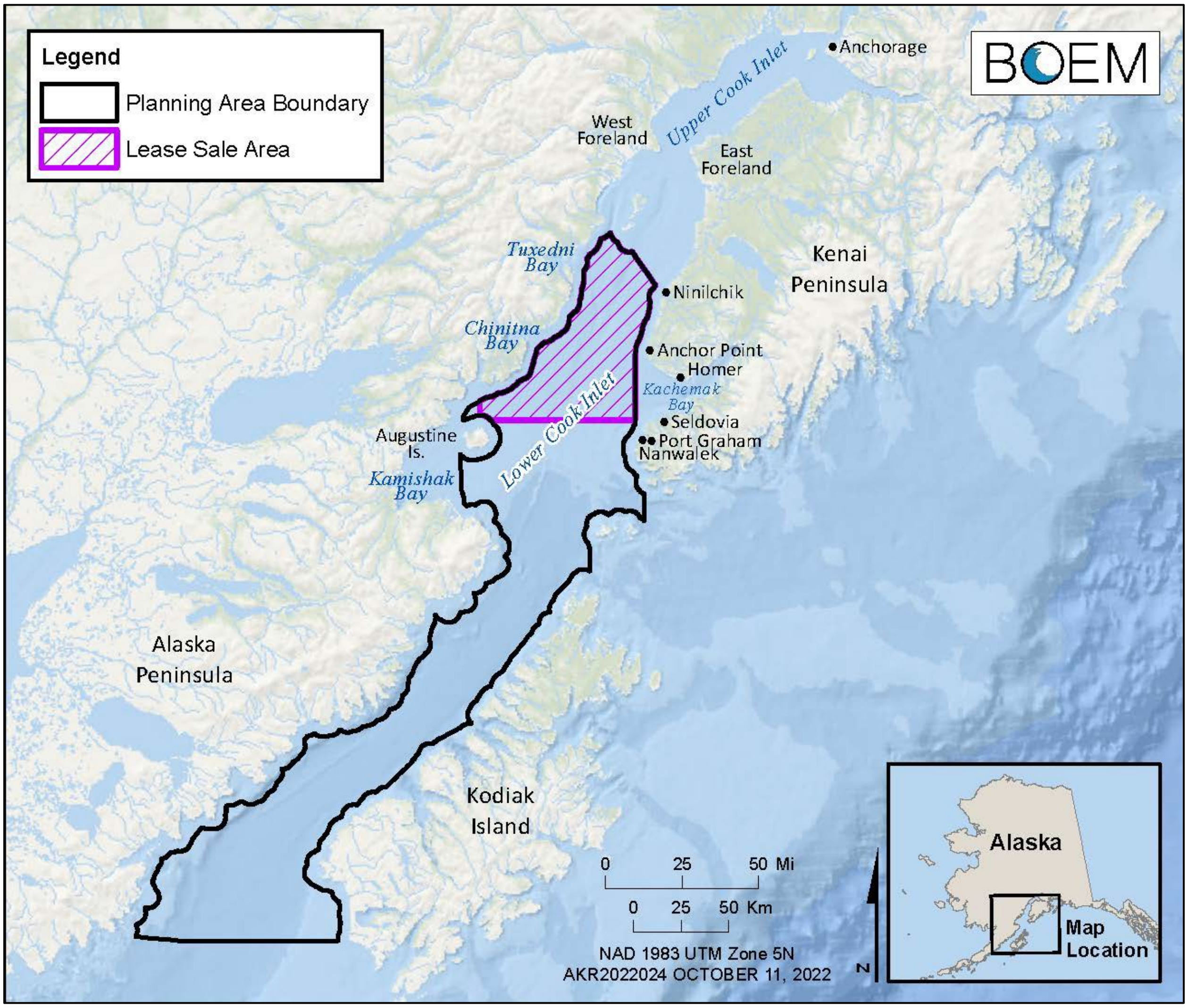


Figure 1-1: Cook Inlet Planning Area, Southcentral Alaska

The purpose of the Proposed Action addressed in this Environmental Impact Statement (EIS) is to offer for lease certain OCS blocks located within the federally owned portion of Cook Inlet that may contain economically recoverable oil and gas resources.

The need for the Proposed Action is to meet the purposes of the Outer Continental Shelf Lands Act of 1953 (OCSLA), as amended (43 United States Code (USC) 1331 *et seq.*). The OCS lease sale in Cook Inlet may lead to oil and gas exploration, development, and production. Oil and gas from the Cook Inlet Planning Area could help meet regional and national energy needs and lessen the need for imports.

Federal jurisdiction over energy and mineral development on submerged lands seaward of state boundaries was established by OCSLA. Under OCSLA, the USDOI is required to manage the leasing, exploration, development, and production of oil and gas resources on the OCS. The Secretary of the Interior (Secretary) is charged with developing the National OCS Oil and Gas Leasing Program and is required to balance development with protection of the human, marine, and coastal environments while simultaneously ensuring receipt of fair market value for the lands leased and the rights conveyed by the federal government. OCSLA grants the Secretary the authority to issue leases to the highest qualified responsible bidder(s) on the basis of sealed competitive bids and to formulate regulations as necessary to carry out the provisions of the statute.

OCSLA sets forth a four-stage process for managing oil and gas resources on the OCS including planning (National Program), leasing (Lease Sale), exploration (Exploration Plan), and production (Development and Production Plan). On January 17, 2017, the Secretary decided to proceed with the 2017–2022 National OCS Oil and Gas Leasing Proposed Final Program (Proposed Final Program). The Proposed Final Program included a Cook Inlet Lease Sale. On May 11, 2022, the Secretary of the Interior cancelled the lease sale due to a lack of industry interest in leasing in the area. On August 16, 2022, the IRA was signed which directs BOEM to hold a lease sale by December 31, 2022.

Operators who obtain lease rights on the OCS are then required to submit an Exploration Plan (EP) prior to exploration activities, and a Development and Production Plan (DPP) prior to development of production infrastructure. BOEM conducts separate, project-specific National Environmental Policy Act (NEPA) analyses prior to potentially approving any EP or DPP.

The Call for Information and Nominations for the Cook Inlet Lease Sale 258 (LS 258) was published in the Federal Register (FR) (85 FR 55859, September 10, 2020) concurrently with a Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) (85 FR 55861).[3] Publication of the NOI began a scoping period that extended through October 13, 2020. BOEM disseminated information about the Lease Sale using virtual methods (BOEM website at https://www.boem.gov/ak258/, virtual meetings, and social media). Opportunities for the public to provide input were available throughout the scoping period via a BOEM Virtual Meeting Room, four live virtual meetings (September 29, October 1, and two on October 8, 2020), and https://www.regulations.gov.

The primary issues and concerns expressed during the scoping period included: the impacts of post-lease activities to species listed under the Endangered Species Act (ESA) (beluga whales, northern sea otters, Steller's eider), ESA-designated critical habitat areas, and other protected areas; impacts to subsistence hunting, fishing, and food security; impacts to commercial and sport fishing; noise pollution associated with oil and gas related activities (including seismic impacts on fish and marine mammals); impacts to area resources and communities from an accidental oil spill; and the contribution of oil and gas activities

[3] BOEM has prepared this EIS under NEPA (1970) (P.L. 91–190, 42 U.S.C. 4321 *et seq.*), and Council on Environmental Quality (CEQ) regulations at 40 CFR Parts 1500–1508 (1978, as amended in 1986 and 2005). This EIS does not apply updated CEQ regulations published in the Federal Register Notice of Final Rule (85 FR 15179) on July 16, 2020, effective September 14, 2020.

to climate change. A scoping report summarizing the comments received on the NOI and at the public scoping meetings is available on the BOEM website at https://www.boem.gov/ak258/.

On October 29, 2021, BOEM published a Notice of Availability for the Draft EIS in the Federal Register (86 FR 60068) commencing a 45-day public review and comment period that ended December 13, 2021. In accordance with NEPA as well as 40 CFR 1503.1, BOEM held three virtual public hearings to receive comments on the DEIS. BOEM developed this Final EIS which responds to the public comments and revises the Draft EIS as appropriate. Appendix B details BOEM's responses to comments received on the DEIS.

BOEM received a total of 92,907 public comment submissions (Federal e-Rulemaking Portal http://www.regulations.gov, docket BOEM-2020-0018). In addition, 54 public comments were documented in the transcripts from the hearing. Of the total 92,961 submissions, 195 were identified as unique and 92,757 were attributed to 7 separate form letter campaigns. Nine comments were dismissed as non-germane or duplicative.

BOEM considered all comments received in the preparation of this EIS. BOEM also coordinated with federal and state agencies and other concerned parties to discuss and coordinate the pre-lease process for this lease sale and EIS. BOEM implemented tribal consultation policies through formal government-to-government consultation, informal dialogue, collaboration, and engagement. BOEM also offered government-to-Alaska Native Claims Settlement Act (ANCSA) corporation consultation opportunities. Throughout the process, BOEM was and remains committed to maintaining open and transparent communications with Tribal governments, ANCSA corporations, Alaska Native organizations, and other indigenous communities. A more complete discussion of consultations and agency coordination is found in Chapter 5.

1.1 Changes between Draft and Final Environmental Impact Statements

Several updates and text changes were made in the Final EIS in response to new information and comments received on the Draft EIS. The main areas of change to the Final EIS are described below. These types of changes were made in response to comments or through review by the interdisciplinary team. Editorial or typographic changes are not listed as these did not change the content of the FEIS.

1.1.1 Alternatives

The Beluga Whale Critical Habitat Mitigation alternative (Alternative 3B) was modified to extend the period prohibiting on-lease seismic surveys or exploration drilling from April 1 to April 30 based on new information received from the National Marine Fisheries Service (NMFS) indicating that beluga whale use of this habitat area extends into the month of April (Gill, Shelden, and Sims, 2022; Gill and Seymore, unpublished data, 2022).

After considering public comments on the Draft EIS, BOEM developed the Preferred Alternative (Alternative 6), which combines the two critical habitat exclusion alternatives with three mitigation alternatives: Alternative 3A (Beluga Whale Critical Habitat Exclusion), Alternative 3C (Beluga Whale Nearshore Feeding Areas Mitigation), Alternative 4A (Northern Sea Otter Critical Habitat Exclusion), Alternative 4B (Northern Sea Otter Critical Habitat Mitigation), and Alternative 5 (Gillnet Fishery Mitigation).

1.1.2 Greenhouse Gas Analysis

The FEIS includes an expanded greenhouse gas (GHG) analysis and, in accordance with recent Executive Orders, BOEM also provides an analysis of monetized impacts from these estimated GHG emissions (even though the National Environmental Policy Act (NEPA) does not require such an analysis in the absence of a cost-benefit analysis).

1.1.3 Appendix B

BOEM added Appendix B, Response to Public Comments, to describe how the comments received on the Draft EIS were considered in developing the Final EIS. Text changes throughout the document were made in response to comments received during the public review period, but none changed the overall impact conclusions of the analyses.

CHAPTER 2: ALTERNATIVES INCLUDING THE PROPOSED ACTION

This chapter describes the Proposed Action and the alternatives analyzed in detail. It also describes alternatives identified but eliminated from detailed study and summarizes the reasons for their elimination. In addition to the Proposed Action and the No Action Alternative required by Council on Environmental Quality (CEQ) regulations, BOEM developed three alternatives based on public and agency input received during the scoping process and on alternatives previously analyzed for Lease Sale 244 (held in 2017). The chapter concludes with a comparison of alternatives.

The USDOI's 2012–2017 OCS Oil and Gas Leasing Program introduced a targeted leasing model to the Alaska OCS lease sale process and continued the model in the 2017–2022 National Program. Targeted leasing identifies areas considered for leasing that have high resource potential and clear indications of industry interest, while appropriately weighing environmental protection and subsistence use needs. The goal of targeted leasing is to focus oil and gas leasing on the most promising OCS blocks, while protecting important habitats and critical subsistence activities. The result is an area that is more geographically limited in scope and that eliminates many areas of environmental concern. BOEM used this information to develop the Area Identification (Area ID) for this lease sale. The Area ID was published in the Federal Register on January 15, 2021 (85 FR 4116). The Area ID is the lease sale area analyzed in this EIS.

As a result of targeted leasing, the lease sale area:

- Focuses on areas closer to existing infrastructure needed to support oil and gas activities;
- focuses on areas closer to active OCS and State of Alaska (SOA) oil and gas leases;
- avoids the vast majority of the ESA-designated critical habitat for the beluga whale and northern sea otter;
- completely avoids critical habitat for the Steller sea lion;
- reduces effects to national parks, preserves, and wildlife refuges by placing the area considered for leasing away from the Katmai National Park and Preserve (NPP), Kodiak National Wildlife Refuge (NWR), and Alaska Maritime NWR; and
- excludes much of the subsistence use area for the Alaska Native villages of Nanwalek and Port Graham that were first identified during Lease Sale 191 (held in 2004) process.

Because many of the areas of environmental concern have already been removed or addressed through targeted leasing, BOEM has developed alternatives for this EIS that are targeted at a very specific set of important resources in Cook Inlet. Consequently, the alternatives analysis is structured to clearly highlight the purposes and differences between alternatives. The EIS is not a decision document but is among the pieces of information used by the decision maker in determining under what terms and conditions to hold the lease sale. The decision maker may choose any of the following alternatives, or combine individual alternatives or pieces of the alternatives, in making its decision.

Alternatives subject to detailed analysis are described below. Although the alternatives are analyzed separately in the EIS, the decision could incorporate elements of multiple alternatives.

2.1 Proposed Action

The Proposed Action would offer for lease all available OCS blocks in the northern portion of the Cook Inlet Planning Area (Figure 2-1). The lease sale area covers approximately 442,537 ha (1.09 million ac), representing approximately 20 percent of the total Cook Inlet Planning Area, 224 OCS blocks (85 FR 55861, September 10, 2020).

Figure 2-1: Cook Inlet Lease Sale 258 Area

2.2 Alternative 2 – No Action

Alternative 2 is the "No Action" alternative and is equivalent to cancellation of the Proposed Action (Figure 2-2). Under this alternative, LS 258 would not occur. The opportunity for development of potential oil and gas resources under the Proposed Action, along with its environmental impacts and benefits, would be precluded at this time or postponed to a future lease sale decision under a new National Program.

2.3 Alternatives 3A, 3B, and 3C – Beluga Whale Critical Habitat Exclusion, Critical Habitat Mitigation, and Nearshore Feeding Areas Mitigation

Alternatives 3A, 3B, and 3C were developed to address potential impacts to the Cook Inlet Distinct Population Segment (DPS) of the beluga whale. Public input during scoping for both LS 258 and the previously held Lease Sale 244 indicated concern for the beluga whale. The following alternatives were identified for detailed evaluation:

Alternative 3A – Beluga Whale Critical Habitat Exclusion. Under this alternative, the 10 OCS blocks that overlap with beluga whale critical habitat at the northern tip of the lease sale area would be excluded from the lease sale (Figure 2-2). Beluga whale critical habitat within the excluded OCS blocks represents approximately 0.85 percent of the total area of the beluga whale critical habitat.

Alternative 3B – Beluga Whale Critical Habitat Mitigation. Under this alternative, all available blocks in the lease sale area would be offered for lease. The 10 OCS blocks that overlap beluga whale critical habitat at the northern tip of the lease sale area would be included in the lease sale; however, no on-lease seismic surveys or exploration drilling would be conducted between November 1 and April 30, when beluga whales are most likely to be present. This timing window reflects a minor change from the DEIS, which evaluated a timing window for Alternative 3B that restricted these activities from November 1 through April 1.[4]

Alternative 3C – Beluga Whale Nearshore Feeding Areas Mitigation. Under this alternative, all available blocks would be offered for lease with seasonal mitigation to protect beluga whales. Certain seasonal mitigations would be applied to all OCS blocks between November 1 and April 1. Additional seasonal mitigation would be applied to the 146 OCS blocks located wholly or partially within 10 miles (mi) of major anadromous streams. The following mitigations would be applied:

- On all blocks offered for lease, no on-lease seismic surveys would be conducted between November 1 and April 1, when beluga whales are most likely to be present and distributed across the lease sale area; and,
- On blocks within 10 mi of major anadromous streams, no on-lease seismic surveys would be conducted between July 1 and September 30 (when beluga whales are migrating to and from their summer feeding areas) (Figure 2-2).

[4] This change was based on new information received from the National Marine Fisheries Service (NMFS), after the close of the public comment period for the DEIS, indicating that recent aerial surveys show beluga whale use of this area extending into the month of April (Gill, Shelden, and Sims, 2022; Gill and Seymore, unpub. data, 2022). After carefully considering this information, BOEM determined that it did not warrant supplementing the EIS because the impacts of on-lease seismic surveys, exploration drilling, and other activities on beluga whales were considered in the analysis of the Proposed Action in the DEIS.

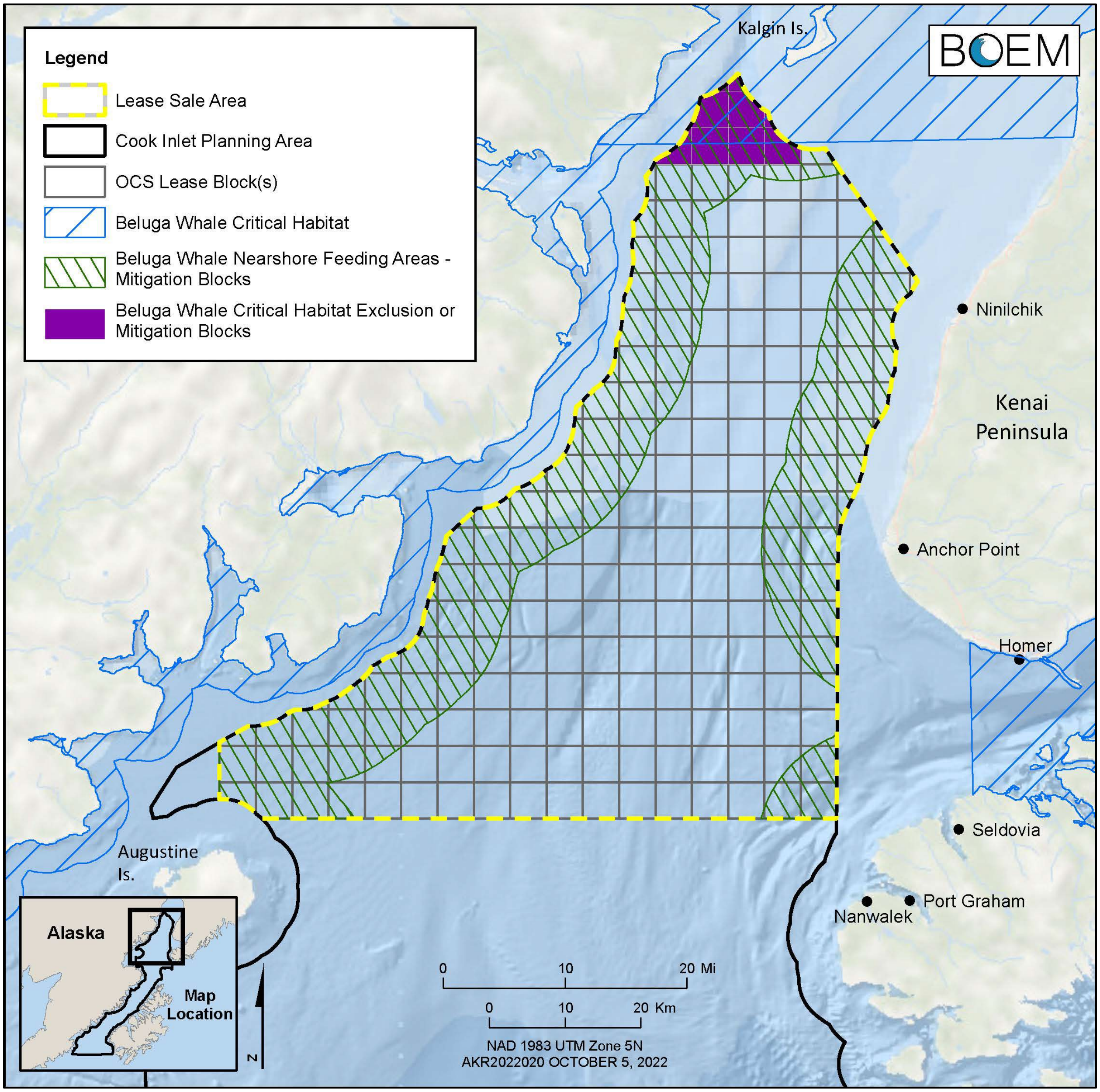


Figure 2-2: Beluga Whale Alternatives 3A, 3B, and 3C

2.4 Alternatives 4A and 4B – Northern Sea Otter SW Alaska DPS Critical Habitat Exclusion or Mitigation

Alternatives 4A and 4B were developed to address potential impacts to the southwest Alaska DPS (also referred to as SW DPS) of the northern sea otter. Scoping for LS 258 and Lease Sale 244 indicated a concern for the northern sea otter. The following alternatives were identified for detailed evaluations:

Alternative 4A – Northern Sea Otter Critical Habitat Exclusion. Under this alternative, the 7 OCS blocks that overlap with northern sea otter southwest Alaska DPS critical habitat would be excluded from the lease sale (Figure 2-3).

Alternative 4B – Northern Sea Otter Critical Habitat Mitigation. Under this alternative, all available OCS blocks would be offered for lease with additional mitigation on the 14 OCS blocks that contain or are located within 1,000 meters (m) of northern sea otter critical habitat. On these 14 OCS blocks, the discharge of drilling fluids and cuttings and seafloor-disturbing activities (including anchoring and placement of bottom-founded structures) would be prohibited.

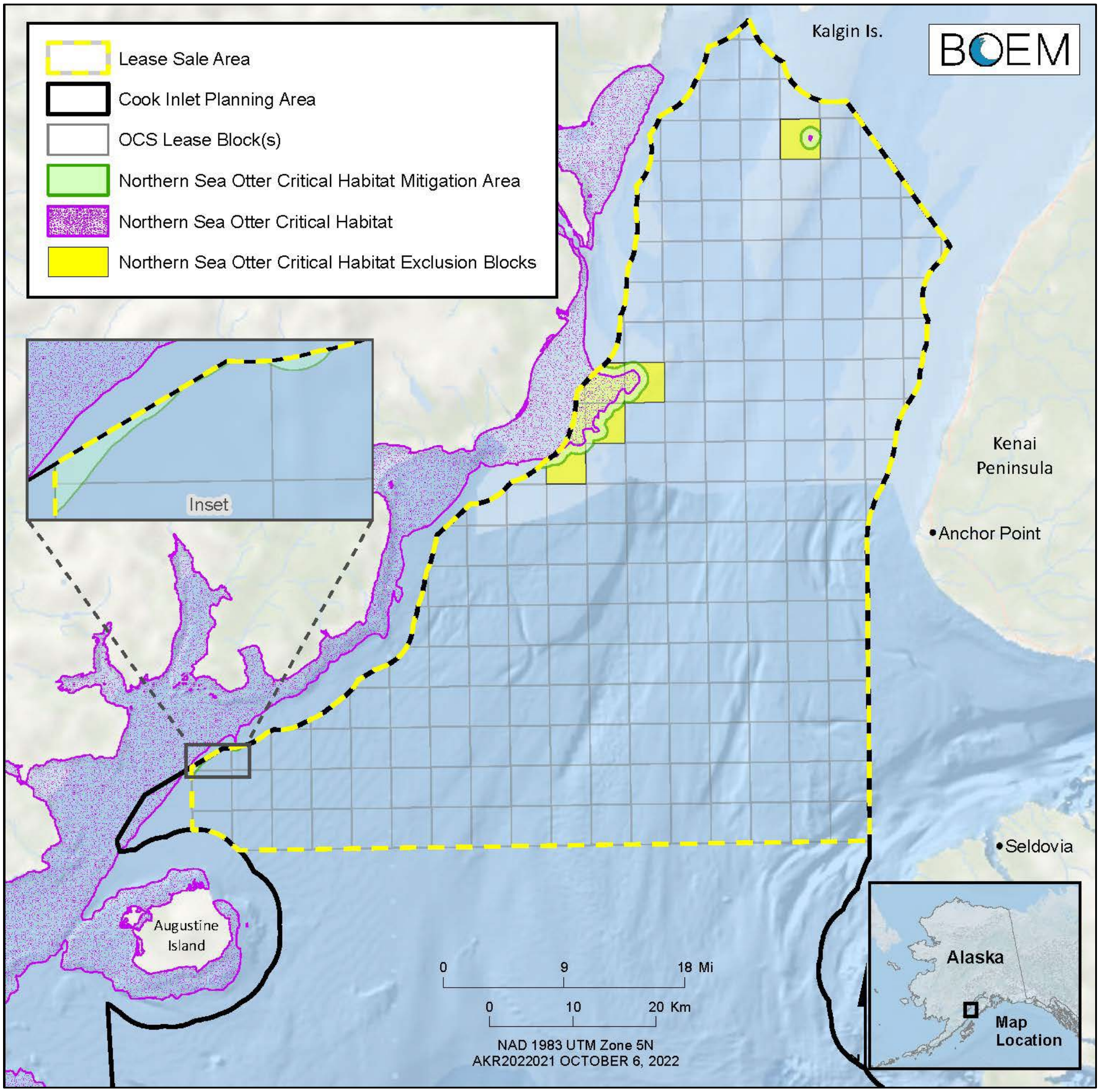


Figure 2-3: Northern Sea Otter Alternatives 4A and 4B

2.5 Alternative 5 – Gillnet Fishery Mitigation

Under Alternative 5, all available OCS blocks in the lease sale area would be offered for lease, but additional mitigation measures would be required in all OCS blocks north of Anchor Point to reduce the potential for conflicts with the Cook Inlet drift gillnet fishery. This alternative would affect 117 whole or partial OCS blocks with an area of 203,779 ha (503,550 ac) or 46.0 percent of the lease sale area (Figure 2-4). The following mitigation measures would be applied to the 117 whole or partial OCS blocks:

- No on-lease seismic surveys would be conducted during the drift gillnetting season as designated by the Alaska Department of Fish and Game (ADF&G) (approximately mid-June to mid-August).
- United Cook Inlet Drift Association must be notified of any temporary or permanent structures planned during the drift gillnetting season.

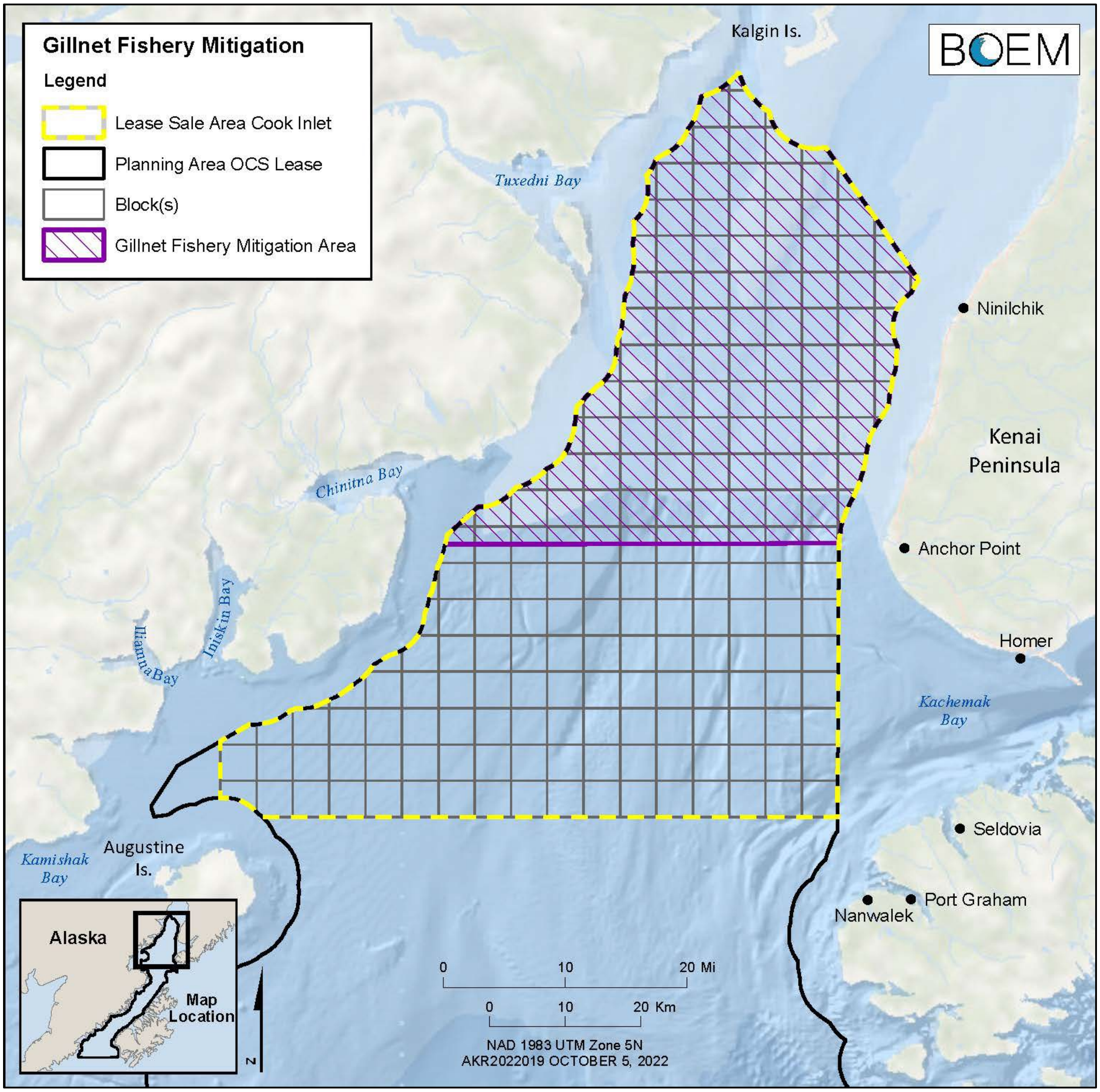


Figure 2-4: Gillnet Fishery Mitigation Alternative 5

2.6 Preferred Alternative

After considering public comments on the Draft EIS, BOEM developed the Preferred Alternative, which combines the two critical habitat exclusion alternatives with three mitigation alternatives: Alternative 3A (Beluga Whale Critical Habitat Exclusion), Alternative 3C (Beluga Whale Nearshore Feeding Areas Mitigation), Alternative 4A (Northern Sea Otter Critical Habitat Exclusion), Alternative 4B (Northern Sea Otter Critical Habitat Mitigation), and Alternative 5 (Gillnet Fishery Mitigation).

Under the Preferred Alternative, 193 OCS blocks would be offered for lease (approximately 399,518 ha or 987,230 acres). The 17 OCS blocks located in beluga whale and northern sea otter critical habitats would be excluded from the sale area. Of the 193 remaining unleased blocks (14 are currently leased), additional mitigation measures would be adopted to further reduce potential impacts to beluga whale critical habitat and feeding areas, sea otter critical habitat, and the gillnet fishery. These areas are identified in Figure 2-5.

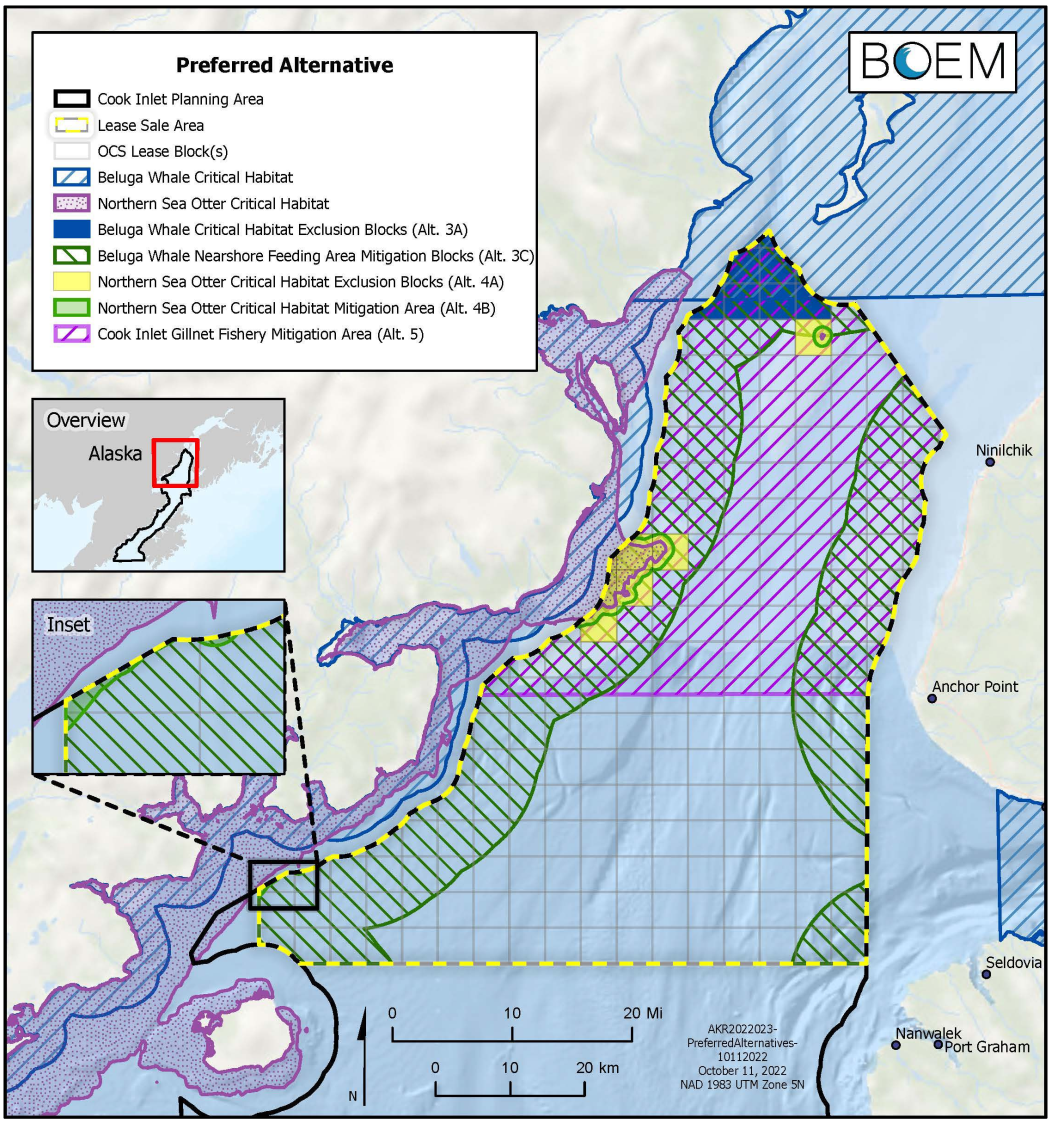


Figure 2-5: Lease Sale 258 Preferred Alternative

2.7 Alternatives Considered but Dismissed from Detailed Analysis

The following alternatives were considered by BOEM but were eliminated from detailed analysis in the EIS.

2.7.1 Prohibition of Drilling Discharges

BOEM considered developing an alternative that would prohibit the marine discharge of all exploration drilling fluids and cuttings produced from post-lease activities resulting from LS 258. This alternative was analyzed in detail in the LS 244 EIS, where it was determined that the minimal decrease in environmental effects associated with the alternative was offset by an increase in impacts associated with barging muds and cuttings to shore. Consequently, this alternative was not selected in the LS 244 Record of Decision (ROD). Furthermore, the U.S. Environmental Protection Agency (EPA) regulates discharges of muds and cuttings through the National Pollutant Discharge Elimination System (NPDES) program and allows such discharges only if they would not cause unreasonable degradation of the marine environment. During scoping for this EIS, BOEM did not receive any requests or comments asking that it reconsider the prohibition of exploration drilling discharge. BOEM has determined, based on its past analysis, EPA's existing authority to regulate discharge through its NPDES program, and the response to scoping for this EIS, that the inclusion of this alternative for detailed analysis for the LS 258 EIS is not warranted.

2.7.2 Directional Drilling

The alternative of directional drilling from shore was suggested during scoping meetings. Under this alternative, drilling would be conducted from onshore locations to avoid or reduce impacts to OCS resources. In the past, this method was used in the Cosmopolitan Unit north of Anchor Point where directional wells were drilled from an onshore pad to access subsurface oil and gas formations located approximately 4.0 kilometers (km) (2.5 mi) offshore (ADNR, 2015). BlueCrest Energy proposed using a similar approach in developing the Cosmopolitan field in Cook Inlet in 2016. Directional drilling has also been used in the North Sea, Gulf of Mexico, and South China Sea as well as the Milne Point, Badami, Point McIntyre, Alpine, and Niakuk fields in Alaska (Judzis et al., 1997).

Although directional drilling could be considered by BOEM in specific cases as part of the NEPA evaluation of an exploration or development and production plan, it is not feasible as a lease sale alternative here where the vast majority of the lease sale area is beyond the limit of directional drilling technology and geologic conditions are not necessarily conducive to safe and effective directional drilling. The maximum horizontal distance achieved by extended-reach drilling is approximately 12 km (7.6 mi) (Rosneft, 2015). The maximum distance reported by Rosneft (2015) was achieved in an area (Sakhalin Island, Russia) where the geology is conducive to drilling extended reach wells, unlike the Cook Inlet area. Wells of this nature could be very high risk in Cook Inlet due to the highly complex nature of the geology and the presence of coal seams that could squeeze (flow) into the wellbore trapping the drill stem. Moreover, all OCS blocks are at least 4.8 km (3.0 mi) from the nearest shoreline, and only 20.42 percent of the lease sale area is within 12 km (7.6 mi) from shore. A directional drilling alternative would not meet the purpose and need for the Proposed Action because at least 80 percent of the lease sale area would not be accessible. In addition, some OCS blocks within this range might require an onshore drill site be in an inaccessible or protected area such as Lake Clark National Park and Preserve (NPP).

2.7.3 Migrating Salmon Seismic Timing

An alternative that would prohibit any seismic surveys when migrating salmon are present was suggested during scoping. The USDOI's 2012–2017 OCS Oil and Gas Leasing Program introduced a targeted leasing model to the Alaska OCS lease sale process. Targeted leasing identifies areas considered for leasing that have high resource potential and clear indications of industry interest, while appropriately weighing environmental protection and subsistence use needs. The overall goal is to focus oil and gas leasing on the most promising blocks, while protecting important habitats and critical subsistence activities. Salmon are present in Cook Inlet year-round, and migrations can occur from May–November, with peak abundances from June–August. These migrating aggregations occur nearshore and in freshwater streams, outside of the lease sale area. Although salmon migrate throughout Cook Inlet, large aggregations occur closer to streams. As a prey species for belugas, the protections for beluga feeding migrations (the Nearshore alternative) would also extend to migrating salmon when they are present in high abundances. BOEM therefore determined that the suggested alternative was duplicative of existing alternatives and the alternative was not analyzed in detail. Additionally, the Gillnet Fishery alternative would prohibit seismic activity in the northernmost 117 OCS blocks during the drift gillnet season, as designated by the Alaska Department of Fish and Game (ADF&G), which substantially overlaps with salmon migration season.

2.7.4 North Pacific Right Whale and North Pacific Right Whale Critical Habitat

An alternative that would prohibit any exploration or drilling activities from June to September when the waters outside Cook Inlet in the Gulf of Alaska are designated as biologically important areas for North Pacific right whales was suggested during scoping. As a result of targeted leasing, North Pacific right whales and designated North Pacific right whale critical habitat are outside the lease sale area and not likely to be impacted by post-lease activities as a result of the lease sale. BOEM therefore determined that additional exploration activity restrictions based on considerations for North Pacific right whales were not warranted and the alternative was not analyzed in detail.

2.7.5 Northern Area Exclusion

BOEM also considered alternatives that were previously considered within the NEPA process associated with Lease Sale 244. This alternative would exclude all whole or partial OCS blocks north of Anchor Point as recommended by the Marine Mammal Commission and other scoping commenters. This alternative would remove 117 OCS whole or partial blocks and reduce the lease sale area by 203,779 ha (503,550 ac), or 46.0 percent. The objective would be to reduce the potential for interactions with the drift gillnet fishery that operates seasonally in this area (Petterson and Glazier, 2004), and reduce the possibility of interactions and impacts with beluga whales, which are more likely to be found in the northern part of the lease sale area (NMFS, 2008a; Ferguson et al., 2015).

BOEM determined that this alternative would not meet the purpose and need of LS 258 because of the large percentage of the lease sale area that would be excluded. In addition, the goals of this alternative are partially addressed by the Proposed Action as well as the various measures proposed under Alternatives 3A (Beluga Whale Critical Habitat Exclusion), 3B (Beluga Whale Critical Habitat Mitigation), and 3C (Beluga Whale Nearshore Feeding Areas Mitigation), which are specifically tailored to addressing potential impacts to beluga whales. The goal of reducing impacts on the gillnet fishery is addressed by Alternative 5 (Gillnet Fishery Mitigation).

2.7.6 Lower Kenai Peninsula Exclusion

Alternatives previously associated with Lease Sale 191 were also considered. The Lease Sale 191 EIS included two exclusions – Lower Kenai Peninsula and Barren Islands – intended in part to reduce conflicts between subsistence users and OCS oil and gas operations (MMS, 2003). The Barren Islands exclusion area has been avoided through the Area ID process and targeted leasing approach; it is entirely outside the boundaries of the lease sale area and is not considered further.

The Lower Kenai Peninsula exclusion area in the Lease Sale 191 EIS consisted of 34 whole or partial OCS blocks offshore of Port Graham, Nanwalek, Seldovia, and the tip of the lower Kenai Peninsula. Through the Area ID process and targeted leasing approach, most of these OCS blocks were already excluded from the Proposed Action. Only 9 of the OCS blocks included in the Lease Sale 191 Lower Kenai Peninsula exclusion are within the lease sale area.

Subsistence uses and harvest patterns are discussed in detail in Section 4.11. Subsistence uses in OCS waters offshore of the lower Kenai Peninsula are inherently seasonal and BOEM expects that potential conflicts can be avoided through other mitigation included in the Proposed Action. Therefore, a lower Kenai Peninsula exclusion was not evaluated in detail for this EIS. Two relevant proposed lease stipulations that would help to reduce conflicts with subsistence uses are discussed in Section 3.3. Lease Stipulation No. 1 requires exploration and development and production operations be conducted in a manner that avoids unreasonable conflict with the fishing community, including subsistence users. Each lessee is required to review planned exploration and development with directly affected fishing organizations, subsistence communities, and port authorities to avoid unreasonable fishing gear conflicts. Local communities, including fishing interests, will have the opportunity to review and comment on proposed EPs and DPPs as part of the BOEM regulatory review process. The comments will be considered during BOEM's decision to approve, disapprove, or require modification of the plan. Lease Stipulation No. 3 requires lessees to include an orientation program in their EPs and DPPs to inform individuals working on the project of specific environmental, social, and cultural concerns that relate to the area that could be affected by the operation or its employees. The program would increase the sensitivity and understanding of personnel to community values, customs, and way of life in project areas and would include information concerning avoidance of conflicts with subsistence uses. These stipulations are expected to be effective in avoiding and/or reducing impacts on subsistence uses, and therefore a Lower Kenai Peninsula exclusion alternative was not evaluated in detail.

2.8 Comparison of Alternatives

The results of the impact analysis for the Proposed Action are summarized in Table 2-1. Impacts on each resource category were rated as negligible, minor, moderate, or major using impact scale definitions based on the context and intensity of impact (Section 4.2). Table 2-1 shows ratings for post-lease activities, as described in the Exploration and Development Scenario (E&D Scenario) (Section 4.1), including probable small spills as described in the Oil Spills and Gas Release Scenario (Section 3.1.1); as well as a separate rating reflecting the addition of a large spill, also described in the Oil Spills and Gas Release Scenario (Section 3.1.2).

Table 2-1: Summary of Potential Impacts of the Proposed Action

Resource	Impacts of the Proposed Action	Post-Lease Activities[1]	Large Spill[2]
Air quality	Impacts from emissions during surveys, exploration, and production operations.	Minor[3]	Minor to Moderate
Water quality	Increase in TSS from construction activities; discharge of exploration and delineation well rock cuttings and fluids, and other operational discharges; petroleum hydrocarbon contamination could persist in sediments or ice and be reintroduced into the water column.	Minor	Moderate
Coastal and estuarine habitats	Impacts from seafloor-disturbance activities, discharges, pipeline landfalls, and onshore construction.	Minor	Major
Fish and invertebrates	Impacts from noise, habitat alteration and disturbance due to platforms and vessels.	Minor	Moderate
Birds	Vessel operations or marine habitat alterations could displace birds or interfere with foraging, and some waterbird populations could experience impacts lasting beyond a single season. Bright artificial lighting or gas flaring from vessels and platforms could cause collisions of migrating birds.	Minor to Moderate	Minor to Major
Marine mammals	Impacts could result from noise associated with seismic airguns and pile-driving; habitat alteration; and vessel strikes.	Negligible to Minor	Minor to Moderate
Terrestrial mammals	Most impacts would be localized to the site of the project infrastructure offshore, geographically distant from terrestrial habitats.	Minor	Minor
Recreation, tourism, and sport fishing	Impacts would primarily arise from disturbance in the form of space-use conflicts. Access to some sport fishing areas may be temporarily limited and some short-term displacement of populations of sport species such as salmon and halibut may result.	Minor	Moderate
Communities and subsistence	Short-term and localized impacts would include changes in availability of subsistence resources and space-use conflicts.	Minor	Major
Economy	Economic impacts related to employment, wages, and revenues would be closely tied to the size of a resource discovery – the larger the discovery the greater the impact.	Negligible to Moderate	Minor
Commercial fishing	Impacts could include displacement of targeted fish species and localized disturbance of fishing activities. For some fisheries, such as salmon gillnetting, impacts could be moderate due to space-use conflicts.	Minor to Moderate	Major
Archaeological and historic resources	Impacts include potential damage or destruction of resources from seafloor and ground disturbance, or offshore discharges.	Negligible to Minor	Moderate
Environmental justice	No major impacts for subsistence activities and harvest patterns, air quality, water quality, or the biological resources harvested for subsistence.	No Disproportionate Effects	Disproportionate Effects

Notes: TSS = total suspended solids
[1] Post LS 258 activities described in the E&D Scenario (Section 4.1) and small spills (Section 3.1.1).
[2] Large spill described in Section 3.1.2.
[3] Impact Scale described in Section 4.2.

Table 2-2 compares the impacts of the No Action Alternative and Alternatives 3 through 5 relative to the Proposed Action. The overall impact ratings (i.e., negligible, minor, moderate, major) did not differ among action alternatives for any resource, except for commercial fishing. Specific differences in impacts were identified for each resource in Chapter 4, Sections 4.3 through 4.15 and are summarized here.

Table 2-2: Comparison of Impacts Relative to the Proposed Action

Alternative[1]	Positive Impacts	Negative Impacts
2 – No Action	• Avoids all negative environmental impacts of the Proposed Action.	• Environmental impacts may occur from the likely substitutes for the lost oil and gas production, though not necessarily in the lease sale area. • Economic benefits from the Proposed Action would be precluded or delayed.
3A* – Beluga Whale Critical Habitat Exclusion	• Avoids most impacts on beluga whales and beluga whale critical habitat in 10 OCS blocks. • May slightly reduce interactions with drift gillnet fishers at northern edge of lease sale area (exclusion would eliminate 8.5% of the blocks north of Anchor Point). • Reduction in impacts from seismic sounds would benefit anadromous fish, including salmon species and commercial salmon fisheries. Impact level for commercial fishing would be slightly reduced from minor-to-moderate to minor. • Eliminates impacts to birds while they are present in the exclusion area.	• The 10 OCS blocks that overlap with beluga whale critical habitat would be excluded from the lease sale. Potential for resource development would be lost on 10 OCS blocks along with associated economic benefits.
3B – Beluga Whale Critical Habitat Mitigation	• Reduces impacts on beluga whales and beluga whale critical habitat in 10 OCS blocks. • Eliminates impacts from on-lease seismic surveys and exploration drilling between November 1 and April 30 when beluga whales are most likely to be present. • Reduction in impacts from seismic sounds would benefit anadromous fish, including salmon species and commercial salmon fisheries. Impact level for commercial fishing would be slightly reduced from minor-to-moderate to minor. • A few impacts would be eliminated for wintering birds.	• The 10 OCS blocks that overlap with beluga whale critical habitat would restrict on-lease seismic surveys or exploration drilling between November 1 and April 30, potentially having negative economic impacts to lessees.

Alternative[1]	Positive Impacts	Negative Impacts
3C* – Beluga Whale Nearshore Feeding Areas Mitigation	• Reduces impacts from on-lease marine seismic surveys on all blocks between Nov. 1 and April 1 when beluga whales are most likely to be present and distributed across lower Cook Inlet. • Reduces impacts on beluga whale nearshore feeding areas in 146 OCS blocks located wholly or partially within 10 miles of major anadromous streams. • Eliminates or reduces impacts of noise between July 1 to September 30 when beluga whales are migrating to and from their summer feeding areas. • Reduction in impacts from seismic sounds would benefit anadromous fish, including salmon species and commercial salmon fisheries. Impact level for commercial fishing would be slightly reduced from minor-to-moderate to minor. • Provides some additional protections from underwater noise, vessel disturbance, and collision risk for some wintering marine birds.	• No on-lease seismic surveys would be permitted between November 1 and April 1 on all 224 OCS blocks. Additionally, for the 146 OCS blocks OCS blocks located wholly or partially within 10 miles of major anadromous streams, lessees would be prohibited from conducting on-lease seismic surveys between July 1 and September 30. • These restrictions could result in a negative economic impact to lessees.
4A – Northern Sea Otter Critical Habitat Exclusion	• Avoids most impacts on sea otters and sea otter critical habitat in 7 OCS blocks. • Would eliminate impacts for marine birds while they are foraging in the 7 OCS blocks.	• The 7 OCS blocks that overlap with northern sea otter critical habitat would be excluded from the lease sale. Potential for resource development and associated economic benefits would be lost on these 7 OCS blocks.
4B* – Northern Sea Otter Critical Habitat Mitigation	• Reduces impacts on sea otters and sea otter critical habitat in 14 OCS blocks that contain or are located within 1,000 m of sea otter critical habitat. • Would benefit benthic habitat and reduce impacts to benthic-foraging birds.	• On the 14 OCS blocks that contain or are located within 1,000 meters of northern sea otter critical habitat, discharge of drilling fluids and cuttings and seafloor-disturbing activities (including anchoring and placement of bottom-founded structures) would be prohibited. • These restrictions could result in a negative economic impact to lessees.
5* – Gillnet Fishery Mitigation	• Reduces risk of interactions with drift gillnet fishers by prohibiting on-lease seismic surveys on 117 whole or partial OCS blocks during the drift gillnet season and by requiring notification of and coordination with gillnet fishers. • Reduces impacts on beluga whales during important summer feeding and rearing times. • Decrease in impacts to commercial drift gillnet fishery because no space-use conflicts or impacts to the targeted fishery would occur from seismic surveys. Overall Impact level for commercial fishing would be slightly reduced to minor.	• No on-lease seismic surveys would be permitted during the drift gillnetting season as designated by ADF&G (approximately mid-June to mid-August) on the 117 whole or partial OCS blocks north of Anchor Point. This alternative would affect an area of 203,779 ha (503,550 ac) or 46.0% of the lease sale area. • This alternative could result in a negative economic impact on lessees.

Notes: [1] The Preferred Alternative (Section 2.6) is comprised of 5 Alternatives identified with an * in this column.

CHAPTER 3: ASSUMPTIONS FOR ANALYSIS

This chapter describes the assumptions upon which BOEM analysts based their effects analyses. To give the decision maker and reader an idea of the types of activities that could follow leasing, and to provide BOEM analysts with a reasonable and consistent basis for their effects analyses, BOEM develops hypothetical scenarios. This chapter begins by describing the Oil Spills and Gas Release Scenario and then provides the past, present, and reasonably foreseeable future activities that informed BOEM's cumulative effects analyses. The assumptions described below, with the addition of the E&D Scenario described in Chapter 4, provide the basis for analysis for each action alternative. This chapter also summarizes the regulatory and administrative framework in which post-lease activities would occur; describes the lease stipulations considered for inclusion on all issued leases; and identifies assumed and proposed mitigation measures considered in the analyses.

3.1 Oil Spills and Gas Release Scenario

During scoping, the public expressed concern about the potential for spills or release of hydrocarbons into the environment as a result of LS 258. Oil spills and gas releases are illegal, accidental events. Except for rare events like the Deepwater Horizon oil spill, both the number of spills and the volume of oil entering the environment from accidental spills have decreased in recent decades, even as petroleum consumption has risen or remained flat (ABS Consulting, 2016; USCG, 2012; EIA, 2020a).

The effects of oil spills and a gas release that could result from the high activity estimate provided in the E&D Scenario (production of 192.3 MMbbl of oil and 301.9 Bcf of gas) are analyzed in Appendix A, Section A-3. The spill and gas release assumptions were developed using technical information and historic data as well as the assumptions in the hypothetical E&D Scenario, modeling results, statistical analysis, and professional judgment (detailed in Appendix A, Section A-2). The analyses are based on a set of assumptions about the number, volume, and types of spills estimated to occur.

3.1.1 Small Oil Spills: <1,000 bbl

Over the past 50 years, small spills on the OCS have occurred with generally routine frequency and are considered probable given the activities associated with the Proposed Action and described in the E&D Scenario. Most small spills would be contained. Refined spills reaching the environment would evaporate and disperse within hours to a few days, but small crude spills take longer to do so.

Assumptions for analysis of small oil spill effects are described in Table 3-1. Approximately 410 small spills are estimated to occur over the 40-year E&D Scenario.

Table 3-1: Small Spill Scenario Assumptions

Variable	Assumption for Purposes of Analysis
Number	Approximately 410 total – Rounded to nearest 10.
Activities	Small, refined oil spills occur during G&G activities, exploration and delineation drilling activities, development and production, and decommissioning activities. Small crude and condensate oil spills occur during development and production activities.
Timing	Small, refined oil spills during G&G or exploration and delineation activities could occur any time of the year. Small, refined and crude oil spills during development and production could occur any time of the year.
Size	G&G Activities: most would be <1 bbl; one would be up to13 bbl. Exploration and Delineation drilling: most would be 0 up to 5 bbl; one would be up to 50 bbl. Development and Production: most would be <1 bbl, 14 would be 3 bbl, and 2 would be 125 bbl each and assumed to occur from either offshore or onshore facilities.
Media Affected	Vessel or facility and then the water or ice; open water; broken ice; on top of or under solid ice; shoreline; or snow.
Weathering	50 bbl diesel spill evaporates and disperses within 3 days. Diesel spills of <1 bbl evaporate and disperse within 6–24 hours. 125 bbl crude spill evaporates and disperses over 30 days.

Notes: bbl = barrel G&G = geological and geophysical

3.1.1.1 Exploration

Spills during exploration are estimated to be small (<1,000 bbl) and would consist of refined oils because crude or condensate oils would not be commercially produced during exploration. Refined oils are used in exploration activities for the equipment (vessels), lubrication, and refueling. Table 3-2 depicts the estimated total number and volume of small spills over the life of the E&D Scenario, as well as annual estimates. During exploration, it is estimated that up to 6 refined oil spills could occur and range in size from <1 bbl to 50 bbl per spill.

Table 3-2: Total and Annual Potential Small Spills throughout Life of the E&D Scenario

Activity	Type of Small Oil Spills	Total Number of Small Spills	Total Volume of Small Spills (bbl)	Annual Number of Small Spills	Annual Volume of Small Spills (bbl)
Exploration Geological and Geophysical Activities	Refined	0–3	0–15	0–1	0–<1 or ≤13
Exploration and Delineation Drilling	Refined	0–3	0–60	0–1	0–<5 or ≤50
Development and Production, Decommissioning	Refined, Crude, or Condensate	0–405	0–310	0–13	0–10

3.1.1.2 Development and Production

An estimated 405 crude, condensate, or refined small oil spills could occur during development, production, and decommissioning (Table 3-2 and Table 3-3). Of those, about 389 are <1 bbl, 14 range from ≥1 bbl up to 50 bbl, and 2 range from >50 bbl up to <500 bbl.

Table 3-3: Generalized Size, Oil Type, and Timing of Potential Spill or Release over E&D Scenario Lifespan

Spill Size	Oil Type	Exploration (Years 1-5)		Development and Production (Years 6-13)				Production (Years 14-34)	Production and Decommission (Years 35-40)		
		YEARS 1 THROUGH 40									
		1-2	3-5	6	7-8	9-10	11	12-34	35-38	39	40
Small	Refined	G&G Surveys									
			Drilling								
				Development, Production and Decommissioning							
	Crude Condensate				Oil Production						
Large	Crude Condensate				Oil Production						
Large	Diesel				Oil and Gas Development and Production						

3.1.2 Large Oil Spill: ≥1,000 bbl

One large spill of crude, condensate, or refined oil is assumed to occur during development and production activities. This assumption is based on considerable historical data that indicate large OCS spills ≥1,000 bbl could occur during these activities (ABS Consulting, 2016). This assumption is also based on statistical estimates of the mean number of large spills (0.21) from platforms and pipelines, the number and size of large spills on the OCS, and project-specific information in the E&D Scenario.

The assumptions BOEM uses to analyze the potential effects of one large crude, condensate, or refined oil spill are summarized in Table 3-3 and Table 3-4.

Table 3-4: Large Spill Scenario Assumptions

Variable	Assumption for Purposes of Analysis
Number	One large spill occurring during the 32 years of oil and gas production (Section 3.1.2).
Percent Chance of One or More Large Spills Occurring	Percent Chance of One or More Large Spills Occurring: 19% chance of one or more large spills occurring; 81% chance of no large spills occurring (Ji and Smith, 2021).
Activities	A large spill occurs during development or production. No large spill occurs during geological and geophysical activities, exploration and delineation drilling activities, or decommissioning activities.
Timing	A large spill occurs any time of the year. A large crude, condensate, or diesel spill could occur during the 32 years of crude oil, natural gas liquid condensate, or gas production.
Source, Size, and Oil Type	Pipeline or platform 3,800 bbl crude, condensate, or diesel oil.
Medium Affected	Production facility and then the water or ice; open water; broken ice; on top of or under solid ice; shoreline; or snow.
Weathering After 30 days	Condensate and diesel oil will evaporate and disperse much more rapidly than crude oil, generally within 1–10 days. After 30 days in open water or broken ice, BOEM assumes the following weathering for crude oil: 17%–20% evaporates, 19%–80% disperses, and 3%–61% remains.
Chance of Large Spill Contacting and Timing	Time to contact and chance of contact from a large oil spill are estimated from an oil spill trajectory model (Ji and Smith, 2021; Appendix A, Tables A.2-1 through A.2-60). Assuming a large spill occurs, the chance of contact is analyzed from the location where it is highest when determining impacts.
Chance of One or More Spills Occurring and Contacting	The overall chance of one or more large oil spills occurring and contacting is calculated from an OSRA model (Ji and Smith, 2021; Appendix A, Tables A.2-61 through A.2-64).
Spill Preparedness, Prevention, and Response[1]	The OSRA does not account for preparedness, prevention, response, cleanup, or containment and therefore may overestimate the chance of a large spill contacting ERAs, LSs, or GLSs. In *Oil Spill Preparedness, Prevention, and Response on the Alaska OCS*, OCS Report 2019-006 (BOEM, 2019), Sections 5.3.4 and Section 7 are incorporated by reference and summarized in Appendix A, Section A-1. Spill drills, including GIUEs, response, and cleanup actions could require multiple technologies including surveillance and monitoring, waste management, wildlife response, source containment, and both mechanical and non-mechanical countermeasures. Drills and Spill Response are analyzed in Chapter 3.

Notes: OSRA = Oil Spill Risk Analysis; ERA = Environmental Resource Area; LS = Land Segment; GLS = Grouped Land Segment; GIUE = Government Initiated Unannounced Exercise

3.1.3 Gas Release

Because gas releases are an important concern to stakeholders, BOEM assumes a release will occur and conducts gas release analysis for development and production activities (detailed in Appendix A, Section A-2). For purposes of this environmental document, one loss of well control or one pipeline rupture (offshore or onshore) is assumed over the 32 years of gas production releasing 20–30 million cubic feet of natural gas over one day.

3.1.4 Opportunities for Intervention and Spill Response

In the event of an accidental oil spill, response operations could occur that may result in a reduction of the spread of spilled oil, thereby potentially decreasing the environmental effects of the spill. These potential mitigating factors are described here but are not factored into the oil spill trajectory analysis or the oil spill and gas release impact assessment. Information regarding spill drills and spill response found in BOEM's 2019 report *Oil Spill Preparedness, Prevention, and Response on the Alaska OCS,* Section 5.3.4 *BSEE Oil Spill Response Plan Drills,* and Section 7 *Description of Potential Response Actions,* are incorporated by reference and summarized here.

Spill drills, including Bureau of Safety and Environmental Enforcement (BSEE) government-initiated unannounced exercises (GIUEs) and other spill response practices, are considered part of the Proposed Action and are analyzed in Chapter 3. These activities could include oil spill response equipment deployment, vessel and aircraft traffic, unmanned aerial surveillance, and personnel or vehicle movement. There is some potential for a small, refined spill during a spill response or exercise. An exercise is estimated to last less than one day and may include a tabletop exercise to test the operator's incident management team or field deployments of listed spill response equipment to demonstrate equipment and personnel readiness (BOEM, 2019, Section 5.3.4). Offshore spill response efforts could require multiple technologies including surveillance and monitoring, waste management, wildlife response, source containment, mechanical countermeasures, and non-mechanical countermeasures such as dispersants and in-situ burning. Onshore response could include onshore and shoreline assessment; booms, sorbents, and fixed barriers; shoreline flushing and surf washing; surface washing and bioremediation; contaminated substrate, vegetation, or debris removal; and natural recovery. These activities include the use of aircraft, vessels, vehicles, heavy equipment, and various response equipment designed for that activity (BOEM, 2019, Section 7).

3.1.5 Very Large Oil Spill: ≥120,000 bbl

Very large oil spills (VLOS) and gas releases are very low probability, but high impact events. Although very unlikely (frequency of spill exceeding 120,000 bbl is >0.00001–<0.0001 per well) and not reasonably foreseeable as a result of the LS 258 Proposed Action or any alternatives, BOEM considered a hypothetical long duration loss of well control resulting in 120,000 bbl of oil and released gas by relying on the analyses completed for the LS 244 Final Environmental Impact Statement (FEIS) (BOEM 2016). This is an appropriate comparison because the lease sale areas are the same in LS 244 and LS 258; the analyses in LS 244 are relatively recent (completed in 2016); and the methodology and assumptions used for the LS 244 VLOS (described in Appendix A, Section A-7, *Very Large Oil Spills*; and Appendix B, *Very Large Oil Spill (VLOS) Estimate for an Exploration Well in the (Federal) Cook Inlet Planning Area, Alaska)* are still applicable and valid. Specifically, information in Section 4.12 of the LS 244 FEIS concluded that the potential effects of a VLOS on environmental, social, and economic resources ranged from minor to moderate for a few resources to major for most resources. Similarly, should a VLOS occur as a result of LS 258, all resources analyzed could be affected and impacts could range from minor to moderate for a few resources to major for most resources.

3.2 Past, Present, and Reasonably Foreseeable Future Actions

Cumulative effects are the incremental environmental impacts of the Proposed Action added to environmental impacts from past, present, and reasonably foreseeable future actions, regardless of the agency (federal or non-federal) or person undertaking such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

The cumulative effects assumptions are a description of past, present, and reasonably foreseeable future actions that are expected to have impacts that overlap spatially and temporally with impacts from the Proposed Action. Actions considered for analysis include:

- Past, present, and reasonably foreseeable future oil and gas activities that occurred in the past, ongoing activities for which infrastructure exists or is under construction, and future activities for which a formal proposal exists in or near the lease sale area.
- Past, present, and reasonably foreseeable future actions other than oil and gas activities in or near the lease sale area.

3.2.1 Oil and Gas Related Activities

Oil and gas have been developed and produced in Cook Inlet state waters and onshore for several decades beginning with the Swanson River, Kenai Peninsula (1958), and the Tyonek North Cook Inlet (1962) natural gas discoveries.

Offshore infrastructure was installed in the mid-1960s in Cook Inlet state waters and production has continued since that time. A liquefied natural gas (LNG) export plant was built in Nikiski in 1969 and began supplying natural gas to Japan under export license by the Department of Energy. Cook Inlet was considered a mature oil province that had reached peak oil production of more than 227,000 barrels per day (bpd) in 1970 and peak natural gas production in 1994. Following this period, Cook Inlet Basin's onshore and offshore oil production had declined to 8,900 bpd. However, with the passage of the SOA's Cook Inlet Recovery Act in 2010 and the subsequent entry of Hilcorp Alaska LLC (Hilcorp) into Alaska, Cook Inlet wells have been worked over and production levels have increased since 2011. An abbreviated listing of onshore and offshore past, present, and reasonably foreseeable Cook Inlet oil and gas discoveries and production is provided in Table 3-5.

Although large spills are highly unlikely, for purposes of analysis, BOEM has considered the effects of up to two additional large spills from sources other than those related to LS 258 post-lease activity (Appendix A, Table A4). These two spills are likely an overestimate of spills given the spill history in Cook Inlet. Over the past 55 years (1966–2020) approximately 16 large onshore and offshore oil spills were documented in the Cook Inlet area, including Joint Base Elmendorf-Richardson (JBER), Port of Anchorage, Nikiski, Drift River, and marine waters near Kenai, Nikiski, Drift River, Fire Island, and Anchorage (ADEC, 2007, 2020; BOEM, 2016; Robertson et al. 2020; Whitney, 2002). These include crude, diesel, jet and aviation fuel, and other types of petroleum spills from various onshore and offshore sources, including pipelines, tanks, platforms, tankers, and other vessels. No large marine spills have been documented since the 1989 M/V Lorna B diesel spill, and no large onshore spills since the 1997 aviation fuel spill on JBER.

Offshore infrastructure in Cook Inlet includes operational and "light-housed" (currently non-operational) platforms in state waters (Table 3-6). Although some platforms are not currently producing, they are likely to remain in place and in some instances could become operational again (Table 3-6). Other existing infrastructure includes subsea oil and gas pipelines, onshore terminal processing, and support facilities. As of 2019, there were approximately 126 km (80 mi) of subsea oil pipelines and 266 km (165 mi) of subsea gas pipelines in Cook Inlet (ADEC, 2019).

Volumes of historical Cook Inlet gas production in comparison with anticipated LS 258 production are illustrated on Figure 4-2. Currently, Cook Inlet produced gas is consumed by a variety of users in Alaska and natural gas processed liquids go to a storage facility in Kenai (CINGSA, 2016). Gas is transported via onshore distribution pipelines on both the east and west sides of Cook Inlet. Reasonably foreseeable future gas-related projects include the Alaska Stand-Alone Natural Gas Pipeline (ASAP) and the Alaska LNG Project. Each would involve the construction of a gas pipeline from the North Slope to southcentral Alaska and the transport of LNG out of state. The ASAP would terminate at Point Mackenzie in upper Cook Inlet where a new LNG plant would be constructed. Alaska LNG proposes to terminate the new gas line at an LNG plant in Nikiski for shipment out of Alaska.

Historical Cook Inlet crude oil production volumes in comparison with anticipated LS 258 production are illustrated on Figure 4-1. Currently, Cook Inlet crude oil production is piped either to the Trading Bay Production Facility located on the west side of Cook Inlet, or to the Kenai Refinery in Nikiski. Crude oil produced outside Cook Inlet, including limited international crude, is delivered by truck and double-hulled tankers through Cook Inlet and pipelines to the refineries. Wholesale delivery occurs through terminals in Kenai, Anchorage, the Nikiski dock, and the Port of Alaska. Processed fuels are transported by pipeline to the Port of Alaska in Anchorage, the Anchorage International Airport, and for use in a network of fuel stations throughout Alaska. The Drift River Oil Terminal on the west side of Cook Inlet has been closed due to proximity to Mt. Redoubt, an active volcano. Drift River and the associated Christy Lee Loading Platform are scheduled to be decommissioned (RCA, 2018).

Both state and federal oil and gas lease sales have been regularly held throughout Cook Inlet for over 50 years. Six (6) federal oil and gas lease sales have been held in the Cook Inlet Planning Area during that time. The first lease sale in the Cook Inlet Planning Area occurred in October 1977, Sale CI, which resulted in 88 leases being issued. In September 1981, Sale 60 resulted in 13 leases being issued. A reoffering sale, Sale RS-2, was held in August 1982 but no bids were received. Sale 149, held in June 1997, resulted in two leases being issued. Lease Sale 191 (2004) was held but received no bids. Two other proposed lease sales (Sale 211 in 2009, and Sale 219 in 2011) were cancelled due to a lack of industry interest. The most recent lease sale was held in June 2017, Lease Sale 244, which resulted in 14 leases being issued. No production has occurred on the Cook Inlet OCS to date.

As described above and in the tables below, exploration on the OCS and exploration and production in state waters and onshore on both state and federal lands are occurring and are expected to continue throughout the 40-year lifespan of the E&D Scenario associated with LS 258. Not all exploration activities have led or will lead to resource development. Seismic surveys and exploration are ongoing throughout Cook Inlet and would be expected to continue throughout the 40-year lifespan of the E&D Scenario associated with LS 258. In 2019 and 2021, Hilcorp conducted geological and geophysical surveys – deep penetrating marine seismic surveys and geohazard surveys, respectively. It is anticipated that data from these surveys would be used to support Hilcorp's submission of an Exploration Plan.

Although highly unlikely, BOEM discussed the potential for up to two additional large spills (Appendix A, Table A4) from sources other than those related to LS 258 post-lease activity.

Table 3-5: Cook Inlet Onshore and Offshore Oil and Gas Production

Cook Inlet Field / Unit Name	Discovery Year	Production Start	Oil and/or Gas Production	Past	Present	Reasonably Foreseeable Future Actions
Cosmopolitan Unit (Starichkof)	1967	2007	Oil & Gas	x	x	x
Kenai Unit	1961	1961	Gas	x	x	x
Cannery Loop Unit	1979	1988	Gas	x	x	x
Ninilchik Unit	1961	2001	Oil & Gas	x	x	x
Redoubt Shoal Unit	1968	2001	Oil	x	x	x
McArthur River Unit	1965	1967	Oil & Gas	x	x	x
West McArthur River Unit	1991	1994	Oil &Gas	x	x	x
Trading Bay Unit	1965	1967	Oil	x	x	x
North Trading Bay Unit	1965	1967	Oil	x		x
Middle Ground Shoal Unit	1962	1967	Oil	x	x	x
North Middle Ground Shoal Unit	1964	1982	Gas	x		x
Kitchen Lights Unit	2007	Undeveloped	Oil &Gas			x
Granite Point Unit	1965	1967	Oil &Gas	x	x	x
North Cook Inlet Unit	1962	1970	Gas	x	x	x
Beluga River Unit	1962	1968	Gas	x		x

Source: ADNR, ADOG, Activity Map, May 2020.

Table 3-6: Cook Inlet Offshore Oil and Gas Platforms

Cook Inlet Oil and Gas Field	Platform by Name	Oil and/or Gas Production	Year Installed	Cook Inlet Location	Platform Status
Redoubt Shoal Unit	Osprey	Oil	2000	mid-channel, west of Nikiski	In operation
Trading Bay Unit	King Salmon	Oil	1967	west side, adjacent to shore	In operation
	Dolly Varden	Oil & Gas	1967	west side, adjacent to shore	In operation
	Grayling	Oil & Gas	1967	west side, adjacent to shore	In operation
	Steelhead	Gas	1986	west side, adjacent to shore	In operation
	Monopod	Oil & Gas	1966	west side of channel	In operation
North Trading Bay Unit	Spurr	none	1966	west side of channel	Decommissioned
	Spark	none	1968	west side of channel	Decommissioned
Middle Ground Shoal Unit	"A"	Oil	1964	mid-channel	In operation
	Baker	Oil	1965	mid-channel	In operation
	Dillon	Oil	1966	mid-channel	In operation
	"C"	Oil	1967	mid-channel	In operation
Granite Point Unit	Bruce	Oil	1966	west side, adjacent to shore	In operation
	Anna	Oil & Gas	1966	west side, adjacent to shore	In operation
	Granite Point	Oil & Gas	1966	west side, adjacent to shore	In operation
North Cook Inlet Unit	Tyonek/Phillips A	Oil & Gas	1968	mid-channel	In operation
Kitchen Lights Unit	Julius R	Gas only (not within unit)	2016	mid-channel	In operation
Drift River	Christy Lee	none	1965	west side	Decommission pending

Notes: Units listed are offshore in state of Alaska waters.
Source: BOEM Report: "2019, Offshore Platforms Onshore Processing and Support Facilities, Cook Inlet Region, Alaska, Revised Feb. 19, 2020."

3.2.2 Other Activities

Other activities that could contribute to cumulative environmental impacts include marine transportation, ports and terminals; mining projects; harvest activities; residential and community development; scientific research and survey activities; and military and homeland security activities.

3.2.2.1 Marine Transportation, Ports, and Terminals

Cook Inlet is a regional hub of marine transportation throughout the year and includes six deepwater ports (Anchorage, Port MacKenzie, Nikiski, Homer, City of Seldovia, and Drift River Terminal), and several light-draft ports (e.g., Port Graham, Tyonek, and Williamsport). Nikiski is the second largest port in Alaska by cargo tonnage (AAPA, 2018). The Port of Anchorage, the third largest port in Alaska, is designated a U.S. Department of Defense National Strategic Port and provides services to approximately 75 percent of the population of Alaska.

Most vessel traffic moves along north-south transit lines with deep draft vessels generally using the east side of Cook Inlet. Offshore supply vessels account for much of the commercial large vessel activity outside of the traditional north-south track lines, whereas commercial fishers and suppliers use cross-inlet traffic routes to reduce travel distances from Cook Inlet locales to the Bristol Bay region. Kachemak Bay is a frequent and preferred port of refuge for ships and tugs during bad weather and historically has the highest level of traffic activity in Cook Inlet. When 2010 Cook Inlet vessel traffic statistics were compared against statistics in 2005–2006, only slight changes in the type and number of vessels were observed. Consequently, only nominal increases in Cook Inlet vessel traffic are projected with any significant increase dependent upon substantial improvements to existing infrastructure for extraction of minerals and coal, and construction of an Alaska gas pipeline vessel (Eley, 2012). It is reasonable to forecast that marine traffic activity will remain similarly flat or show a slight increase due to relatively stable population and commercial activities (Nuka Research & Planning Group and Pearson Consulting, 2015).

3.2.2.2 Mining Projects

There are several mining claims and resources in southcentral Alaska that have been subject to mineral exploration activities. Exploration activities have been intermittent depending on the specific claim or resource. Three proposed mining projects are considered in the cumulative effects analysis: the Donlin Gold Mine Proposed Natural Gas Pipeline, the Diamond Point Rock Quarry, and the Pebble Mine Project.

Donlin Gold Mine Proposed Natural Gas Pipeline

Donlin Gold is an undeveloped gold deposit located in western Alaska's Yukon-Kuskokwim region. Donlin Gold, LLC proposes to construct a 14-inch diameter steel pipeline to transport natural gas approximately 507 km (315 mi) from an existing 50.8-cm (20-in) pipeline tie-in near Beluga, Alaska to the proposed mine site power plant. Except for two above-ground fault crossings, the pipeline would be buried within an approximately 15.2-m (50-ft) right-of-way. The pipeline would be designed to deliver up to 73 million standard cubic feet per day of natural gas at a maximum allowable operating pressure of 1,480 pounds per square inch gauge for 30 years. Electrical power for the compressor station would be supplied by a 25-kilovolt transmission line running north from the Beluga Power Plant to the gas compressor station. U.S. Army Corps of Engineers (USACE) released the Final EIS in April 2018 and, with the Bureau of Land Management (BLM), issued a Joint ROD. State and federal permitting activities are currently in progress.

Diamond Point Rock Quarry

Diamond Point, LLC has proposed to develop a granite quarry at Diamond Head near the convergence of Cottonwood and Iliamna bays on the western shore of Cook Inlet. The project involves modification of the shoreline to construct an access road, breakwater, barge landing, and solid fill dock. Coastal infrastructure includes discharging fill material into 11.42 acres below high tide line for staging equipment, stockpiling aggregate, and barge-loading facilities. Dredging would be required in Iliamna

Bay. The 30–40 million cubic yards of hard rock would be a source for infrastructure projects in Anchorage, Kodiak, and the Alaska Peninsula.

Pebble Mine Project

Pebble Limited Partnership (PLP) is proposing to develop a large-scale copper, gold, and molybdenum deposit known as the Pebble Deposit. Located in the Bristol Bay watershed west of Cook Inlet, the proposed project includes an open-pit mine with associated infrastructure; the development of a port, dock, and year-round shore-based facilities located north of Dimond Point in Iliamna Bay on the west side of Cook Inlet; and a transportation corridor that includes a 264-km (164-mi), 30.5-cm (12-in) diameter gas pipeline from the Kenai Peninsula across Cook Inlet to the mine site. In February 2019, the USACE released the draft EIS for the Pebble Mine Project. A final EIS was issued in July 2020. The ROD was issued on November 20, 2020, and found that the mine was contrary to the public interest. The USACE's decision was appealed. The Pebble Mine project is currently on hold due to pending litigation but is included as a pending future project.

3.2.2.3 Harvest Activities

Resource harvest activities, including subsistence, commercial, and sport fishing and hunting, have occurred and will continue to occur throughout lower Cook Inlet. Harvest levels (and therefore their potential to contribute to environmental cumulative effects) will continue to rise and fall and be subject to regulations, co-management, or other decision-making.

3.2.2.4 Residential and Community Development

The 2019 estimated population of the KPB was 58,367. The Alaska Department of Labor and Workforce Development projects modest increases over the next two decades (ADLWD, 2020a). A majority (86 percent) of the land in the KPB is federally or state owned and managed and is not generally available for community development. Borough, city, and private land ownership is concentrated primarily along major road corridors and the towns and cities that are located along the road system, except for Native corporation land holdings (KPB, 2019). Within the area available for development, residential land use dominates interspersed with clusters and individual areas of commercial, industrial, gravel extraction, and agricultural use (KPB, 2019). The planning objectives identified in the *Kenai Peninsula Borough Comprehensive Plan* support future community development that follows these trends (KPB, 2019).

3.2.2.5 Scientific Research and Survey Activities

Scientific surveys and research conducted by government, institutional, and private parties have the potential to disturb wildlife and interfere with subsistence and recreational activities. Animal mark and recapture studies and relocation efforts occur and have the potential to alter wildlife distributions (ADF&G, USFS, and USFWS, 2003; Olson, 2015). Activities conducted by aircraft and vessels typically have created the most potential for conflict with wildlife, but no substantial change in scientific aircraft or vessel activity is anticipated over the timescale of the lease sale.

3.2.2.6 Military / Homeland Security Activities

Joint Base Elmendorf-Richardson (JBER) is located approximately 11 km (7 mi) northeast of downtown Anchorage in the upper Cook Inlet watershed. The 32,306-ha (74,641-ac) facility houses active-duty military personnel including Air Force, Army, Marine Corps, Navy, Army National Guard, Air National Guard, and Coast Guard. Although the various activities at JBER are land- or air-based, they could affect resources in Cook Inlet due to ongoing operations and historical disposal practices (e.g., sites such as

Eagle River Flats contaminated by white phosphorus). There is no indication that the military presence at JBER will change in the foreseeable future, so BOEM has assumed JBER activities will continue at current levels.

3.2.2.7 Climate Change

Climate change is important to the cumulative effects analysis because of the potential for the changing climate to influence the established climatic pattern of Cook Inlet. Potential cumulative impacts were considered in the context of a changing climate. A changing climate could contribute to cumulative effects in many ways, including increased noise and disturbance due to increased shipping; increased severity of storms; increased glacial melting and riverine runoff; increased coastal erosion; drying of freshwater wetlands; decreases in ice cover with the potential for resultant changes in prey-species concentrations and distribution with related changes in species distributions; increased ocean acidity; range extension of species into Cook Inlet; changes in timing and magnitude of plankton blooms; changes in food web structure; changes in subsistence harvest practices; and changes in potential for community economic development and regional tourism activities. Evidence of warming in Alaska is wide-ranging and includes increases in average air and ocean temperatures, melting snow and ice, and sea level rise (IPCC, 2014; NMFS, 2013). Data collected during the past 60 years indicate the state of Alaska has warmed more than twice as fast as the rest of the U.S., with average annual air temperature increasing by 1.7°C (3°F). Warming is expected to continue or accelerate (Chapin et al., 2014; IPCC, 2014; Stewart et al., 2013).

Cook Inlet is a dynamic marine environment where warming is interacting with other complex large-scale environmental processes. Ocean acidification, a decrease in marine pH levels resulting from climate change, is occurring in the North Pacific Ocean, including the Gulf of Alaska (Byrne et al., 2010). A notable marine ecosystem shift occurred in the Gulf of Alaska in the late 1970s, and more marine ecosystem shifts are predicted (Anderson and Piatt, 1999; Litzow, 2006). Warm water anomalies have become increasingly common and larger in scale (Frölicher and Laufkötter, 2018; Amaya et al., 2020). "The Blob," one of the largest marine heatwaves ever observed on Earth, occurred in 2014 to 2016 and stretched from the Gulf of Alaska to the coast of Baja California (Gentemann et al., 2017; Joh and Di Lorenzo, 2017). Marine heatwaves have been linked to the growth of diatoms and dinoflagellates that produce algal toxins, supporting predictions that harmful algal blooms will be increasingly common (Walsh et al., 2018; Wells et al., 2015; Gobler, 2020).

3.3 Regulatory and Administrative Framework

The OCS Oil and Gas Leasing Program is established by OCSLA, and the implementing regulations promulgated by BOEM pursuant to its OCSLA authority. Oil and gas activities on the OCS must also comply with other federal, state, and local laws and regulations. Compliance with all applicable laws and regulations is assumed for all action alternatives considered in this EIS. Based on the requirements in the applicable laws and regulations, mitigation can be implemented through binding and enforceable measures known as lease stipulations.

BOEM and BSEE also issue Notices to Lessees and Operators (NTLs), documents that provide clarification, description, or interpretation of a regulation or an OCS standard; provide guidelines on implementation of a special lease stipulation or regional requirement; provide a better understanding of the scope and meaning of a regulation by explaining BOEM's and BSEE's interpretation of a requirement; or transmit administration information. NTLs can be national or regional in scope and can be found on BOEM and BSEE's websites. Existing NTLs applicable to Cook Inlet apply to activities conducted pursuant to LS 258 and are considered part of the Proposed Action and each action alternative.

Additionally, BOEM and BSEE issue Information to Lessees and Operators (ITLs), for informational purposes. Some ITLs provide information about issues and concerns related to particular environmental or sociocultural resources. Others explain how lessees might plan their activities to meet BOEM or BSEE requirements or reduce potential impacts. Still other ITLs provide information about the requirements or mitigation required by other federal and state agencies. Existing ITLs applicable to Cook Inlet apply to activities conducted pursuant to LS 258 and are considered part of the Proposed Action and each action alternative.

Post-lease activities resulting from LS 258 will take place pursuant to BOEM regulations governing Ancillary Activities, Exploration Plans, and Development and Production Plans. Post-lease activities will also be covered by certain BSEE regulations and oversight, particularly regarding platform design and installation and oil spill response. BOEM may require additional post-lease mitigation as part of the environmental review and approval of Exploration and Development and Production Plans. Further mitigation may also be required by the National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS) through the ESA Section 7 consultation process. Also, any activities that would incidentally "take" marine mammals are prohibited unless authorized by a Letter of Authorization or an Incidental Harassment Authorization under the Marine Mammal Protection Act (MMPA). These authorizations typically require extensive mitigation measures as described in Section 3.3.2. Mitigation requirements are also typically required by other regulatory agencies for buried pipelines constructed through wetlands on the Kenai Peninsula and for crossing beneath anadromous fish streams; the USACE, Alaska District, and the State of Alaska are expected to add time of year restrictions and require specific construction methods that would minimize impacts.

3.3.1 Lease Stipulations

The following proposed Lease Stipulations are considered part of the Proposed Action and would apply to all leases issued under Cook Inlet LS 258.

3.3.1.1 Stipulation No. 1 – Protection of Fisheries

Exploration, development, and production operations must be conducted in a manner that minimizes or prevents conflicts with fishing communities and gear (including, but not limited to subsistence, sport, and commercial fishing). To minimize or prevent fishing activity conflicts, prior to submitting an EP or a DPP, the lessee/operator must review the planned exploration or development activities with directly affected fishing organizations, subsistence communities, and port authorities. This includes plans for on-lease surveys, offshore drilling unit mobilization and location, service vessel routes, and other vessel traffic.

The EP or DPP must include a summary of fishing activities near the proposed operations, an assessment of effects on fishing from the proposed activity, and measures to be taken by the lessee/ operator to minimize or prevent conflicts. The assessment of effects and measures to minimize or prevent conflicts must be described under the environmental impact analysis, as required by 30 CFR 550.227 for EPs and 30 CFR 550.261 for DPPs.

3.3.1.2 Stipulation No. 2 – Protection of Biological Resources

If biological populations or habitats that may require additional protection are identified by BOEM in the leased area, the Regional Supervisor, Leasing and Plans (RSLP) may require the lessee/operator to conduct biological surveys to determine the extent and composition of such biological populations or habitats. The RSLP will provide written notification to the lessee/operator of the requirement to conduct such surveys. Based on any surveys that the RSLP required of the lessee/operator, or based on other information available to the RSLP regarding special biological resources, the RSLP may require the lessee/operator to: relocate the site of operations; establish to the satisfaction of the RSLP, on the basis of a site-specific survey, either that such operations will not have a significant adverse effect upon the resource identified or that a special biological resource does not exist; operate only during those periods of time, as established by the RSLP, that do not adversely affect the biological resources; and/or modify operations to ensure that significant biological populations or habitats deserving protection are not adversely affected.

If populations or habitats of biological significance are discovered during the conduct of any operations on the lease, the lessee/operator must immediately report such findings to the RSLP and make every reasonable effort to preserve the biological resource and protect it from damage. The RSLP will direct the lessee/operator with respect to the protection of the resource. The lessee/operator must submit all data obtained from biological surveys to the RSLP to include geospatial information in relation to the lessee's/operator's proposed action. The lessee/operator may take no action that might affect the biological populations or habitats surveyed until the RSLP provides written directions to the lessee/ operator regarding permissible actions. The RSLP will provide a written response outlining permissible actions within 30 days.

3.3.1.3 Stipulation No. 3 – Orientation Program

An EP or DPP submitted under 30 CFR 550.211 or 30 CFR 550.241, respectively, must include a proposed orientation program for all personnel involved in the proposed action (including personnel of the lessee's/operator's agents, contractors, and subcontractors).

The program must be designed in sufficient detail to inform individuals working on the project of specific types of environmental, safety, social, and cultural concerns that relate to the area that could be affected by the operation or its personnel. The program must address the importance of not disturbing archaeological and biological resources and habitats, including endangered species, fisheries, bird colonies, and marine mammals, and provide guidance on how to avoid or minimize disturbance. The program must address Safety and Environmental Management System elements including, but not limited to: Stop Work Authority; Ultimate Work Authority; Employee Participation Program (Safety); and Reporting Unsafe Working Conditions. The program must be designed to increase the sensitivity and understanding of personnel to community values, customs, harvest practices, and way-of-life in areas where such personnel will be operating. The orientation program also must include information concerning avoidance of conflicts with subsistence, sport, and commercial fishing activities.

The program must be attended at least once a year by all personnel involved in on-site exploration or development and production activities (including personnel of the lessee's/operator's agents, contractors, and subcontractors) and all supervisory and managerial personnel involved in such activities of the lessee/operator and its agents, contractors, and subcontractors. The lessee/operator must maintain, for a minimum of five years, a record of the name(s) and date(s) of attendance of all employees that have attended the orientation program.

3.3.1.4 Stipulation No. 4 – Transportation of Hydrocarbons

Pipelines may be required for transporting produced hydrocarbons to shore if BOEM determines that: (a) pipeline rights-of-way can be determined and obtained; (b) laying such pipelines is technologically feasible and environmentally preferable; and (c) pipelines can be laid without net social loss, taking into account any incremental costs of pipelines over alternative methods of transportation and any incremental benefits in the form of increased environmental protection or reduced multiple-use conflicts.

BOEM may require that any pipeline used for transporting produced hydrocarbons to shore be placed in certain designated areas. In selecting the means of transportation, consideration will be given to recommendations of knowledgeable advisory groups within federal, state, and local governments, and industry.

This stipulation reflects the agency's considerations for transporting produced hydrocarbons in a safe, environmentally sound, and practicable way. This stipulation would help reduce risks to water quality, lower trophic level organisms, fish and fish migration, endangered species, marine mammals, and other resources from spills resulting from oil and gas transportation. In doing so, the stipulation would enhance environmental justice through the agency's determination of whether or not a pipeline is the preferred method of transportation.

3.3.2 Additional Requirements of NMFS and USFWS for Marine Mammals

NMFS and the USFWS have regulatory responsibilities for marine mammals under the ESA (for those marine mammals listed as threatened or endangered), and for all marine mammals under the MMPA. BOEM's obligation to conduct ESA consultations with NMFS and USFWS generally results in project-specific requirements which would be included as conditions of BOEM's approval. However, if warranted, operators may receive authorization for incidental take under the MMPA. Such authorizations may contain project-specific conditions in addition to the typical/standard measures summarized below that apply to all MMPA authorizations. BOEM's analyses of impacts to biological resources in this EIS assume that these typical measures would be implemented.

3.3.2.1 General

- The operator shall comply with the National Oceanic and Atmospheric Administration's (NOAA's) most current Marine Mammal Oil Spill Response Guidelines.
- Protected species observers (PSOs) shall be used where appropriate to monitor for marine mammal presence and take steps to avoid and minimize injury and disturbance.

Noise

- Activities shall be timed and located in a manner that reduces potential marine mammal disturbance.
- Attenuation zones, also termed "safety radii" or "exclusion radii," shall be established and monitored around noise-producing activities to identify, prevent, and reduce harassment and injury to marine mammals from noise.
- In poor visibility conditions, operational and monitoring adjustments shall be made to increase detection of marine mammals or reduce noise exposure; for example, noisy activities may be halted or postponed.
- When marine mammals are detected outside a vessel's safety or exclusion radius and are likely to enter the attenuation zone, the vessel's activities, speed, and/or direct course will be modified to exclude the animal(s) from that zone in a manner that does not compromise human safety.
- Seismic surveys, drilling, or pile-driving shall not begin if marine mammals are in exclusion zones.

Vessel Traffic

- Vessels shall not approach within 91 m (100 yards) of cetaceans or pinnipeds, or 100 m (109 yards) of sea otters, except if necessary to protect the health and safety of the crew.

- Vessels shall not approach within 500 m of harbor seal haulouts (Jansen et al., 2010).
- Vessels shall be operated at speeds necessary to ensure no physical contact with marine mammals occurs (including prop strikes at startup), and shall reduce speed to <5 knots when near marine mammals, or as weather conditions require, to reduce the potential for collisions.
- Vessels shall not be operated in such a way as to separate marine mammals from their group.
- Vessel operators shall not make multiple changes in direction when within 274 m (300 yards) of marine mammals.
- Vessels shall avoid multiple speed changes; however, vessels should slow down when within 274 m (300 yards) of marine mammals, especially during poor visibility.

Aircraft Traffic

- Aircraft shall operate at least 457 m (1,500 feet) above sea level, except during an emergency or to maintain safety.
- When weather conditions do not allow a 457-m flight altitude, aircraft may be operated at altitudes below 457 m.
- Helicopters shall not hover or circle above marine mammals and shall use prescribed transit corridors.

3.4 Mitigation Measures Proposed

Where appropriate, BOEM also identified mitigation measures which, if implemented for LS 258, would further reduce potential impacts to various environmental resources. These additional mitigation measures are described below and in relevant sections of Chapter 4 to which they apply. BOEM may require additional mitigation as part of the environmental review and approval of proposed EPs and DPPs.

Throughout Chapter 4, BOEM analysts identify and analyze additional mitigation measures which, if implemented through lease stipulations or other mechanisms, would further reduce potential impacts from the activities associated with the E&D Scenario. These additional mitigation measures are described below, and in relevant sections in which they apply.

3.4.1 Birds

3.4.1.1 Habitat Impacts

- To minimize impacts caused by terrestrial habitat alteration: Construction activities and infrastructure, such as pipelines, shall avoid important habitat areas, including estuarine and salt marshes and coastal Important Bird and Biodiversity Areas (IBAs).
- Steps shall be taken to minimize destruction of active nests, eggs, and flightless chicks. These include conducting land clearing in winter prior to the arrival of spring migrants, avoiding land clearing between April 20 and July 15, staging mechanized equipment in winter to deter ground-nesting birds, and/or other measures that achieve the stated goal (USFWS, 2020).

3.4.1.2 Disturbance Impacts

Flushing

To minimize disturbance to colonial nesting birds, and to follow existing practice (FAA/AIM, 2019; Denny and Hobi, 2017), aircraft will maintain an altitude of at least 610 m (2,000 ft) when flying over seabird colonies.

Lighting

To minimize collision impacts to flying birds, including those caused by light attraction, a lighting plan should be developed in cooperation with BOEM, BSEE, and USFWS. The lighting plan would include details on design, installation, and day-to-day operation of lighting on production platforms and large vessels (e.g., marine seismic survey vessels which may be offshore overnight or longer) and incorporate the monitoring and adaptive management strategies listed below:

- Education on lighting attraction and bird collisions shall be provided to relevant contractor/staff.

Where safety allows, the plans shall incorporate the following:

- The number of exterior lights operating at "on" at any one time shall be minimized. Lessees will minimize the use of high-intensity work lights. Exterior lights will only be used as necessary to illuminate active, on-deck work areas during periods of darkness or inclement weather; otherwise, they will be turned off.
- Exterior lights shall be down shielded.
- Black-out curtains shall be used on exterior-facing windows.
- All avian mortalities and collisions (i.e., presence of birds, dead or stranded, that are unable to depart on their own) shall be reported in a timely manner to BOEM and USFWS for use in potential adaptive management strategies. Records shall be kept and reported according to protocols developed in cooperation with BOEM, BSEE, and the USFWS, and the data shall be annually submitted in an electronic format to BOEM and USFWS.

The Plan shall also consider the following for production platforms:

- Green or blue exterior lights shall be used instead of white lights. Green and blue artificial lights have been shown to decrease the number of mortalities among nocturnally migrating birds.
- A strobe-based light-repellant system, similar to that used at the Northstar Unit, shall be designed and implemented for use on production platforms.
- Crane booms shall be lowered when not in use, rather than kept aloft and lighted.
- The height of gas flare booms shall be designed above 20 m (66 ft) (i.e., to include consideration of the mean flight altitude of vulnerable bird species). At-risk birds such as Steller's eider are known to fly relatively low, at about 20 m (66 ft), during migration.
- Flare boom operating procedures shall minimize gas flaring on low visibility nights during the spring and fall passerine and waterbird migration seasons (approximately March 15 to May 30 and July 20 to October 15).
- An adaptive management component shall be included in the monitoring plan for avian mortalities and collisions. At a minimum, the plan shall include daily surveys and timely identification of any potential causal factors, record-keeping, and reporting to BOEM/BSEE/USFWS, i.e.:

- Daily surveys of the platform for the presence of birds, stranded or dead, and the circumstances of their death. Surveys may be performed in conjunction with other work/surveys.
- Records shall be kept according to protocols described above under Lighting, and
- Data shall be submitted to allow for timely potential alteration of lighting protocols (design or operation) that have been specifically indicated as causing increased strikes (where and as soon as feasible and safety allows).
- Surveys shall be conducted until decommissioning is commenced unless all parties (BOEM, BSEE, and USFWS) agree to a different timeline.

Vessel Traffic

- To minimize impacts to nesting seabirds, vessels travelling greater than 5 knots shall not approach within 1 nautical mile (nmi) of all seabird colonies.

Aircraft Traffic

- To minimize impacts to nesting seabirds, where safety allows: Aircraft shall avoid approaching within 1 nmi of any seabird colony April 15 through August 31.

3.4.2 Commercial Fishing

- Prior to commencing an activity, lessees shall coordinate with commercial fishing groups to develop a mutually agreeable plan that minimizes space-use conflicts.

CHAPTER 4: AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

An OCS lease sale provides qualified bidders the opportunity to bid on OCS blocks to gain conditional rights to explore, develop, and produce oil and natural gas. Issuance of a lease does not authorize any exploration, development, or production activities. However, in order to provide the public and decision makers with a picture of the post-lease activities and potential impacts that may occur as a result of the proposed lease sale (Proposed Action), BOEM creates and analyzes an E&D Scenario. The E&D Scenario describes the types of post-lease oil and gas activities that could occur as a result of the lease sale and provides an estimate of their timing, frequency, and duration.

This chapter begins by describing the E&D Scenario. The affected environment, environmental consequences, and cumulative impacts associated with the post-lease activities described in the E&D Scenario follow. The chapter is organized by resource area: physical, biological, and social. Each resource-specific section begins by describing the environment of the area likely to be affected by the post-lease activities described in the E&D Scenario. Impact analyses in this chapter are as specific and quantitative as reasonably possible given the 40-year timeframe of the described post-lease activities. Additionally, climate change is an on-going consideration in these impact analyses given its role in the changing subarctic ecosystem.

For each resource, the Proposed Action is analyzed first and in greatest detail because it includes the entire lease sale area and encompasses all the post-lease OCS oil and gas activities considered in the E&D Scenario. In addition to the activities associated with the E&D Scenario, the analysis of the Proposed Action includes a section summarizing the potential impacts of small and large oil spills with associated response, a gas release, and spill drills as described above in the Oil Spills and Gas Release Scenario (and fully considered in Section A-3, Appendix A). Each action alternative is analyzed in comparison to the Proposed Action and is structured to clearly highlight the purposes of and differences between alternatives. To avoid repetition, analysis of the No Action Alternative for all resources is presented in Section 4.16.

Each section ends with an analysis of the potential cumulative impacts of the Proposed Action. Cumulative impacts of the other action alternatives are similar to the cumulative impacts identified for the Proposed Action because all action alternatives are presumed to entail the same amount of oil and gas activity. Where the selection of an alternative would lead to notable reductions (or other changes) in the Proposed Action’s contributions to cumulative impacts, these instances are noted. To keep the cumulative analysis useful and meaningful, the analysis focuses on activities that are reasonably foreseeable and that overlap geographically and temporally with the impacts of the Proposed Action. The activities considered in the cumulative analyses in Chapter 4 are described in the Past, Present, and Reasonably Foreseeable Future Actions section (Section 3.2).

4.1 Exploration and Development Scenario

E&D scenarios are hypothetical views of future oil and gas activities based upon professional judgment of the geologic features within the area offered for lease coupled with an analysis of current exploration and production activities. E&D scenarios provide a plausible set of post-lease activities that may result from leasing. The LS 258 E&D Scenario is only one possible view of how the potential resources of the lease sale area could be developed. It provides a set of activities to frame BOEM’s environmental analyses and to inform decision-makers and the public of potential environmental effects of the Proposed Action (to hold a lease sale). The full E&D Scenario, explaining the basis for the assumptions described in this Chapter, is available on BOEM's website at https://www.boem.gov/ak258/.

The E&D Scenario is based on both modeling and professional judgment of the interpreted geologic features, coupled with an analysis of current and historic exploration and production activities. Scenario estimates for levels of post-lease oil and gas activity are based on interpretation of available geologic data and specific assumptions about the methods required to extract oil and gas from a given number of fields.

The Scenario identifies a range of low, medium, and high hydrocarbon production levels (referred to individually as the low, medium, and high "case"). This range of production and the activities associated with each case provide the basis for the analyses that follow in this chapter. The E&D Scenario considers a range of oil production between 0 and 192.3 MMbbl (million barrels) and a range of natural gas production between 229.5 and 301.9 Bcf (billion cubic feet). The high case assumes production of 192.3 MMbbl of oil and 301.9 Bcf of natural gas.

So as not to underestimate the potential impacts of the Proposed Action, BOEM is analyzing the high case. The tables in this section display the low to high range of activity. Where only one value is provided for a certain activity, it means the same level of that particular activity is expected across the low, medium, and high cases. The E&D Scenario has been used to prepare environmental analyses that overestimate, as opposed to underestimate, impacts of the Proposed Action. To that end, the E&D Scenario's high case describes a level of activity that exceeds what is expected to result from LS 258. For example, the E&D Scenario estimates up to 8 exploration and delineation wells over a 3-year time period; however, a total of only 13 such wells, the result of two lease sales, have been drilled in the Cook Inlet OCS since 1978, with the last well drilled in 1985.

The high case assumes one oil and one gas field are discovered and developed as a result of LS 258. Developing these discoveries is estimated to occur over a 40-year period, and is categorized into three phases: exploration, development and production, and decommissioning.

Figure 4-1 and Figure 4-2 show how the hypothetical oil and gas fields for this scenario compare to producing fields in the Cook Inlet region.

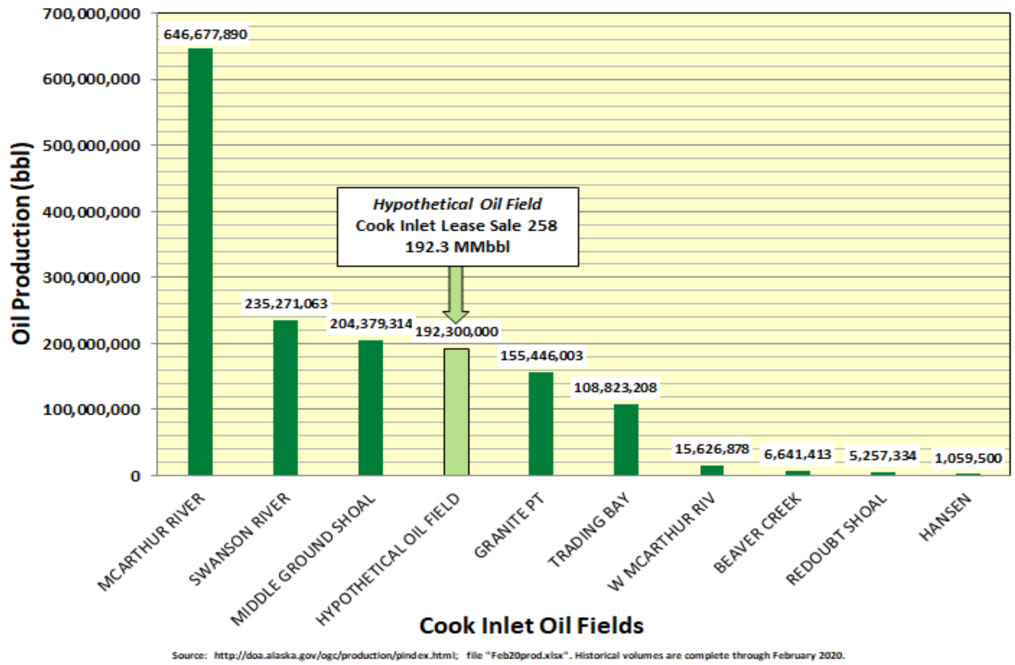
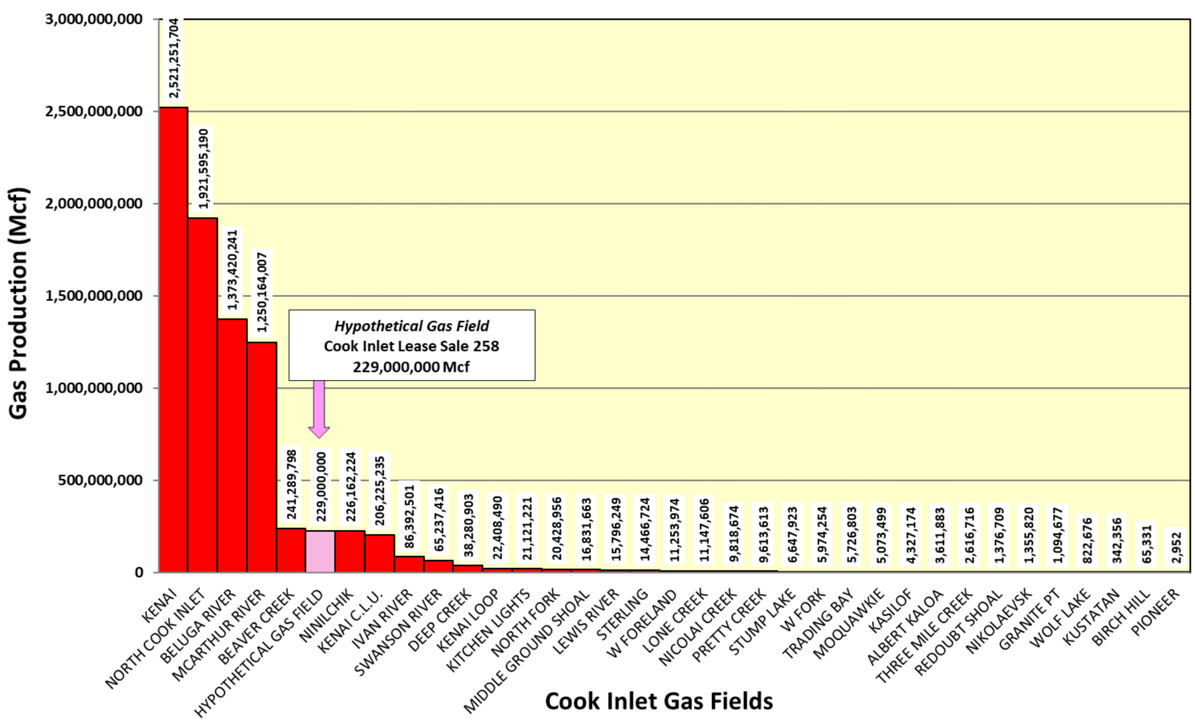


Figure 4-1: Oil Production Assumed in the Lease Sale 258 E&D Scenario's Medium and High Cases



Note: Cook Inlet LS 258 (pink bar), in context with historical production from other Cook Inlet gas fields (red bars). Historical production data is from the Alaska Oil and Gas Commission.

Figure 4-2: Gas Production Assumed in the Lease Sale 258 E&D Scenario's Low Case (Gas Only Production)

4.1.1 Exploration Activities

The purpose of exploration activity is to locate and characterize oil and gas fields. Geological and geophysical (G&G) surveys are used to understand seabed and subsurface conditions. Geological surveys consist of bottom sampling and coring. Geophysical surveys include seismic surveys (which use reflected sound waves to estimate subsurface properties) and geomagnetic surveys (which use magnetic anomalies to locate features). Seismic surveys play the most significant role in supplying data for oil and gas exploration. The E&D Scenario includes the following types of G&G surveys:

1. Seismic Surveys –
    A. Deep Penetrating Marine Seismic Surveys – Used to locate subsurface oil and gas prospects. They are used to cover large areas and map geologic structures on a regional scale. Airguns are the typical sound source for two dimensional (2D) and three dimensional (3D) seismic surveys.
    B. Geohazard Surveys – Used to evaluate potential hazards on the ocean bottom and document any potential cultural resources or benthic communities. The types of equipment used during a typical geohazard survey include echosounders, side-scan sonar, sub-bottom profilers, and boomers.
2. Airborne Geophysical Survey – Used to detect subsurface materials by measuring the earth's magnetic field.
3. Geotechnical Surveys – Used to collect ocean bottom samples to obtain physical and chemical data. The type of equipment used during a typical geotechnical survey includes core sampler, grab sampler, or dredge sampler.

Table 4-1 describes the exploration activities for this E&D Scenario, which represent the following assumptions:

- One deep penetrating marine seismic survey would be conducted to determine the location of prospects for exploration drilling.
- Geohazard and geotechnical surveys characterize individual sites to determine if the seafloor is suitable for exploration and development activity. Multiple sites may be examined in a single survey.
- A mobile offshore drilling unit (MODU) such as a jack-up or drillship would be used for exploration drilling, depending upon availability and site-specific water depths.
- If the exploration wells are successful, delineation wells would be drilled to determine the extent of the field. These wells would also be drilled by MODUs.
- Exploration and delineation drilling operations would take between 30 and 60 days per well depending on the depth of the well, delays during drilling, and time needed for well logging and testing operations.
- Up to three exploration or delineation wells per MODU could be drilled, tested, and plugged during a single drilling season.

Table 4-1: Exploration Activities Assumed in the LS 258 E&D Scenario's Low to High Cases for the Life of the Scenario (40 years)

Element	Number	Line Miles or Area	Season	Comment
Deep Penetrating Marine Seismic Surveys	1	28 Blocks (3D)	Open Water	One 3D seismic survey will be conducted.
Airborne Geophysical Survey	1	1 million acres	Year-Round	Airborne geophysical survey could be conducted over the leasing area.
Geohazard & Geotechnical Surveys	1 to 4	1,403–4,596-line miles and point sampling locations	Open Water	G&G surveys include shallow hazard site clearances (11-36) and point sampling locations. For geohazard surveys, multiple sites may be cleared in a single survey.
Total number of exploration and delineation wells drilled[1]	3-8	N/A	Open Water	Drilling would be done from MODUs such as a jack-up or drillship.
Maximum number of exploration and delineation rigs in a year	1	N/A	Open Water	Exploration and delineation wells are drilled from the same rig.
Volume of rock cuttings discharged for exploration and delineation wells (cy)[2]	1,764–4,704	N/A	Open Water	Exploration and delineation wells would average 588 cy of dry rock cutting per well.
Volume of drilling fluids from exploration and delineation wells (bbl)[3]	27,000–72,000	N/A	Open Water	On average, 9,000 bbl of drilling fluid would be used per exploration well.

Notes: cy = cubic yards bbl = barrels G&G = geohazard and geotechnical N/A = not applicable
[1] All exploration and delineation wells would be permanently sealed with cement.
[2] Cuttings would be discharged in accordance with NPDES permit requirements.
[3] Water-based drilling fluids would be discharged in accordance with the terms of the NPDES permit issued in accordance with the Clean Water Act. Oil-based drilling fluids are not anticipated to be used for exploration drilling (EPA, 2015b).

4.1.2 Development and Production Activities

Development activities include installing production platforms, installing and connecting pipelines to existing onshore pipelines, drilling production and service wells, disposing of drilling wastes, and constructing facilities. Production activities include the processing of produced oil, gas, and water; treatment and reinjection of produced water and gas for reservoir pressure maintenance; facility, well, and process equipment maintenance; and transportation of materials, process waste, and personnel to support these ongoing production activities. Table 4-2 and Table 4-3 describe development and production activities and infrastructure for the LS 258 E&D Scenario based on the following assumptions:

- A reservoir could be discovered and developed at any location leased under this sale.
- Offshore developments resulting from LS 258 would use existing facilities in the Cook Inlet region such as airfields, docks, storage, and processing facilities.
- Production platforms would have a single drilling rig capable of year-round drilling.
- Each platform could have up to 24 well slots, processing equipment, fuel and production storage capacity, and quarters for personnel.
- All processing would be done on platforms; there would be no new onshore processing facilities.
- Produced water would be separated and reinjected into the reservoir using service wells.
- Domestic wastewater from the crew quarters and mess facilities on the platforms would be disposed of in service wells.
- Up to 128.7 km (80 mi) of offshore and 128.7 km (80 mi) of onshore oil pipelines would be installed to connect the offshore oil field to the oil refinery at Nikiski.
- Up to 193.1 km (120 mi) of new offshore gas pipelines would be installed with 1.6 km (1 mi) of new onshore gas pipeline installed that would connect to the existing gas pipeline that runs from Homer to Nikiski.

Table 4-2: Development and Production Activities Assumed in the LS 258 E&D Scenario's Low to High Cases for the Life of the Scenario (40 years)

Element	Number	Footprint Area (Acres)	Season	Comment
Production wells	8–81	N/A – area within platform footprint	Year-Round	Production wells area disturbance is included in the platform seafloor disturbance.
Service wells	4–27	N/A – area within platform footprint	Year-Round	Production wells area disturbance is included in the platform seafloor disturbance.
Rock cuttings from production and service wells (cy)	7,056–63,504	0	Year-Round	Production and service wells would average 588 cy of dry rock cutting, which would be disposed in service wells or barged to shore for disposal and established treatment facilities.
Drilling fluids from service and production wells (bbl)	9,360–84,240	0	Year-Round	On average, 2,369 bbls of drilling fluid would be used to drill each production well. 80% of the drilling fluid is expected to be recycled; 20% would be injected into disposal wells or discharged[1].
Steel jacketed platforms installed	1–6	<1	Open Water	0.14-acre footprint/platform (85 ft by 70 ft)
New shore bases	0			
New onshore drilling and production waste handling facilities	0			
Total oil production (MMbbl)	192.3	N/A	Year-Round	
Total gas production (Bcf)	301.9[2]	N/A	Year-Round	
Peak oil rate (Mbbl/day)	36.7	N/A	Year-Round	
Peak gas rate (MMcf/day)	85.64	N/A	Year-Round	

Notes: cy = cubic yard; bbl = barrels; Bcf = Billion cubic feet; MMbbl = million barrels; Mbbl = thousand barrels; MMcf = million cubic feet; N/A = not applicable

[1] Water-based drilling fluids and cuttings would be discharged under the NPDES permit in accordance with the Clean Water Act. Oil-based drilling fluids are not anticipated to be used for development drilling.

[2] In the high case, the additional gas (72.4 Bcf) is gas associated with the produced oil.

Table 4-3: Pipelines Assumed in the LS 258 E&D Scenario's Low to High Cases for the Life of the Scenario (40 years)

Element	Number	Footprint Area (Acres)	Season	Comment
Onshore Oil Pipeline (mi)	0–80	0–290	Year-Round	Footprint based on an estimated 9.1-m (30-ft) wide disturbance for pipeline installation. Onshore pipeline would be buried where practical.
Onshore Gas Pipeline (mi)	1	4	Year-Round	Footprint based on an estimated 9.1-m (30-ft) wide disturbance for pipeline installation. Onshore pipeline would be buried where practical.
Offshore Oil Pipeline (mi)	0–80	0–291	Open water	Footprint based on an estimated 9.1-m (30-ft) wide disturbance for pipeline installation. Offshore pipeline would be buried where practical.
Offshore Gas Pipeline (mi)	40–120	145–437	Open water	Footprint based on an estimated 9.1-m (30-ft) wide disturbance for pipeline installation. Offshore pipeline would be buried where practical.
New Pipelines to shore	1–2	N/A	N/A	New shoreline crossings of pipelines provided in this table.

Notes: All values are for entire lifespan of the scenario. N/A = not applicable

4.1.3 Decommissioning Activities

Operators would begin well and facility shutdown when income from production no longer covers operating expenses. Decommissioning activities are regulated by BSEE under 30 CFR Part 250, Subpart Q.

- Decommissioning would be completed in stages with hub platforms remaining in service the longest, because production would continue to flow through them from satellite platforms to nearshore facilities.
- Wellhead equipment would be removed, and wells would be permanently plugged with cement. Processing modules would be moved off the platforms.
- Subsea pipelines would be decommissioned by cleaning out inner diameter, plugging both ends, and leaving them buried in the seabed.
- Platforms would be disassembled and removed from the area and the seafloor site restored to a practicable predevelopment condition.
- Any seafloor or terrestrial disturbance would be reclaimed per standards of the applicable land management agency.
- Post decommissioning geohazard surveys would be required to confirm that no debris remains, and pipelines were decommissioned properly.

4.1.4 Transportation

The E&D Scenario includes assumptions about transportation for the entire lifespan of the scenario. Personnel and materials would be transported to exploration and production sites by helicopter, and/or marine supply vessels from an existing onshore base or dock. The highest number of trips by helicopter or supply vessel would occur during platform installation (development) and then during decommissioning. Supply vessel trips may drop to two per week per platform during normal production operations. Table 4-4 describes transportation activity assumptions used for the effects analyses.

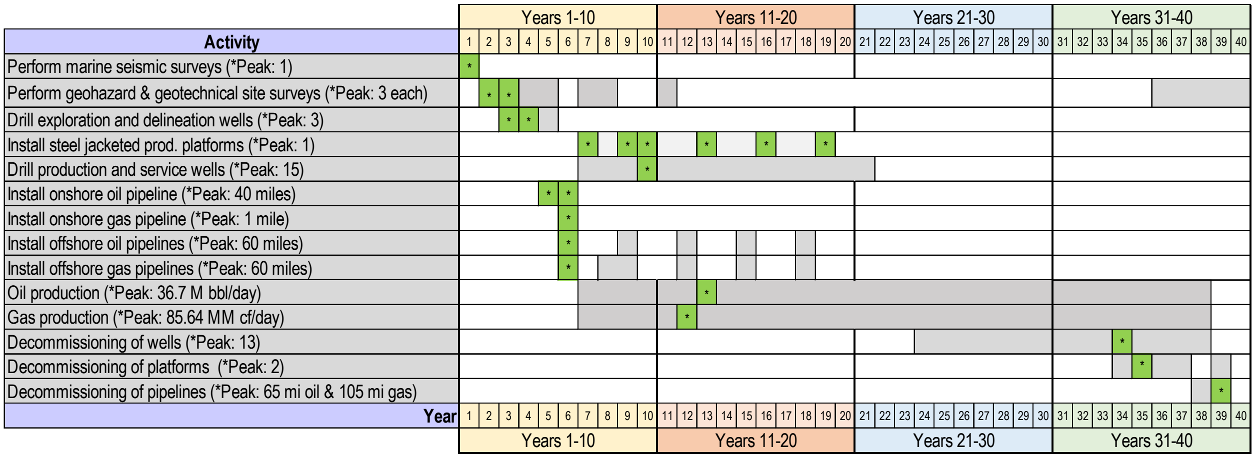
Table 4-4: Transportation Activities Assumed in the LS 258 E&D Scenario's Low to High Cases for the Life of the Scenario (40 years)

Element	Number of Activities	One Way Distance (Miles)	Season	Comment
Flights per week during peak exploration activity	14	700[1]	Year-Round	Approximately 2 flights per day. Flights would depart from Homer or Nikiski.
Boat trips per week during peak exploration activity	5	250[1]	Open Water	Vessels would depart from Homer.
Flights per week during peak development, production, and decommissioning phases	7–42	350–2,100[1]	Year-Round	One flight could service multiple platforms. Number of platforms range from 1-6. Flights would depart from Homer or Nikiski.
Boat trips per week during peak development, production, and decommissioning phases	7–42	350–2,100[1]	Open Water	Number of platforms range from 1 – 6. Vessels would depart from Homer.

Notes: All values are for entire lifespan of the scenario.
[1] Estimates use 50 mi as the typical distance traveled.

4.1.5 Schedule of E&D Scenario Activities Over Life of Field

Exploration, development and production, and decommissioning activities would occur over the 40-year lifespan of the E&D Scenario as shown in Figure 4-3. The range of years depicted for a given activity covers the number of years in which the activity could occur, although activities may not occur in each year within the range. Peak activity is the highest maximum number of occurrences within a year. For example, no more than three geohazard and geotechnical surveys (Table 4-1) would occur in any one year.



Notes: Maximum number of occurrences for each activity in given year.
Gray shaded areas denote years of activity.
Green squares with * denote years of peak activity.

Figure 4-3: E&D Scenario Schedule and Peak Activity

4.2 Impact Scale

The analyses in Chapter 4 apply a scale to categorize the extent of potential impacts to specific resources. The scale considers the context and intensity of the impact based on four parameters: detectability, duration (i.e., short-term or long-lasting), spatial extent (i.e., localized or widespread), and magnitude (i.e., less than severe or severe, where the term "severe" refers to impacts with a clear, long-lasting change in the resource's function in the ecosystem or cultural context).

Analysts used the best available information and their professional judgment to determine where a particular effect falls in the continuum on a relative scale from "negligible" to "major." For biological resources, impacts were determined based on changes in the stock or population, rather than the individual level.

The impacts scale applied in this EIS is as follows:

- Negligible: Little or no impact;
- Minor: Impacts are short-term and/or localized, and less than severe;
- Moderate: Impacts are long-lasting and widespread, and less than severe; and
- Major: Impacts are severe.

In applying this scale and the terms that describe impact categories (levels of effect), analysts considered the unique attributes and context of the resource being evaluated. For example, in considering impacts to biological resources, attributes such as the distribution, life history, and susceptibility of individuals and populations to impacts were considered. For impacts to subsistence activities, factors considered include the fundamental importance of these activities to cultural, individual and community health, and well-being. Based on these unique characteristics, impacts to subsistence activities are considered severe, and thus, major, if they would disrupt subsistence activities, make subsistence resources unavailable or undesirable for use, or only available in greatly reduced numbers for a substantial portion of a subsistence season for any community.

4.3 Air Quality

4.3.1 Affected Environment

The nation's air quality is regulated on a federal level under the Clean Air Act (CAA), as amended (42 USC Ch. 85, §§ 7401 et seq.). The CAA requires the EPA to set National Ambient Air Quality Standards (NAAQS). The NAAQS set limits or criteria for ambient air concentrations of six "criteria" pollutants – sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), particulate matter (PM) (PM_{10} and $PM_{2.5}$), and lead (Pb) (Title 40 CFR 50), which are considered harmful to public health and the environment at concentrations that exceed the NAAQS (EPA, 2015c). The NAAQS represent the concentrations of criteria pollutants that reflect healthful outside (ambient) air. There are two types of NAAQS: primary standards to protect public health, including sensitive populations (e.g., asthmatics, children, and the elderly); and secondary standards to protect public welfare and "quality of life," including protection against degraded visibility and damage to animals, crops, vegetation, and buildings. The EPA also sets Prevention of Significant Deterioration (PSD) increments. A PSD increment is the amount of pollution by which an area is allowed to increase without clean air deterioration to the level set by NAAQS. While PSD increments are used by the EPA when evaluating new industrial facilities, it is used here as a proxy metric to ensure that there is no significant impact to air quality.

The air quality agencies of each coastal state have regulatory authority that extends from its "normal baseline" outward to the sea, lakes, and bays, up to 12 nmi (UN, 1982). The seaward extent of this ribbon of water along a coast is known as the State Seaward Boundary (SSB) (Presidential Proclamation No. 5928, 1988). The SSB for all coastal areas of Alaska is defined at 3 nm from the baseline (coastline) (5 AAC 09.301). For the Cook Inlet region, EPA maintains jurisdiction to control air pollution from OCS sources located within 25 nm of the SSB (CAA Sec. 328(a) and 42 USC 7627), which for Alaska extends to a point 28 nm seaward from the baseline. Within this area of water, EPA must attain and maintain federal and state ambient air quality standards and comply with the provisions of Section 328 of the CAA (42 USC 7627).

The state of Alaska regulates air quality over the land area surrounding the waters of Cook Inlet relative to a demarcated geographical area designated by EPA as the Cook Inlet Intrastate Air Quality Control Region (AQCR), where AQCRs are defined under 42 USC 7407 (40 CFR 81.54 and ADEC 18 AAC 50.020, Table 2). The Cook Inlet AQCR includes all of the Municipality of Anchorage, the Kenai Peninsula Borough (KPB), and the Matanuska-Susitna Borough. Thus, the EPA regulations applicable to the corresponding onshore area refer to the attainment status of the Cook Inlet AQCR and are also relevant to the lease sale area; attainment status, which is characterized as either attainment, nonattainment, or unclassifiable, is defined in Sec. 107 of the CAA (42 USC 7407).

The CAA also gives special air quality and visibility protection to national parks and wilderness areas larger than 6,000 and 5,000 acres, respectively, by allowing their designation as "Class I" areas. The Tuxedni Wilderness area within the Alaska Maritime National Wildlife Refuge is a 5,564.8-acre area located on Chisnik Island and Duck Island in Cook Inlet, adjacent to the lease sale area. It is the only Class I area in the region.

Within the Cook Inlet AQCR, a portion of the Anchorage urban area located 160.9 km (100 mi) northeast of the lease sale area is designated a serious maintenance area for emissions of carbon monoxide. In addition, 2.4 km (1.5 mi) northeast of Anchorage, the community of Eagle River is a moderate maintenance area for emissions of PM_{10} (EPA, 2015a and 2022; ADEC, 2016). No other nonattainment area or maintenance area for any other criteria pollutant is located within the Cook Inlet AQCR. Maintenance areas are those areas with a past violation of air quality standards that has been corrected, and which have since maintained the standard. These 'maintenance areas' remain under evaluation for 10 years. Background concentration of pollutants 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 4-5. Currently, the air quality on the Kenai Peninsula meets, or is cleaner than, the NAAQS.

Table 4-5: Background NAAQS Concentrations in Lease Sale Area

Pollutant	Averaging Period	Primary NAAQS	Alaska AAQS	Alaska LNG – Nikiski, Alaska	Percentage of the Standard
Nitrogen Dioxide (NOx)	1 hour	188 µg/m³	188 µg/m³	30.6 µg/m³	16.3
	Annual	100 µg/m³	100 µg/m³	2.6 µg/m³	2.6
Sulfur Dioxide (SO_2)	1 hour	196 µg/m³	196 µg/m³	4.3 µg/m³	2.2
	3 hours	N/A	1,300 µg/m³	0 µg/m³	0
	24 hours	N/A	365 µg/m³	0 µg/m³	0
	Annual	N/A	80 µg/m³	0 µg/m³	0
Particulate Matter (PM_{10})	24 hours	150 µg/m³	150 µg/m³	30 µg/m³	20
Particulate Matter ($PM_{2.5}$)	24 hours	35 µg/m³	35 µg/m³	12 µg/m³	34.3
	Annual	12 µg/m³	12 µg/m³	3.7 µg/m³	30.8
Carbon Monoxide (CO)	1 hour	40,000 µg/m³	40,000 µg/m³	1,145 µg/m³	11.5
	8 hours	10,000 µg/m³	10,000 µg/m³	1,145 µg/m³	11.5
Ozone (O_3)	8 hours	140 µg/m³	140 µg/m³	94 µg/m³	67.1

Source: AAQS = Ambient Air Quality Standards µg/m³ = microgram per cubic meter
ADEC Industrial Data Summary, 22 May 2018 (https://dec.alaska.gov/air/air-monitoring/data-summaries;
AK LNG, Nikiski data: https://dec.alaska.gov/media/9162/industrial-data-summary052218.xlsx)

4.3.2 Environmental Consequences of the Proposed Action

Combustion of fuels, primarily diesel, is the primary source of air quality impacts associated with post-lease activities conducted as a result of LS 258 as described in the E&D Scenario. The primary emissions contributor from post-lease activities would be diesel-powered generators from vessels, drill-ships, and platforms. Emissions from diesel combustion would locally and temporarily increase the concentrations of NOx, CO, SOx, and $PM_{2.5}$ and PM_{10} (including black carbon).

The secondary contributor of combustion emissions from post-lease activities associated with the lease sale would be natural gas combustion. Once facilities have started producing natural gas from their reservoirs, many operators would likely change from diesel powered generators and engines to natural gas turbines and engines. Also, as a safety precaution, facilities conducting well operations would start and maintain a natural gas flare pilot light once in close proximity to the reservoir. The emissions from natural gas combustion would locally and temporarily increase the concentration of $PM_{2.5}$ and PM_{10} (including black carbon), although at lower levels than those produced by diesel combustion.

Other sources of emissions that have the potential to impact air quality are aircraft landing and takeoff operations. Emissions from aviation fuel combustion would briefly increase the concentrations of CO, NOx, and oxides of sulfur (SOx) in the immediate area around the helipads/landing areas.

Not all sources of emission are solely attributed to combustion. Emissions could also be released from leaking or evaporation during venting, storage, and transport of crude oil. These emissions would allow some volatile organic compounds (VOCs) to escape. VOCs are not listed as a criteria pollutant. However, in the presence of NOx and other environmental factors (sunlight, heat), VOCs could lead to the formation of O_3 which has the potential to impact air quality.

Using its Revised Offshore Economic Cost Model (OECM), BOEM quantified (in tons) the criteria pollutants and greenhouse gases (GHG) estimated to be released over the projected lifetime of the post-lease activities associated with the lease sale, as described in the E&D Scenario. This allowed BOEM to conduct an air quality impact analysis at the lease sale stage of potential oil and gas development when there is not yet an EP or DPP to analyze. Second, BOEM compared these results to those emissions previously estimated for the most recent lease sale in the Cook Inlet Planning Area (Lease Sale 244). BOEM determined that, despite differences in emissions estimates between LS 258 and LS 244, the existing dispersion modeling that had been conducted for LS 244 used assumptions that were conservative and appropriate and would yield an informative analysis of potential impacts. Dispersion modeling takes the estimated gross emissions (tons) and considers weather patterns for the area to estimate the concentration of pollutants at the shoreline. These results can then be compared against the NAAQS to determine the impacts of emissions from the activities considered. Therefore, the dispersion modeling analysis described in the LS 244 FEIS, Section 4.3.1.1, is being incorporated by reference and summarized below (BOEM, 2016).

Table 4-6 lists the results from the OECM analysis which quantified the amounts of emissions of pollutants, including GHGs, estimated to result from LS 258. The table illustrates that LS 258 is estimated to produce more emissions of NOx, CO, and VOCs, and less emissions of SOx and PM than those estimated for LS 244 over the projected lifetime of post-lease activities associated with each sale.

Table 4-6: Estimated Emissions from LS 258 and LS 244

Criteria and Precursor Pollutants	Emissions LS 258 (short tons)	Emissions LS 244 (short tons)	Difference (short tons)
NOx	51,701	44,152	7,657
SOx	1,483	8,566	(7,069)
PM_{10}	87	1,869	(980)
$PM_{2.5}$	861	1,827	(965)
CO	22,883	12,109	10,784
VOCs	25,356	17,490	8,012
Greenhouse Gases			
N_2O	190		
CH_4	69,427		
CO_2	8,435,637		
Total CO_2e	10,227,866		

Notes: Numbers in parentheses indicate a decrease in short tons. Greenhouse gases are presented in metric tons.

As stated above, dispersion modeling was conducted for LS 244 in 2016. The model used was the EPA's Offshore and Coastal Dispersion Model (OCD), a straight-line Gaussian plume model recommended by the EPA for modeling short-range transport of air pollutants over water. Because of the relatively short time span (~5 years) between LS 244 and this lease sale, the OCD Model and its meteorological inputs were considered valid for use for this lease sale. The dispersion modeling completed for LS 244 used geographic locations for emissions sources that estimated the maximum potential impact on the sensitive Class I Area of Tuxedni Wilderness and the remaining onshore areas near the lease area. It is important to note that the lease sale area for each of the two lease sales, LS 258 and LS 244, is identical; however, there are differences in E&D scenarios, available blocks, and the numbers of surveys.

The highest, most conservative, potential impacts on the Class I and onshore areas were simulated by placing emission sources in the northwestern corner of the lease sale area, approximately 6 km (3.7 mi) from the Tuxedni Wilderness, Alaska Maritime National Wildlife Refuge. Emissions from exploration drilling ships while secured to the seafloor, and all platform operations, were modeled as stationary point sources. Modeling considered emissions from facilities and thus did not include emissions projected to occur from the operations of vessels continuously underway, such as support vessels and aircraft traveling across the program area to and from platforms and drilling ships. Vessel and aircraft traffic would most likely occur between the platform and the Kenai Peninsula between Homer and Nikiski and is not expected to impact the air quality of onshore areas repeatedly in any one location, which does occur in the case of stationary sources.

Table 4-7 and Table 4-8 show the maximum increases in pollutant concentrations estimated from dispersion modeling. The emission impacts shown on these tables are the impacts resulting from the highest activity year. The dispersion modeling conducted under LS 244 was separated between exploration and production activities. The results also show the increase of pollutant concentrations in the ambient air onshore, offshore, and at the Tuxedni Wilderness area. As previously mentioned, the PSD increment is the amount of pollution by which an area is allowed to increase without clean air deterioration to the level set by the NAAQS. PSD increments, while used by the EPA for new industrial facilities, are used here as a proxy metric to ensure there is no substantial impact to air quality.

The onshore results from Table 4-7 and Table 4-8 show offshore exploration and production activities would not be expected to lead to any onshore area exceedance of the NAAQS/AAAQS. However, results from Table 4-7 and Table 4-8 show that the incremental impact from modeling at the Tuxedni Wilderness Class I area was larger than the PSD Class I Increment. Because of this, there is a chance that an operator proposing exploration or development and production activities associated with LS 258 may be required to obtain an EPA PSD permit for a Class I area and submit their air quality analysis to the USFWS for review.

Class I areas are also subject to visibility protections to ensure the preservation of the viewshed. To assess potential impacts to visibility in the Tuxedni Wilderness area, the Visibility-Screening Model VISCREEN was applied as part of the LS 244 dispersion modeling. Model results indicated that for an exploration project located 12 km (7.5 mi) away from the Tuxedni Wilderness area, the visibility screening criteria are exceeded in situations where wind blows directly from the facility to the observing site, assuming a 1 m/s (3.28 ft/s) wind speed within stable atmospheric conditions. If the screening criteria are exceeded, it indicates the possibility that a plume generated by emissions would be visible by an observer in the Wilderness area. It does not provide a measure of any general visibility effects such as regional haze in the area. It is likely this scenario would occur less than 1 percent of the time. For distances greater than 50 km (31 mi), the visibility screening criteria were not exceeded, and it is presumed a plume would not be visible at that distance.

Table 4-7: Highest Predicted Concentrations* – Exploration Phase of LS 244 E&D Scenario

Year	Offshore	Tuxedni Wilderness Class I Area	Onshore Area	PSD Class I Increments	PSD Class II Increments
Annual Avg. NO_2	6.957	2.45	0.196	2.5	25
Annual Avg. SO_2	0.115	0.04	0.003	2	20
Max. 24-hour SO_2	1.614	0.363	0.068	5	91
Max. 3-hour SO_2	5.599	1.125	0.023	25	512
Annual Avg. PM_{10}	0.823	0.29	0.023	4	17
Max 24-hour PM_{10}	11.59	2.608	0.487	8	30

Notes: * Pollutant Concentrations are shown in $\mu g/m^3$.

Table 4-8: Highest Predicted Concentrations* – Production Phase of LS 244 E&D Scenario

Year	Offshore	Tuxedni Wilderness Class I Area	Onshore Area	PSD Class I Increments	PSD Class II Increments
Annual Avg. NO_2	2.959	1	0.083	2.5	25
Annual Avg. SO_2	0.003	0.001	0.0001	2	20
Max. 24-hour SO_2	0.039	0.009	0.002	5	91
Max. 3-hour SO_2	0.137	0.027	0.011	25	512
Annual Avg. PM_{10}	0.254	0.09	0.007	4	17
Max 24-hour PM_{10}	3.58	0.806	0.15	8	30

Notes: * Pollutant Concentrations are shown in $\mu g/m^3$.

4.3.2.1 Oil Spills Impact Summary

Effects of spills, spill drills, and spill response activities on air quality are described in Section A-3.1 of Appendix A. Small spills of refined oil such as lube oil, hydraulic oil, gasoline, or diesel fuel would float on the water surface, disperse and weather rapidly, potentially causing localized air quality degradation due to increases in VOCs. Small spills of crude oil would persist longer in the environment and result in greater air quality impacts than spills of refined products. The impacts at a given location would depend on the size, location, and duration of the spill, and meteorological conditions such as wind speed and direction, but would not likely impact onshore air quality.

Although unlikely, for purposes of analysis, BOEM has considered the effects of a large spill involving a platform or pipeline. The impact on air quality from such a spill would be due to the evaporation of VOCs from the oil on the water. When combined with prior emissions of NOx, the formation of ozone would be possible. The impacts at a given location would depend on the proximity of the spill to the shore, response and cleanup time, and meteorological conditions such as wind velocity. Temporary and localized to long-lasting and widespread, and therefore minor to moderate, impacts to onshore air quality could occur under these circumstances.

Similarly, a large gas release could result in degraded air quality in the immediate vicinity of the release. Blowouts of natural gas condensates that did not burn would be dispersed rapidly at the blowout site; and air quality impacts would be considered minor to moderate.

4.3.2.2 Conclusion

Impacts from post-lease activities conducted as a result of LS 258, as described in the E&D Scenario, accidental small spills, and spill drills, would be minor. Although production platforms would be physically present for decades, impacts to air quality resulting from the emissions of those platforms would dissipate as the emissions mix with the surrounding air masses, reducing the overall impact. The air quality in the areas surrounding these activities would recover and return to pre-activity levels within weeks or months after the completion of the activity. A large oil spill may increase impacts to air quality, depending on the size and proximity to shore, because a large spill close to the shoreline could expose population centers to higher levels of VOCs and other pollutants. The post-lease activities described in the E&D Scenario could have minor to moderate impacts on air quality when impacts from a large oil spill are considered.

4.3.3 Environmental Consequences of the Alternatives

Potential impacts on air quality under all action alternatives would not differ substantially from those described for the Proposed Action. These alternatives would not change the total level of activity under the E&D Scenario, and none of the restrictions identified in these alternatives would be expected to change the likelihood or severity of impacts on air quality. Consequently, impacts of these alternatives on air quality would be the same as those for the Proposed Action — minor for E&D Scenario activities, accidental small spills and spill drills, and minor to moderate with the addition of a large spill.

4.3.4 Cumulative Effects

Past, present, and reasonably foreseeable future actions that could affect air quality include oil and gas operations, large oil spills, anticipated growth in vessel and aircraft traffic, national security activities, and regional recreation and tourism, as well as climate change. These activities each represent potential onshore or near-shore sources of air emissions. Emissions from past actions would already have dispersed throughout the atmosphere and would no longer contribute to cumulative impacts.

Present and reasonably foreseeable future actions each represent potential onshore or near-shore sources of air emissions. These include both stationary and mobile sources, such as industrial facilities, vessels, and vehicles. Currently, emission sources in and around the area do not produce levels that cause an exceedance or violation of NAAQS. This is because air quality effects would not be additive due to rapid dispersion and diffusion with surrounding clean air, meaning the impact is less than the sum of the individual effects. The impacts stemming from activities described in the E&D scenarios in both LS 244 and 258 are also not synergistic or additive.

Although some activities could occur at the same time, they would not occur in the same vicinity. This is because lease blocks are approximately ~14.5 km (9 mi^2) in size, and operators typically do not lease blocks adjacent to other operators. Consequently, it is unlikely that there would be two independent exploration or production operations occurring close enough for emissions to have a synergistic effect. Furthermore, since these sources are not likely to be emitting within the same space, their emission plumes would not have an opportunity to combine and raise concentrations to a higher level.

A large oil spill may have minor to moderate impacts on air quality. These impacts to air quality may overlap with reasonably foreseeable future activities, thereby increasing the overall level of effect expected. The magnitude of this increase, however, depends heavily on the circumstances, such as time of year, type of activity, and/or size of the spill(s), but short-term changes in air quality may occur.

Climate change can also affect air quality by increasing ambient air temperatures and weakening global circulation. Higher water vapor content (due to higher temperatures) is expected to decrease the ozone background concentrations. Particulate matter (including black carbon) is "much more complicated and uncertain than ozone." (Jacob and Winner, 2009). Although black carbon is a small portion of the $PM_{2.5}$ spectrum, it is a contributor to climate change. Changes to global circulation may lead to localized changes in precipitation levels, in some cases, this would lead to wetter than normal conditions, and in others, drier. Post-lease activities conducted as a result of LS 258, as described in the E&D Scenario, may have an additive effect when considering the on-going impacts of climate change.

Impacts to air quality from past, present, and reasonably foreseeable future actions are negligible. When the potential effects of post-lease activities associated with the E&D scenario are considered along with the on-going effects of climate change, potential impacts would be minor. Additionally, it is not anticipated that there would be a violation of NAAQS.

4.3.5 Life Cycle Greenhouse Gas Emissions and Social Cost of Greenhouse Gas Emissions

In this section, BOEM estimates greenhouse gas (GHG) emissions and social costs for oil and gas leasing on the Cook Inlet OCS for LS 258. This analysis encompasses emissions potentially resulting from the full life cycle of oil and gas exploration, development, and consumption; it also estimates emissions from use of energy substitutes in the absence of that leasing.

Anthropogenic emissions of GHGs are the main contributor to climate change. BOEM recognizes the global scope of the impacts of GHG emissions and the potential contributions of the effects of agency actions to global GHG concentrations. This analysis expands on BOEM's previous analysis, OCS Oil and Natural Gas: Potential Lifecycle Greenhouse Gas Emissions and Social Cost of Carbon (Wolvovsky and Anderson, 2016), which addressed domestic carbon emissions related to life cycle OCS oil and gas activity. In addition, BOEM considers the impact of the leasing and eventual production of OCS resources on foreign energy consumption and provides an overview of how the OCS leasing fits into the context of aggregate emissions, demand, and U.S. GHG reduction goals.

This analysis assumes the continuation of current laws and policies and baseline supply and demand. Should the U.S. and other nations move towards a net-zero emissions future and make substantial changes in policies and technological advancements, the substitution rates and resulting analyses could likely change. Life cycle refers to emissions from all activities related to the exploration, development, production, and consumption of a resource. For hydrocarbon resources, the activities are often grouped into three stages: upstream, midstream, and downstream (Figure 4-4). The activities associated with the Proposed Action would result in GHG emissions from upstream as well as midstream and downstream activities. Upstream activities include the exploration, development, and production described in the E&D Scenario. Midstream and downstream activities are associated with the transportation, refinement, and consumption of the fuels produced from leases issued via LS 258.

Figure 4-4: Life Cycle Stages of Greenhouse Gas Emissions

The activities associated with each stage would result in GHG emissions, including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). These GHG emissions would contribute to climate change globally. The analysis below quantifies projected GHG emissions that would occur from the Proposed Action and the consumption of the produced fuels. These projected GHG emissions serve as a proxy for assessing the Proposed Action's contribution to climate change globally.

The GHG analysis also estimates emissions associated with the No Action Alternative. Under the No Action Alternative, there would be no LS 258. Thus, no development or production activities as a result of this lease sale would occur and no oil and natural gas attributable to LS 258 would be transported or consumed.

In the absence of production stemming from LS 258, demand for oil and gas would not disappear. Rather, it would be fulfilled from alternative sources, which BOEM refers to as “substitute” sources. This substitution does not occur on a 1:1 basis (a concept known as “perfect substitution”) because the lack of production from LS 258 would correspond with an estimate of slightly higher prices (and slightly lower demand). BOEM’s analysis of the No Action Alternative thus reflects the energy sources estimated to substitute for oil and gas that would have been produced under the E&D scenario for LS 258, along with the GHG emissions associated with consuming those substitute energy sources. The No Action Alternative life cycle GHG emissions are those generated from the substitute fuels that are produced or consumed in the absence of LS 258. Alternatively stated, these sources are displaced with LS 258 oil and gas production. BOEM’s modeling suggests that the substitute fuels are primarily additional oil imports and domestic onshore natural gas production.

The emissions analysis can be categorized into two components: 1) estimated GHG emissions resulting from domestically produced or consumed fuels, and 2) estimated GHG emissions when considering the shift in foreign oil consumption. BOEM can model domestic energy markets with sufficient reliability to estimate the energy substitutes consumed or produced domestically. However, global energy markets cannot be modeled to the same level of detail as the domestic energy sources. BOEM's GHG analysis has been updated to include a newly developed quantitative analysis of the impact on foreign oil consumption. This update aligns with the court rulings in *Center for Biological Diversity v. Bernhardt*, Case No. 18-73400 (9th Cir. 2020) and, more recently, *Friends of the Earth v. Haaland*, Case No. 1:21-cv-02317-RC (D.D.C. 2022). The *Center for Biological Diversity* court stated, in part, that BOEM must provide a quantitative assessment of GHG emissions resulting from shifts in foreign consumption attributable to the proposed action or explain why such quantitative assessment could not be done. As a result, BOEM updated its analysis to consider the potential impacts of GHG emissions from the change in foreign oil consumption.

Table 4-9 demonstrates BOEM's GHG modeling approach. BOEM fully and quantitatively considers the GHG emissions associated with domestically produced or consumed energy (Table 4-12). This analysis includes GHG emissions from production through consumption of OCS oil and gas under the Proposed Action. The No Action Alternative estimates include GHG emissions from the domestically consumed energy substitutes. A portion of these life cycle GHG emissions include upstream emissions from foreign production of energy that is imported and consumed domestically in the U.S. Globally, BOEM has quantitatively estimated downstream emissions associated with the increase in foreign oil consumption given the price decrease estimated to result from the Proposed Action (Table 4-13). Given the estimated price decrease, foreign oil production would likely decrease resulting in a decrease in upstream emissions. There would be changes in midstream emissions as well. At this time, BOEM does not quantify the changes in foreign oil's upstream and midstream emissions for reasons more fully described below. In response to the change in oil price, additional energy substitutions for foreign energy sources other than oil likely would occur, but these are complex and beyond BOEM's current modeling capabilities.

Table 4-9: BOEM's Life Cycle GHG Modeling Approach

Emissions Source	Modeling Capability (Yes = quantified; else not quantified)		
	Upstream	Midstream	Downstream
Domestically Produced or Consumed Energy			
Proposed Action: new OCS oil and gas production	Yes (Table 4-12)	Yes (Table 4-12)	Yes (Table 4-12)
No Action Alternative: all domestically consumed substitutes (onshore, gross imports, renewables, reduced domestic demand)	Yes (Table 4-12)	Yes (Table 4-12)	Yes (Table 4-12)
Non-U.S. Consumed Energy			
Foreign Oil Market Change	Under consideration but unavailable at this time	Under consideration but unavailable at this time	Yes* (Table 4-13)
Substitutes for Oil in Foreign Markets (natural gas, coal, biofuels, renewables, reduced demand)	Not available at this time given available resources **	Not available at this time given available resources **	Not available at this time given available resources **

NOTES: * Foreign oil consumption is not modeled as dynamically as domestic oil consumption. The Market Simulation Model's estimate of foreign oil consumption does not include cross-price effects. Also, foreign oil consumption double counts some exports of new OCS crude oil and petroleum exported to foreign markets. Those amounts are not disaggregated from the Greenhouse Gas Life Cycle Energy Emissions Model when it estimates midstream and downstream emissions from new OCS oil.
** Source: Price (2021)

This analysis uses a similar methodology BOEM first employed and published in Alaska's Cook Inlet LS 258 Draft Environmental Impact Statement (DEIS) (BOEM, 2021a). The initial GHG analysis included a quantification of GHG emissions from foreign consumption. Since then, BOEM has updated assumptions in the Market Simulation Model. BOEM has also published a second similar analysis using this updated model as part of the 2023–2028 National OCS Oil and Gas Leasing Proposed Program (2023–2028 Proposed Program) (BOEM, 2022). BOEM received comments on the LS 258 Draft EIS. Several areas of this analysis have been updated to respond to those comments. The comment period for the 2023–2028 Proposed Program analysis was open through October 6, 2022. BOEM continues to review and evaluate the comments and input from outside experts and the public to improve GHG analyses and methodologies.

One of the reasons BOEM did not previously prepare a quantitative analysis of foreign emissions for lease sales was the lack of information on foreign consumption of petroleum products. To address that data gap and prepare this quantitative analysis, BOEM used a single generic emissions factor, described below, in place of specific emissions factors for the different types of petroleum products consumed. BOEM is also working with outside experts on both short- and long-term efforts to refine and expand existing models and methodologies for deployment in future analyses.

The resulting LS 258 analysis indicates that selection of the No Action Alternative results in lower GHG emissions than would be emitted under the Proposed Action when considering only emissions associated with domestic consumption and production and when the analysis is expanded to consider global impacts. After estimating GHG emissions, BOEM then monetizes the social costs of those GHG emissions to estimate the Proposed Action's incremental social cost of greenhouse gas emissions relative to the No Action Alternative.

Life Cycle Greenhouse Gas Methodology

BOEM's life cycle greenhouse gas methodology was first described in Wolvovsky and Anderson (2016). The GHG model (now called the Greenhouse Gas Life Cycle Energy Emissions Model, or GLEEM) was developed to examine the life cycle GHG emissions associated with OCS oil and gas development activities both pre- and post-production. The scope includes all operations on the OCS associated with oil and gas leasing (i.e., exploration, development, and production). The analysis relies on three BOEM models to estimate results: the Market Simulation Model (MarketSim) (Industrial Economics Inc., 2021),[5] the Offshore Environmental Cost Model (OECM) (Industrial Economics, Inc., 2018a, b),[6] and GLEEM (Wolvovsky, 2021).[7] For a full description of these models, please refer to their documentation and associated reports, which are available on BOEM's website.

BOEM acknowledges that these models were developed for analysis at a national level for the National OCS Oil and Gas Leasing Program and that there may be limitations on the scalability of the models to this regional analysis. However, the models incorporate a regional framework and specify assumptions by planning area (e.g., Cook Inlet) when applicable. The models represent the best science and methodology available for estimating energy market impacts and substitution rates, which are important factors in the larger analysis and comparison of GHG emissions that would occur under the No Action Alternative and the Proposed Action.

When estimating emissions, BOEM's models quantify the three main GHGs: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). To provide a single metric for estimating an action alternative's emissions profiles, BOEM provides combined totals of all three GHG emissions in CO_2 equivalent, or CO_2e. This allows for a direct, aggregate, comparison between emissions of different pollutants which have varying potentials to trap heat as well as different atmospheric lifespans. For example, emission of

[5] Available at https://www.boem.gov/oil-gas-energy/energy-economics/national-ocs-program.
[6] Available at https://www.boem.gov/oil-gas-energy/energy-economics/national-ocs-program.
[7] Available at https://www.boem.gov/environment/greenhouse-gas-life-cycle-energy-emissions-model.

one metric ton of CH_4 has an impact similar to 25 metric tons of CO_2. The analysis uses conversion factors developed by the U.S. Environmental Protection Agency (EPA, 2021a) (see Table 4-10).

Table 4-10: Global Warming Potential in Metric Tons

Greenhouse Gas	CO_2	CH_4	N_2O
Global Warming Potential (CO_2e)	1	25	298

Source: EPA, 2021a

BOEM evaluates life cycle GHG emissions assuming annual exploration, development, and production as estimated under the high activity case described in the LS 258 E&D Scenario. To estimate the energy market substitutions that would occur in the No Action Alternative, BOEM uses the MarketSim. The substitute estimates are then used as inputs in the OECM and GHG Model (Figure 4-5).

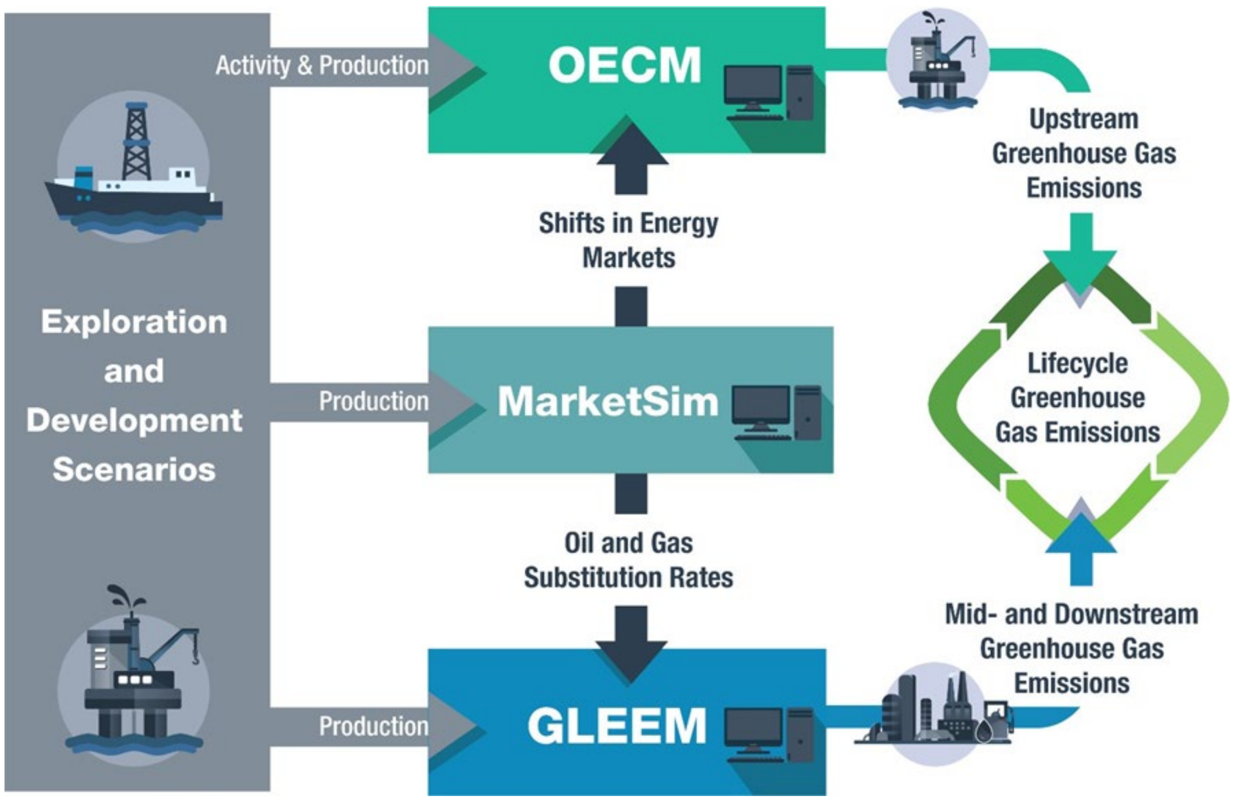


Figure 4-5: Illustration of BOEM's Models and Methodology

The Market Simulation Model (MarketSim)

MarketSim is a Microsoft Excel-based model for the oil, gas, coal, and electricity markets that is calibrated to a special run of the U.S. Energy Information Administration's (EIA's) National Energy Modeling System (NEMS) from the *2020 Annual Energy Outlook* reference case (EIA, 2020b; Staub, 2020). The run includes no new OCS lease sales after 2022.[8] Removing the EIA's expectation of future OCS leasing and production allows investigation of alternative new OCS leasing scenarios within the

8 NEMS projections including production from new OCS leasing is typically reported in EIA's Annual Energy Outlook (EIA 2020).

EIA's broad energy market projection. MarketSim makes no assumptions about future technology or policy changes other than those reflected in the EIA NEMS forecast.

BOEM continually evaluates its models to update with the most recent available data. BOEM recently completed a review and update of its MarketSim model and documentation. Since the GHG analysis was performed for the DEIS, the model was updated to include new elasticity values from the literature and an additional modeling category to directly incorporate onshore unconventional production (splitting from one generic onshore oil production category). MarketSim's elasticities and adjustment rates, which determine fuel substitution calculations, underwent a literature review by an outside contractor and were evaluated by experts in 2021. These updates and additional details about how MarketSim models fuel substitutions across energy markets can be found in the MarketSim documentation (Industrial Economics Inc., 2021).

MarketSim takes the estimated production from the LS 258 Proposed Action high activity case and adds it to the baseline (the No Action Alternative). *MarketSim* then evaluates a series of simulated price changes until each individual fuel market (i.e., coal, natural gas, oil, and electricity) reaches equilibrium where supply equals demand. *MarketSim* uses price elasticities derived from NEMS runs, peer-reviewed studies, and input from experts to quantify the potential effects on prices, energy production, and consumption over the Proposed Action's period of production.

MarketSim's modeling of oil, natural gas, coal, and electricity for U.S. markets accounts for substitution between alternate fuel sources. It incorporates feedback effects among the markets for substitute fuels using cross-price elasticities between the fuels. For instance, additional natural gas production leads to reduced gas prices. With a reduced price, there is an increase in the quantity of gas demanded. The increase in natural gas quantity demanded then decreases the demand for other fuels like coal. The model also then considers the resulting decrease in the price of coal which dampens the initial increase in the quantity of gas demanded. To better depict these substitutions, each fuel's demand is categorized into distinct sectors, i.e., residential, commercial, industrial, and transportation with its own-price and cross-price elasticity specific to each submarket. Additionally, each fuel is modeled for up to nine components of supply. For example, for the oil market, supply is modeled from domestic (lower 48) onshore conventional, domestic (lower 48) onshore unconventional, domestic (lower 48) offshore, Alaska onshore, Alaska offshore, biofuels, other, rest of world, and Canadian pipeline imports. This complexity allows *MarketSim* to simulate changes in energy prices and the resulting substitution effects between the various fuels in the presence of changes in OCS oil and gas production.

Table 4-11 shows the substitution of other energy sources as percentages of the Proposed Action's forgone production of oil and gas under the No Action Alternative. For example, the estimated production from the Proposed Action is 246 million barrels of oil equivalent (mmBOE). Under the No Action Alternative, *MarketSim* estimates that 54 percent or approximately 132 mmBOE, would be replaced by imports. In other words, 132 mmBOE of imports are estimated to be displaced by anticipated high-case production under the Proposed Action.

Table 4-11: Substitution of Other Energy Sources Under the No Action Alternative

Substitute Energy Source	% of Proposed Action Forgone Production
Onshore Production	26.9%
Onshore Oil	12.5%
Onshore Gas	14.3%
Production from Existing State/Federal Offshore Leases	0.6%
Imports	54.3%
Oil Imports	53.7%
Gas Imports	0.6%
Coal	0.7%
Electricity from Sources Other Than Coal, Oil, and Natural Gas	1.5%
Other Energy Sources	7.3%
Reduced Demand/Consumption	8.8%

Notes: The percentages in this table represent the percent of forgone production that is replaced by a specific energy source (or in the case of reduced demand, the resulting reduced consumption rather than replacement) with the selection of the No Action Alternative. The numbers can be interpreted as the percentage of anticipated production that would have been produced from the Proposed Action if leasing had occurred (e.g., 26.9% by onshore production of oil and natural gas).
* Numbers may not sum due to rounding.
** Includes electricity from wind, solar, nuclear, and hydroelectric sources.
*** Includes primarily natural gas liquids (roughly 80%), with the balance from biofuels, refinery processing gain, product stock withdrawal, liquids from coal, and "other" natural gas not captured elsewhere.

The OECM and Upstream GHG Emissions Estimates

BOEM estimates upstream emissions of the Proposed Action and the energy substitutes using the OECM. The OECM takes the level of exploration, development, and production activities estimated to occur from the Proposed Action, as well as other outputs from MarketSim, to estimate the upstream GHG emissions from the No Action Alternative. The model also uses outputs from MarketSim to estimate the upstream emissions associated with the substitute energy sources (e.g., oil imports, onshore gas production) under the No Action Alternative. MarketSim estimates differences in gross energy exports between the No Action Alternative and the Proposed Action. The range of activities[9] and their respective GHG emissions factors are available in the OECM's documentation (Industrial Economics Inc., 2018a, b).

GLEEM: Midstream and Downstream GHG Emissions Estimates

GLEEM incorporates upstream emissions from the OECM and energy substitutions from MarketSim with additional information to generate the life cycle estimate. The model also includes additional calculations for the emissions associated with onshore processing (refining and storage), delivery of energy (i.e., oil, natural gas, or other energy substitutes) to the final consumer, and consumption of the oil and gas products. GLEEM relies on the substitution estimates from MarketSim to estimate midstream and downstream emissions under the No Action Alternative. GLEEM provides the annual emission estimates for the Proposed Action and domestic midstream and downstream emission estimates for the No Action Alternative. More details on GLEEM are available in the model documentation (Wolvovsky, 2021).

Foreign GHG Emissions Methodology

The analysis prepared for LS 258 represents BOEM's first time estimating the change in foreign emissions resulting from a lease sale. BOEM uses the best available information to convert MarketSim's estimate of the change in global oil market demand between the Proposed Action and the No Action Alternative into a change in GHG emissions. As described in the section "Global Life Cycle Greenhouse Gas Analysis," the foreign energy market simulations using MarketSim are necessarily more simplistic

[9] The OECM estimates emissions from upstream activity, which includes (1) propulsion and auxiliary engines operated onboard vessels, (2) drilling operations, (3) platform operations including flaring, (4) helicopters and light aircraft, (5) use of above-ground pipelines, (6) construction (onshore and offshore), and (7) accidental oil spills and gas releases.

given limited information when compared to that available for the U.S. domestic energy markets. To arrive at a reasonable estimate for GHG emissions from foreign oil consumption under the No Action Alternative relative to the Proposed Action for a lease sale, BOEM utilizes simplifying assumptions that allow for use of a broad foreign oil consumption estimate made by MarketSim and a generic GHG emissions factor published by the U.S. Environmental Protection Agency (EPA, 2021a). BOEM expects to make refinements to its analysis and future refinements for upcoming OCS lease sales and post-lease activities.

As described above under the No Action Alternative, oil prices would be expected to be slightly higher due to the lower energy supply relative to the Proposed Action. Oil is a global commodity, meaning any price changes will likely impact global production and consumption. MarketSim estimates changes in foreign oil production and consumption to determine a global equilibrium (the price where supply equals demand) for oil. MarketSim estimates the change in foreign consumption for each year of anticipated production.

GLEEM takes the annual change in foreign consumption and applies an emissions factor attributable to combusted oil. For this analysis, BOEM uses a single EPA emissions factor called 'Other Oil <401°F' (EPA, 2021a). This emissions factor is a miscellaneous factor used when the end petroleum product consumed is unknown. Typically, rather than using a single emissions factor, it would be preferable to use a range of emissions factors that correspond to the different end uses of petroleum products after oil refining. However, for this analysis, BOEM applies this emissions factor to all combusted oil due to a lack of information about the end petroleum products consumed in foreign markets. The consumption of oil and its end uses vary from country to country.

GLEEM's calculations for non-combustion uses of oil is based on the U.S. market as an approximation (Wolvovsky, 2021). This approach is unlikely to change the results significantly, as the amount of oil used globally in non-combustion products is small.

Although the U.S. non-combusted oil products are used as a proxy for global non-combusted oil, taking a similar approach for emissions factors would likely produce less accurate results. For instance, in 2019, the most recent year for which data are available, about 20 percent of European Union oil was consumed as motor gasoline (Eurostat, 2022), while in the U.S. that portion was more than double, i.e., approximately 45 percent of all oil was consumed as motor gasoline (EIA, 2022). The different emissions factors for each type of fuel (EPA, 2021a) would likely result in significant changes in multiple ways. This variability applies to all countries around the world, including variability in oil product consumption within the European Union. Therefore, a U.S. consumption model would not apply to most other countries, and though these figures are available for the European Union, as well as some other countries, they are not available globally. As a result, BOEM has decided to use a generic emissions factor that does not corollate with specific oil products but that does give a reasonable approximation of emissions from oil consumed in other countries without introducing other uncertainties into the results.

Domestic Production and Consumption Life Cycle Greenhouse Gas Analysis

Table 4-12 shows the estimates of life cycle GHG emissions of domestically consumed or produced energy for both the Proposed Action and the No Action Alternative. BOEM determined that the other action alternatives, which exclude certain lease blocks, will not increase the total level of activity considered under the high activity case E&D Scenario. While these alternatives would focus activities away from certain areas or prohibit activities during certain times of the year, the overall lifespan of the lease sale activities would be similar and not vary significantly for air emissions, including GHG emissions from direct emissions, transportation, or life cycle emissions from combustion of resources.

Thus, the downstream life cycle of CO_2e emissions for all action alternatives will be similar to those for the Proposed Action.

Table 4-12: Domestic Production and Consumption Life Cycle GHG Emissions

	Upstream				Midstream and Downstream				Life Cycle			
	CO_2e	CO_2	CH_4	N_2O*	CO_2e	CO_2	CH_4	N_2O*	CO_2e	CO_2	CH_4	N_2O*
	Thousands of Metric Tons											
No Action (A)	9,978	7,225	109	*	68,844	68,030	27	1	78,822	75,255	135	1
Proposed Action (B)	9,279	7,653	63	*	77,783	76,736	35	1	87,061	84,388	98	1
Difference (A-B)	699	(427)	46	*	(8,938)	(8,706)	(9)	*	(8,240)	(9,133)	37	*

Notes: Values rounded to nearest 1,000 metric tons.
* Values are between -0.5 and 0.5.

For the upstream portion of life cycle emissions, BOEM estimates about 9.28 million metric tons of CO_2e would be emitted due to Proposed Action activities. The total emissions emitted from upstream activities associated with the energy substitutes in the No Action Alternative are 9.98 million metric tons of CO_2e. BOEM's upstream emissions factors for OCS oil and gas, as well as for OCS substitutes like imports and onshore production, are based on emissions factors found in Table 5 of the OECM documentation (Industrial Economics Inc., 2018a). The No Action Alternative results in higher CO_2e emissions for upstream activities compared to those of the Proposed Action, given that collectively the substitute energy sources have higher GHG emissions per unit of production (also known as "GHG intensity") compared to the forgone domestically produced OCS oil and natural gas of the Proposed Action.

The Proposed Action results in higher midstream and downstream emissions than the No Action Alternative. This increase is due to slightly lower consumption and fuel switching away from oil and natural gas under the No Action Alternative. BOEM estimates that 77.78 million metric tons of CO_2e would be emitted from midstream and downstream activities associated with the Proposed Action and 68.84 million metric tons of CO_2e from midstream and downstream activities of substitute energy sources under the No Action Alternative.

BOEM calculates that, under the No Action Alternative, in the absence of the production resulting from the Proposed Action, oil prices would be slightly higher than they would be under the Proposed Action.[10] With the higher energy prices, MarketSim estimates that energy demand (from all modeled energy sources) would be approximately 21.36 mmBOE lower under the No Action Alternative than under the Proposed Action. The lower demand is roughly 8.8 percent of the Proposed Action's 246 mmBOE anticipated production that would be foregone under the No Action Alternative. For oil, MarketSim estimates U.S. demand to be 12.07 mmBOE less under the No Action Alternative. Although oil and natural gas demand are expected to be lower in the No Action Alternative, there may be higher domestic onshore production (largely natural gas) and imports (largely oil), in addition to higher coal consumption and production.

BOEM's modeling shows that the net difference between the No Action Alternative and Proposed Action in life cycle emissions from domestic production or consumption is higher under the Proposed Action relative to the emissions from substitutes under the No Action Alternative. The differences are such that even small changes in variables like the ratio of anticipated oil to natural gas production within the Proposed Action and underlying assumptions within the models could lead to different results. The primary modeling assumptions affecting the results are elasticities, adjustment rates, differences in emission factors, and regional energy market differences. The interplay of all these variables, along with

[10] The average differences in price in the No Action Alternative relative to the Proposed Action over the 32 years of oil and natural gas production anticipated from LS 258 are \$0.0227 per barrel higher for oil, \$0.00104 per thousand cubic feet higher for natural gas, \$0.000295 per ton higher for coal, and \$0.001668 per kilowatt higher for electricity.

the ratio of oil versus natural gas production within the exploration and development scenario, is the main driver of the differences in GHG emissions estimates between the Proposed Action and No Action Alternative.

Elasticity, simply defined, is a mathematical value that expresses the percent change expected in one economic variable given a 1 percent change in another economic variable (e.g., supply, demand, or price). Adjustment rates are the limits MarketSim sets on how much of the long-term change estimated by the elasticity values can occur in 1 year. Collectively, elasticities and adjustment rates determine the change in supply and demand of alternative energy sources given a change in the anticipated production from the Proposed Action. The changes in the alternative energy sources determine the substitution rates estimated by MarketSim. These substitution rates impact the GHG emissions for each portion of the GHG emissions life cycle, from upstream to downstream.

The varying emissions factors among the different energy sources, along with the amount of anticipated OCS oil and natural gas and their substitutes, also play a role in determining the results. For the upstream analysis, the OECM makes assumptions about the onshore regions adjacent to each of BOEM's 26 OCS planning areas and their reliance on imports versus existing onshore energy resources. These assumptions determine where substitute resources would come from or go to and the associated transport emissions from those substitute energy sources. The midstream and downstream analysis results in equal, or lower, emissions rates for most substituted sources relative to those of OCS oil and natural gas, particularly for substitutes like wind, solar, nuclear, and hydrokinetics, which have no midstream or downstream emissions. Although some coal substitution (which has higher emissions than OCS oil and natural gas) is possible domestically, its substitution rate is small relative to the combination of reduced demand and non-emitting sources of energy substitution rate.

Finally, the ratio of anticipated oil to natural gas production from the Proposed Action interacts with the underlying model assumptions, particularly the elasticities, to drive the amount of reduced demand under the No Action Alternative. Reduced demand is a form of substitution and, like other energy substitutes, is also estimated by MarketSim. The midstream and downstream analysis shows that the No Action Alternative results in fewer emissions than the Proposed Action, due in part to the estimated reduced demand associated with the price increases that would result with the No Action Alternative. Thus, as the ratio of OCS oil to natural gas fluctuates, the amount of reduced demand under the No Action Alternative also changes.

BOEM continues to review and evaluate the models and assumptions used in this analysis and notes that, when emissions associated with the shift in foreign consumption are considered, the margin of emissions between the Proposed Action and the No Action Alternative is expected to grow wider in the context of global GHG emissions.

Foreign Oil Consumption Greenhouse Gas Analysis

MarketSim estimates that under the No Action Alternative, foreign oil consumption would be roughly 45.7 MMbbl lower than the Proposed Action in total over the 32-year production period estimated for the Proposed Action. This difference represents 0.0034 percent of the foreign (non-U.S.) oil consumption of 1.3 trillion barrels under the No Action Alternative during this time period. This comparison is provided for context only with regard to consumption and is not meant to characterize the relative impacts of the Proposed Action's GHG emissions to those of the No Action Alternative. Table 4-13 presents the reduction in GHG emissions attributable to the lower foreign consumption of oil under the No Action

Alternative.[11] Foreign oil consumption estimated under the No Action Alternative emits 14.5 million metric tons of CO_2e less GHG emissions compared to foreign consumption estimated under the Proposed Action.

Table 4-13: Shift in Foreign Oil Consumption GHG emissions Under the No Action Alternative (when compared to the Proposed Action)

	Foreign Downstream Emissions (Crude Oil and Petroleum Product Consumption Only)			
	CO_2e	CO_2	CH_4	N_2O
	Thousands of Metric Tons			
No Action	(14,537)	(14,477)	(1)	*

Notes: Values rounded to nearest thousand metric tons. Negative values represent the lower foreign downstream emissions under the No Action Alternative relative to the increased foreign emissions under the Proposed Action.
* Values are between -0.5 and 0.5 thousand metric tons.

The lower global oil consumption associated with the No Action Alternative has been quantitatively analyzed for other oil infrastructure projects, such as the Keystone XL pipeline (Erickson and Lazarus, 2014) and BOEM's 2017–2022 National OCS Oil and Gas Leasing Program (Erickson, 2016). Both analyses reflect lower GHG emissions from global oil consumption under a no action alternative, when compared to the proposed actions under consideration. Both analyses used a multiplier to quantify GHG emissions resulting from increases in global oil consumption. BOEM agrees with the primary contention of both papers (cited above) that a reduction in domestic production leads to less foreign consumption and subsequently lower foreign emissions. Central to the authors' argument is their calculation that a change ('Δ') in foreign consumption can be estimated by multiplying the change ('Δ') in imports consumed in the U.S. by a ratio ('factor') of the foreign elasticities of demand (E_d) and supply (E_s):

$$\Delta\, Foreign\ Consumption \cong\ \Delta\, Forgone\ U.S. Imports\ Available\ to\ Foreign\ Markets * \frac{E_d}{(E_d - E_s)}$$

BOEM finds that its results (using MarketSim) closely align with this calculation, though the elasticity assumptions used by BOEM here differ from those used by the authors cited above. BOEM's MarketSim currently has an elasticity of foreign demand (E_d) of -0.15 and an elasticity of foreign supply (E_s) of 0.28, resulting in a factor equal to 0.35. BOEM's MarketSim estimates that U.S. oil imports decrease by 130.7 MMbbl due to the Proposed Action. Erickson's equation treats these forgone U.S. imports as equivalent to new production which is available to foreign markets and is used to calculate the increase in foreign consumption from the Proposed Action. Using Erickson's (2016) methodology, the 0.35 factor and estimated forgone oil imports of 130.7 MMbbl yields a change (increase) in foreign oil consumption of 45.6 MMbbl. This result is very similar to BOEM's estimation that foreign consumption would increase by 45.7 MMbbl over the entire 32 years of production estimated under the Proposed Action. BOEM is continually seeking to update its models as new information and methodologies become available. BOEM has recently updated MarketSim and its underlying elasticity assumptions. Additional information on this analysis and its limitations is included in Section 4.3.5.3, Global Life Cycle Greenhouse Gas Analysis.

4.3.5.1 Life Cycle Emissions Compared to Targets and Carbon Budgets

The Paris Agreement requires countries to set goals to help stabilize atmospheric GHG concentrations at a level that would limit anthropogenic warming to within 2ºC, and preferably to within 1.5ºC of preindustrial temperatures. These intermediate goals, which are on the pathway to global net-zero

[11] While these could alternatively be presented as an increase of GHG emissions under the Proposed Action, it is more consistent with BOEM's Table 4 on domestic GHG emissions to present it under the No Action Alternative as a reduction in emissions.

emissions, are referred to as Nationally Determined Contributions (NDCs) (United Nations Framework Convention on Climate Change 2015). The U.S. set its NDCs using domestic emissions from a base year of 2005. In 2005, U.S. net emissions were 6,680,300 thousand metric tons of CO_2e (EPA, 2021b). The U.S. achieved its 2020 goal to reduce its net GHG emissions by 17 percent below 2005 levels, in part due to the coronavirus pandemic. Currently, the U.S. has established NDCs for 2025 and 2030, each with a two-percentage-point range (The White House 2021). Table 4-14 lists the current emissions targets. The U.S. has an additional goal of net-zero emissions by 2050 (U.S. Department of State and U.S. Executive Office of the President 2021); this target is outside of the Paris Agreement framework.

Table 4-14: U.S. Domestic GHG (CO_2e) Reduction Targets

Target Year	Target Net Reduction	Target Net Emissions (Current) of CO_2e (in thousands of metric tons)
2025[a]	26 to 28%	4,943,422 to 4,809,816
2030[a]	50 to 52%	3,340,150 to 3,206,544
2050[b]	100%	0

Notes: [a] Target submitted to the United Nations as part of the U.S. NDC.
[b] Target established outside of the Paris Agreement framework.

Table 4-15 compares the estimated emissions from the target year to the U.S. NDCs and shows the percentage of the target that is expected to be consumed under the Proposed Action and No Action Alternative. LS 258 consumes a very small percentage of domestic GHG emissions relative to U.S. targets. Further, the percentages in Table 4-15 likely show a worst-case scenario for years 2025 and 2030, as there is the potential for carbon capture and storage (CCS) to allow for higher emissions than the targets, while still achieving the NDCs. By 2050, to achieve the net-zero emissions target, all GHG emissions would have to be offset by removal of an equal CO_2e amount of GHGs from the atmosphere, including those resulting from any OCS development. As Table 4-15 shows, the Proposed Action is expected to release higher amounts of CO_2e into the atmosphere than the No Action Alternative, but the estimates are quite similar.

Table 4-15: Comparison Between the Proposed Action and No Action Alternative and U.S. Emissions Target Reductions for Cook Inlet Lease Sale 258 (CO_2e, in thousands of metric tons)

Target Year	Proposed Action		No Action Alternative	
	CO_2e	% of U.S. Targets	CO_2e	% of U.S. Targets
2025	14	0.0003% to 0.0003%	0	0.0000% to 0.0000%
2030	1,959	0.0587% to 0.0611%	1,834	0.0549% to 0.0572%
2050	1,198	-	844	-

Notes: Percentages represent the amount of the U.S. targets that are estimated to be consumed by new leasing on the OCS or substitutions. There is no production yet in 2025, so there are no GHG emissions from substitute energy sources under the No Action Alternative. Percentage of the 2050 target consumed by OCS production, or its substitutes, is blank because by 2050 an equal amount of emissions would have to be removed from the atmosphere to achieve the net-zero emissions target. However, if the amount of emissions removed in 2050 is less than the amount emitted, then any emissions will exceed the U.S. target for 2050.

4.3.5.2 Monetized Impacts from GHG Emissions

The “Social Cost of Carbon” (SCC), “social cost of nitrous oxide” (SCN), and “social cost of methane” (SCM) – together, the “social cost of greenhouse gases” (SC-GHG) – are estimates of the monetized damages associated with incremental increases in GHG emissions in a given year. The SC-GHG is an estimate of the generalized economic damages associated with an increase in GHG emissions. BOEM applies the SC-GHG to the estimates of GHG emissions. The results are then presented as monetized, potential climate damages attributable to a decision for Alternative A or the No Action Alternative.

On January 20, 2021, President Biden issued EO 13990, Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis.[12] Section 1 of EO 13990 establishes an Administration policy to, among other things, listen to the science; improve public health and protect our environment; ensure access to clean air and water; reduce greenhouse gas emissions; and bolster resilience to the impacts of climate change.[13] Section 5 of Executive Order 13990 emphasizes how important it is for Federal agencies to "capture the full costs of greenhouse gas emissions as accurately as possible, including by taking global damages into account" and establishes an Interagency Working Group on the Social Cost of Greenhouse Gases (IWG). In February 2021, the IWG published Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide; Interim Estimates under Executive Order 13990 (IWG, 2021). This interim report updates previous guidance from 2016. The final report is still pending as of the date of this publication. BOEM is utilizing the interim IWG estimates for this analysis; as IWG's estimates are refined and revised, BOEM may update the analysis herein as necessary.

Such analysis should not be construed to mean that a cost determination is necessary to address potential impacts of GHGs associated with specific alternatives. Although NEPA requires consideration of "effects" that include "economic" and "social" effects (40 CFR 1508.8(b)), NEPA does not require an economic cost-benefit analysis (40 CFR 1502.23). The GHG emission estimates were annualized and monetized; however, they do not constitute a complete cost-benefit analysis nor do the cost of GHG numbers present a direct comparison with other impacts analyzed in this Supplemental EIS. For instance, BOEM's overall economic analysis for a GOM lease sale does not monetize most of the major costs or benefits and does not include all revenue streams from a GOM lease sale but seeks to quantify certain impacts related to employment numbers and labor income. The social cost of GHG analysis is provided only as a useful measure of the benefits of GHG emissions reductions to inform agency decision-making. This is a new and evolving approach, and BOEM will continue to evaluate the methodology with input from outside experts and the public.

Uncertainty in Computing Social Costs

The IWG provides impact estimates evaluated at three different discount rates[14] (5 percent, 3 percent, and 2.5 percent). The cost of a greenhouse gas is calculated as the sum of all future impacts that one ton of greenhouse gas has when released into the atmosphere in a given year. A lower discount rate values future damages more and results in a higher present aggregate value. The range of potential discount rates is provided to show the range of potential impacts.

The IWG includes the 5 percent, 3 percent, and 2.5 percent discount rate at the average level of damage, but also includes a fourth case at the 3 percent discount rate and the 95th percentile of damages.[15] The statistical level of damages represents the uncertainty within SC-GHG estimates. The modeling calculates the social cost at an average level (with half of the potential estimates higher than the social cost and half of the potential estimates lower than the stated cost). Alternatively, the 95th percentile means that 95 percent of the potential damages would be lower than that cost estimate. The 95th percentile estimate is significantly higher than the average case. The different discount rates and their assumption of a statistical

[12] 86 FR 7037 (Jan. 25, 2021).

[13] Id., Sec. 1.

[14] Discount rate is an interest rate used for discounted cash flow analysis to determine the present value of future cash flows. It is based on the time value of money concept that a dollar today is worth more than a dollar in the future. When the discount rate is higher, money in the future will be worth less than it is today.

[15] The models used to assess damages from an additional metric ton of GHG perform tens of thousands of simulations as to how that metric ton of emissions would work its way through the underlying assumptions of the model to arrive at a distribution of probable damages, based on one estimate for each of those tens of thousands of runs. The SC-GHG at the 95th percentile suggests that 95 percent of the simulations are at or below the SC-GHG estimate. The average statistical values suggest that they are the average of all values simulated.

level of damages represent uncertainty within SC-GHG estimates. With higher discount rates, future damages are more discounted and less significant in the total estimated costs. Because damages from GHG emissions are long-term, higher discount rates lead to lower estimates of the SC-GHG. This is evident when comparing the SC-GHG at a 2.5 percent discount rate versus 5 percent discount rate, both at average statistical damages.

The assumption of a statistical level of damages plays a significant role in capturing uncertainty. The IWG interim report contains frequency distributions that show uncertainty in the quantified parameters defining the damage functions of the three models (DICE, PAGE, FUND) used to estimate the sets of SC-GHG values. The magnitude of uncertainty reflected in the distribution of damages is evident by comparing the average and 95th percentile values of the 3 percent discount rate models. There are additional sources of uncertainty that are not quantified in these estimates. For example, the damages associated with ocean acidification are not included in any of the three climate models. Uncertainty around those impacts is thus not captured within the SC-GHG but may be captured qualitatively within this Final EIS. For example, ocean acidification is discussed throughout (see Section 4.3.4; Cumulative Effects).

Methodology for Estimating the Social Cost of Greenhouse Gas Emissions

IWG (2021b) SC-GHG estimates represent the monetary value of the net harm to society associated with adding one metric ton of GHG to the atmosphere in any given year. This SC-GHG estimated value is specific to a given year and increases through time as the harm in later years leads to greater damages given the compounding nature of GHG emissions and their relationship to an increasing Gross Domestic Product (IWG, 2021).[16] The SC-GHG emissions represent the value of the future stream of damages associated with a given metric ton of emissions discounted to the year of emission.

BOEM uses the IWG's annual SC-GHG estimates for each of the three GHGs to compute the Proposed Action and No Action Alternative social cost estimates. The total SC-GHG is then discounted back to a net present value (NPV) using the same discount rate as the IWG's SC-GHG. Next, the NPV for the three GHGs are aggregated to derive the total SC-GHG for the Proposed Action and No Action Alternative under the specific discount rate and statistical damage assumptions for that set of SC-GHG values. BOEM provides an estimate for each of these cases.

A detailed example of the calculation is provided below.

The IWG provides SC-GHG estimates through 2050. BOEM extrapolated for future years using the growth rate for the final 5 years available using the equation:

$$\left(\frac{2050\,SC-GHG\ \ value}{2045\,SC-GHG\ \ value}\right)^{\frac{1}{5}}$$

The IWG presents the SC-GHG estimates in 2020 dollars. BOEM has inflated these social cost estimates to 2022 dollars based on the assumed start date of the Proposed Action.[17] Table 4-16 provides examples of the IWG SC-GHG values at the 3 percent discount rate and average statistical damages assumption

[16] The tables of estimated annual SC-GHG values can be found in the IWG interim report at: https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf

[17] Inflated using the Bureau of Economic Analysis' Table 1.1.9. Implicit Price Deflators for Gross Domestic Product and also EIA's GDP Chain-type Price Index from their Annual Energy Outlook 2022. Available online at: https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=2#reqid=19&step=2&isuri=1&1921=survey and https://www.eia.gov/outlooks/aeo/tables_ref.php

inflated to 2022 dollars for the first year of GHG upstream emissions (2024), the peak year of upstream GHG emissions (2040), and the last year of upstream GHG emissions (2060).

The inflated annual IWG estimates of SC-GHG are applied to the annual emissions estimate for each of the three gases. Table 4-16 shows an example calculation for select years of the Proposed Action's upstream emission estimates. Note that the first year does not have methane (CH_4) and nitrous oxide (N_2O) emissions because those are not associated with the activities taking place in that year. While there are methane (CH_4) and nitrous oxide (N_2O) emissions estimated in the last year, they are so small they round to zero as they are less than 0.5 thousand metric tons.

Table 4-16: Example of Domestic Upstream GHG Emissions in Select Years (for Proposed Action)

	IWG's SC-GHG Estimates			GHG Emissions			Social Cost of GHG Emissions		
	Methane (CH_4)	Carbon dioxide (CO_2)	Nitrous oxide (N_2O)	Methane (CH_4)	Carbon dioxide (CO_2)	Nitrous oxide (N_2O)	Methane (CH_4)	Carbon dioxide (CO_2)	Nitrous oxide (N_2O)
Year	2022 $/Metric Ton (at 3% discount rate, average damages)			Metric Tons, Thousands			2022 $, Thousands		
2024	1,784	59	21,498	-	14	-	-	853	-
2040	2,675	78	29,542	3	357	*	7,207	27,891	233
2060	3,961	104	41,597	*	13	*	*	1,311	22

Notes: *= Value is less than 0.5 thousandths and so rounds to zero

The above calculation is performed for every year of GHG emission. To arrive at an NPV of social costs, the annual amounts are then discounted back to the year of analysis (which is 2022 for this project) using the same discount rate used by the IWG for the SC-GHG estimate (in this example, 3 percent).

The NPVs for each of the GHGs are aggregated to arrive at an estimated social cost for each discount rate and statistical damage assumption recommended by the IWG. This process is repeated for every component of the life cycle for both the Proposed Action and the No Action Alternative.

Social Cost of Greenhouse Gas Results

For the reasons described below, BOEM presents the results of its SC-GHG analysis separately—one for the SC-GHG resulting from domestic production, production of imports, and domestic consumption, and another for those resulting from a shift in foreign oil consumption.

Domestic Production and Consumption Life Cycle

Using the methodology described above, Table 4-17 estimates the social cost of the emissions expected from domestic production and consumption in the life cycle analysis of LS 258 (for the No Action and Proposed Action Alternatives, respectively). Under each of the SC-GHG cases, the social costs of emissions are higher under the Proposed Action than the No Action Alternative. For example, at 3 percent discount rate and an average level of statistical damages, the No Action Alternative would result in savings of $330 million when considering domestically produced or consumed OCS oil, natural gas, and their substitutes alone.

Table 4-17: Domestic Production and Consumption Lifecycle Social Cost of Greenhouse Gas Emissions (2022 $, Billions)

Discount Rate	Statistical Damages	No Action SC-GHG (A)	Proposed Action SC-GHG (B)	Difference (A-B)
5%	Average	$0.91	$0.98	($0.07)
3%	Average	$3.62	$3.96	($0.33)
2.5%	Average	$5.54	$6.07	($0.53)
3%	95th Percentile	$10.99	$12.04	($1.04)

Notes: Values rounded to nearest $10 million. A positive value is a cost. A negative value is a benefit. Incremental SC-GHG is in terms of the No Action Alternative. So, a negative value represents a benefit (lower SC-GHG) under the No Action Alternative.

Foreign Oil Consumption

BOEM followed the same process described above to calculate the social cost of emissions from the lower foreign consumption under the No Action Alternative. Table 4-18 shows the lower cost (i.e., benefits) of the No Action Alternative due to lower foreign oil consumption emissions. The estimate in Table 4-18 does not account for the cost of GHG emissions from shifts in foreign energy market consumption of other substitute fuel sources, nor the upstream or midstream GHG emissions from any foreign energy market substitutes, for the reasons discussed below.

Table 4-18: Change in Social Cost of GHG Emissions from the Lower Foreign Oil Consumption under the No Action Alternative (2022 $, Billions)

Cook Inlet: Lease Sale 258 – High Activity Case		
2022 Billions $		
Discount Rate	Damages Statistic	Incremental Value of SC-GHG (2022 $, billions)
5.0%	Average	(0.16)
3.0%	Average	(1.65)
2.5%	Average	(1.01)
3.0%	95th Percentile	(2.00)

Notes: Values rounded to nearest $10 million. Values are presented as negative costs (benefits) as they represent the lower SC-GHG of emissions from lower foreign consumption under the No Action Alternative relative to the Proposed Action.

4.3.5.3 Global Life Cycle Greenhouse Gas Analysis

Within the analysis above, BOEM estimates GHG emissions associated with the anticipated increase in foreign oil consumption resulting from LS 258. The foreign GHG emissions estimates (Table 4-13) and their estimated social costs (Table 4-18) are based only on changes in foreign oil consumption and are not as comprehensive as the estimates of life cycle emissions from domestic production or consumption (Table 4-12). BOEM recognizes that there are additional market responses and impacts that cannot be quantified at this time (Table 4-9); however, these are considered qualitatively in this section.

In developing the global life cycle GHG analysis, BOEM consulted with the contracted developer of MarketSim, Industrial Economics, Inc. (IEc)[18] to assist in refining and expanding its analysis. Through this expert review, IEc extensively evaluated BOEM's approach to estimating the change in emissions associated with the shift in foreign energy consumption. However, given the model's current capabilities and limitations, IEc acknowledged that MarketSim would not allow a complete estimation of global life cycle GHG emissions at this time.

According to IEc, the model would need demand-driven and competition-driven substitution effects for all global major energy forms as well as upstream, midstream, and downstream emissions profiles for

[18] IEc is a consulting firm that engages on a wide variety of projects including economics, public policy, and natural resource management.

OCS oil and gas and domestic and foreign substitutes (Price, 2021). To derive these substitution effects, the model requires a detailed global baseline energy forecast that includes multiple categories of supply, demand, and prices at a regional level. IEc indicated they were unaware of any such existing forecasts with the required level of detail that has been published by a major organization. IEc suggested that, in theory, BOEM could develop its own projections of foreign supply, demand, and prices based on less detailed forecasts, but doing so would "require a number of assumptions that would introduce significant uncertainty into MarketSim's results" (Price, 2021).

Currently, MarketSim estimates total non-U.S. demand for oil, but its specification of non-U.S. oil demand does not include cross-price elasticities that would capture how non-U.S. demand for oil changes in response to other energy prices. Similarly, the model does not capture how non-U.S. demand for oil substitutes changes in response to oil prices. MarketSim also does not capture non-U.S. production of gas and coal consumed outside the U.S. or non-U.S. consumption of gas or coal produced outside the U.S. A comprehensive accounting of all these effects would require a significant expansion of MarketSim in scope and complexity, as well as the development of baseline supply and demand projections beyond what is included in the EIA's Annual Energy Outlook.

Given the extensive data requirements and limitations, BOEM determined that, for this analysis, the Bureau could reasonably quantify the GHG emissions from foreign consumption of oil (for downstream only, as presented in Table 4-13). However, BOEM continues to evaluate options to improve methodologies to estimate upstream and midstream emissions from foreign oil production for use in future analyses.

Looking at the foreign energy market qualitatively, the price decreases for oil under the Proposed Action would be felt beyond U.S. borders given that oil is a globally traded commodity. The same substitutions (i.e., natural gas, coal, biofuels, and renewables) discussed earlier for the domestic energy market also occur in the foreign markets in response to the decrease in the price of oil.

Foreign Oil Life Cycle Change: Upstream

IEc found existing data that would allow BOEM to estimate the upstream emissions associated with the production of non-U.S. oil consumed outside of the U.S (Price, 2021). However, at this time, BOEM has not quantified the associated emissions, as the Bureau continues to explore the necessary assumptions required to reliably estimate these foreign upstream emissions.

Using MarketSim's existing calculations, BOEM estimates that crude oil production in foreign markets would be higher under the No Action Alternative than the Proposed Action. To estimate the emissions associated with this increase in production, BOEM would need information on where the increase in oil production is coming from and the relative GHG intensity of different foreign oil markets. For comparison, in the domestic analysis, foreign upstream emissions estimated for oil imported to the U.S. is more specific because BOEM has data on its trading partners and constructs a weighted average to estimate emissions based on imported oil consumed in the U.S. BOEM could use a generic factor to translate the increase in emissions under the No Action Alternative, but the Bureau prefers not to overestimate the impact nor skew the results.

BOEM continues to review relevant data sources that would allow for quantifying emissions from the estimated change in foreign oil production in future analyses. In the interim, the best available and credible information suggests that the changes in foreign oil production would increase GHG emissions under the No Action Alternative and potentially mitigate (decrease) some of the increased GHG emissions under the Proposed Action. However, even when combined with other potentially offsetting sources of emissions from foreign energy substitutes currently not quantified under the No Action

Alternative, mitigating changes in foreign oil production would not overcome the full magnitude of increased GHG emissions under the Proposed Action, and the Proposed Action would still result in increased GHG emissions when compared to the No Action Alternative.

Foreign Oil Life Cycle Change: Midstream

According to IEc, estimating midstream emissions resulting from the change in oil consumption would also introduce several new complexities, as the GHG emissions associated with activities such as refining differ based on the quality of crude oil and the technological capabilities of different refining sectors. Given these complexities and limited data availability, BOEM considers these impacts qualitatively in this section. Unlike foreign upstream emissions, the models provide no direct estimates for the foreign midstream. However, it is reasonable to qualitatively conclude that midstream emissions would increase under the Proposed Action given the increase in consumption.

Under the Proposed Action, foreign production is expected to decrease, and foreign oil consumption is projected to increase. Increased consumption must be met with increases in midstream activities, either from the U.S. or other foreign markets. Although some of the midstream refining occurs in the U.S. and is exported to foreign markets, not all of the increase in midstream processes is accounted for in BOEM's estimate of new OCS oil refined in the U.S. and exported. BOEM does not account for the midstream transportation and storage activities or the refining that takes place abroad. A portion of the midstream emissions due to the increased consumption is unaccounted for and would represent an increase under the Proposed Action or, alternatively, a decrease under the No Action Alternative.

Substitutes for Oil in Foreign Markets

To understand the complexities and limitations of estimating substitutes and their emissions in foreign markets, it is useful to provide context from BOEM's domestic analysis. The inputs for BOEM's domestic GHG model are based on the best available and most credible information. They are illustrative of the range and depth of data necessary to credibly conduct a full quantitative analysis of changes in foreign GHG emissions. BOEM's MarketSim model adopts assumptions from the EIA (the primary Federal government entity on energy statistics and analysis) and from economics literature cited in the model documentation. These assumptions help BOEM estimate where the likely substitute sources of oil and gas would come from (i.e., oil and gas production from state submerged lands, onshore domestic production, and international imports) and the other types of energy sources that would be utilized to balance demand and supply (i.e., coal, biofuels, nuclear, and renewable energy). Accurately estimating this mix of substitute energy sources is important because each substitute energy source has a different life cycle GHG emissions profile over the course of its production, transportation, refining, and/or consumption.

A main factor in considering the impact of the change in foreign oil consumption is identifying the other energy sources that would be replaced with oil consumption given an oil price reduction. These sources vary throughout the world. In some areas, oil may replace coal, and the emissions associated with the oil consumption increase is expected to bring a reduction in global emissions as a result of the Proposed Action. However, it is unlikely that coal would substitute for oil on such a scale as to fully compensate for the decrease in emissions from lower foreign oil consumption under the No Action Alternative relative to the Proposed Action. Instead, other areas may rely more heavily on natural gas, biofuels, nuclear, or renewable energy, all of which have a lower GHG intensity than oil. In these cases, the shift to oil leads to a net increase in emissions, though the net change in emissions would still not be as large as that estimated in Table 5. The degree to which various energy substitutes might replace forgone oil consumption in foreign energy markets under the No Action Alternative is uncertain, but it is appropriate to acknowledge that substitution would certainly occur and mitigate a portion of the decreased emissions due to forgone foreign oil consumption.

IEc highlighted the complexities and wide range of data required to consider these substitutions. IEc found that the incremental emissions associated with the full life cycle for all energy sources other than oil produced and consumed in foreign markets cannot be quantified without making significant assumptions and are more appropriately addressed qualitatively. Though oil is a global commodity, the regional nature of gas, coal, and electricity would require MarketSim to consider regional price differences and calculate regional equilibriums for these other fuels. IEc characterized the necessary updates to create this global-regional analysis as “a major challenge.” Furthermore, regarding the necessary underlying data that would be required to support a model if built, IEc stated the following:

BOEM is unaware of any existing forecasts published by EIA, the International Energy Agency, or other organizations that include this level of detail. In the absence of such a forecast, BOEM could develop its own based on less detailed forecasts that may be available, but this would likely require a number of assumptions that would introduce significant uncertainty into MarketSim’s results (Price, 2021).

In summary, domestic production and consumption analysis estimates the emissions associated with the production of energy substitutes under the No Action Alternative, but foreign GHG emissions quantitative analysis is limited to the foreign downstream (consumption) of oil only. Missing from the foreign emissions impacts are changes in foreign oil’s upstream and midstream emissions associated with the downstream consumption. However, for future analyses, BOEM is considering suggested methodologies that would allow for foreign oil’s higher upstream emissions to be captured under the No Action Alternative. Moreover, though foreign oil consumption is lower in the No Action Alternative, foreign energy substitutes likely would be higher, because elevated oil prices can cause oil consumption to be lower due to fuel switching to other fuels (e.g., coal, natural gas, biofuels, renewables) and a small reduction in overall energy demand. Because the quantifiable foreign analysis is not comprehensive, domestic production and consumption emissions are not directly comparable to the foreign estimates. Therefore, BOEM is not providing a combined quantitative estimate of domestic and foreign emissions because it would be potentially misleading to add them together.

BOEM is investigating methods to incorporate the global upstream emissions and estimate the full life cycle of foreign energy substitutes other than oil; as discussed above, the results are not expected to significantly change the conclusion of the analysis here.

4.3.5.4 Areas of Uncertainty in Modeling Inputs

BOEM’s GHG emissions and social cost analysis is subject to uncertainty regarding several key variables. As shown in the preceding tables, GHG emissions from domestic energy consumption or production associated with the Proposed Action and those associated with the energy substitutes under the No Action Alternative are within 10 percent of each other. BOEM recognizes the importance of understanding and considering the trade-offs of different policy decisions; several factors and inherent differences in model assumptions lead to differences in results. Among the primary factors are those related to elasticities, adjustment rates, and ratio of anticipated OCS oil versus OCS natural gas. The interplay of the different elasticities for oil versus natural gas and their substitutes with the ratio of oil versus natural gas production is the main driver of the differences in emissions between OCS oil and natural gas and their substitutes.

This section focuses on the two key variables in the analysis and the importance of those assumptions in the final results: 1) elasticities and adjustment rates, and 2) anticipated activity and production, specifically the ratio of anticipated OCS oil versus natural gas. Lastly, BOEM acknowledges the uncertainty in results derived from using model inputs that are based on current policies and technological capabilities, which would change under a net-zero emissions future.

Elasticities and Adjustment Rates

Elasticities and adjustment rates within MarketSim are integral to the GHG emissions results, and there is inherent uncertainty within the values used by the model.

Elasticities are used to determine the amount of fuel switching, which is the change in demand and supply between alternate energy sources in response to the price change driven by the anticipated production of OCS oil and natural gas. Elasticity measures the percentage change of one economic variable in response to a change in another variable. It is often used to estimate a change in supply or demand given a change in price (Figure 4-6). Additionally, there are cross-price elasticities that describe the response consumers have to a particular energy source given a change in price of a substitute energy source.

$$\text{Supply Elasticity} = \frac{\text{\% Change, Quantity Supplied}}{\text{\% Change, Price of Supply}} \Rightarrow \text{\% Change, Price of Supply} = \frac{\text{\% Change, Quantity Supplied}}{\text{Supply Elasticity}}$$

Figure 4-6: Illustration of Supply Elasticity

Along with elasticities, MarketSim also includes an adjustment rate variable. Given that the elasticities are long-term elasticities, BOEM uses adjustment rates to limit the amount an energy source's quantity supplied or demanded can shift in any year. Elasticities and adjustment rates together determine the change in supply and demand of substitute energy sources, given a change in the anticipated production from the Proposed Action. The changes in substitute energy sources, primarily determined by the elasticities and adjustment rates, determine the substitution rates estimated by MarketSim. In turn, these substitution rates impact GHG emissions rates for each portion of the GHG emissions life cycle, from upstream to downstream.

BOEM continually evaluates its models to update them with the most recent available data. BOEM completed a review and update of its MarketSim model and documentation in November 2021 (Industrial Economics Inc., 2021). The updated model includes new elasticity values from peer-reviewed literature and expert sources, as well as two new baseline oil supply categories of conventional onshore (lower 48) and unconventional onshore (lower 48) oil production.

Anticipated Activity & Production: Oil and Gas Ratios

Another model input that drives results and has an element of uncertainty is anticipated activity and production. The amount of production and associated activities (exploration, development, and decommissioning) drive upstream emissions from the Proposed Action. However, the ratio of anticipated OCS oil to OCS natural gas production is the major driver for the substitutions analysis and, subsequently, the No Action Alternative and incremental life cycle emissions. Chapter 5 of the Draft Economic Analysis Methodology for the 2023–2028 National Outer Continental Shelf Oil and Gas Leasing Proposed Program discusses BOEM's process for estimating anticipated production (BOEM, 2022). More specifically, for LS 258, BOEM has published a document, Revised Exploration and Development (E&D) Scenario for Environmental Impact Statement, Lease Sale 258, Cook Inlet, Alaska (BOEM, 2021a; https://www.boem.gov/oil-gas-energy/leasing/ls258-exploration-and-development-scenario). This document details the specifics of establishing the E&D scenario, which includes the anticipated production, for LS 258.

Changes in the ratios of production of oil versus natural gas led to different substitution rates and, consequently, different GHG emissions results. Oil and natural gas have different own-price supply and demand elasticities, as well as different cross-price elasticities with substitute energy sources. Table 4-11 shows the substitution rates for oil and natural gas. Furthermore, each OCS planning area has different volumes of anticipated oil versus natural gas production. Therefore, GHG emissions estimates vary among areas depending in part on their proportion of oil to natural gas production.

Changes in Current Laws and Policies

As noted above, substitution analysis is impacted by significant uncertainty given that it is an indicator of changes in energy markets. MarketSim uses as its baseline the Annual Energy Outlook (EIA, 2020a), which is based only on current policies and laws and does not assume regulations will be implemented to achieve net-zero emissions by 2050. If additional climate policies are put into place, there could be major changes in future energy markets and corresponding changes in how oil supply reduction may impact the markets. Alternatively, if major international supplies of oil are no longer available, the importance of OCS oil may increase, and substitutions could then have even broader implications.

BOEM is considering ways to incorporate U.S. climate commitments and future climate scenarios into the emissions modeling analysis. The changes in producer and consumer behavior patterns and policy changes that could help in achieving net-zero energy emissions are largely beyond the scope of BOEM's authority, but the Bureau recognizes the need to continually seek the best available information for our analyses and to address the policy mandates adopted under the Paris Agreement and established by the President for the Nation.

4.3.5.5 GHG Analysis and SC-GHG Summary

BOEM's analysis of life cycle GHG emissions resulting from LS 258 finds that the No Action Alternative will result in fewer GHG emissions than those of the Proposed Action when considering only the GHG emissions resulting from domestic energy production or consumption (see Table 4-12). Further, when considering the emissions from changes in foreign oil consumption under the No Action Alternative (Table 4-13), the reduction is even larger when compared to the Proposed Action. Although BOEM's analysis includes quantification of GHG emissions from foreign oil consumption, the analysis can neither include quantification of foreign oil's upstream and midstream emissions nor foreign substitutes' full life cycle emissions at this time. However, such estimates would not be expected to change the conclusion of BOEM's analysis, as BOEM expects the result of fewer GHG emissions in the No Action Alternative to remain.

BOEM's quantitative and qualitative GHG analyses together represent the best available approach for comparison of GHG emissions from the Proposed Action and No Action alternatives and serve as a proxy for evaluating and comparing impacts to climate change under both scenarios.

Nonetheless, BOEM continues its review and study of these issues and will update the foreign life cycle analysis as new data and methodologies become available. BOEM includes the global analysis in this document as an initial methodology using the most credible information currently available and will continue to review and refine the methodology moving forward.

4.4 Water Quality

4.4.1 Affected Environment

Cook Inlet is a complex estuary receiving freshwater discharge from numerous rivers and streams, and marine connections with Shelikof Strait and the Gulf of Alaska. Water, hosting a large variety of naturally occurring inorganic and organic compounds, is transported into Cook Inlet by streams, rivers, point and non-point source wastewater discharges, groundwater, atmospheric deposition, runoff, and currents from the Gulf of Alaska. Suspended or dissolved substances within the water column are rapidly dispersed by the highly dynamic tidal and subtidal currents.

Many of the streams flowing into Cook Inlet are glacially fed and contain high concentrations of suspended particulate matter (Segar, 1995). Seasonally, an estimated 99 percent of the annual suspended particulate matter is carried by rivers and streams from May through October due to spring thaw and storm events (Okkonen et al., 2009; Parks and Madison, 1985). Concentrations of total suspended solids (TSS) fluctuate daily due to tidal cycles and riverine inputs. They are higher in the most northern stream-influenced end of the upper inlet and decrease through lower Cook Inlet (Feely and Massoth, 1982; Saupe et al., 2005; Segar, 1995). In upper Cook Inlet, suspended sediment concentrations are typically high and can reach 2,000 parts per million (ppm), and measurements of light transmittance yield values <10 percent (Saupe et al., 2005). In lower Cook Inlet, suspended sediment concentrations are more typically <100 ppm (Saupe et al., 2005; Segar, 1995) and light transmittance values approach 100 percent. Overall, about 80 to 90 percent of the 63.5 million metric tons (70 million tons) of sediment deposited in lower Cook Inlet and Shelikof Strait is derived from suspended particulate matter primarily from the Knik, Matanuska, and Susitna rivers (MMS, 2001; Feely and Massoth, 1982; Trefry, 2000).

The quality of water in the Cook Inlet Planning Area meets criteria for the protection of marine life according to Section 403 of the Clean Water Act (CWA). No waterbodies directly draining into the Proposed Action area are identified by the State of Alaska as impaired per Section 303 of the CWA (ADEC, 2018). While contaminants have been reported, many are attributed to erosion of the local soils, rocks and ores, and few can be decidedly linked to human activities unlike anthropogenic input of pollutants at urban centers that have deleteriously impacted local streams and lakes (e.g., Chester Creek; Brabets and Whitman, 2004; Glass et al., 2004). Furthermore, in 2005 water quality data collected at approximately 20 locations in Cook Inlet met Alaska Water Quality Standards (AWQS) criteria for all marine water uses (Saupe et al., 2005). Hydrocarbon concentrations in Cook Inlet sediments are comparable to values reported for background hydrocarbons in Alaska offshore coastal waters; therefore, oil and gas production in upper Cook Inlet does not appear to be a source of petroleum contaminants (Boehm, 2001).

Previous studies have found no indication of heavy metal pollution in lower Cook Inlet, but some evidence of elevated mercury (Hg) in suspended sediment, most likely linked to riverine inputs, may originate naturally or from past mining and other anthropogenic activities (Kinnetic Laboratories, 2010; Segar, 1995). Kinnetic Laboratories (2010) found dissolved metal concentrations from Cook Inlet to be less than the AWQS, and no evidence for enhancement of any metal concentrations in bottom sediments could be linked to discharges of produced water from oil and gas activities. Metal concentrations of Ba, Cd, Cr, Cu, Ni, Pb and Zn[19] for bottom sediments were reported at background levels for all 55 stations sampled throughout Cook Inlet (Kinnetic Laboratories, 2010). Similarly, Apeti and Hartwell (2015) completed a baseline assessment of heavy metals in Cook Inlet investigating surficial sediments of Kachemak Bay, Port Graham Bay, and Homer Bay. The authors emphasized that concentrations of most

19 Ba (Barium), Cd (Cadmium), Cr (Chromium), Cu (Copper), Ni (Nickel), Pb (Lead), and Zn (Zinc).

metals in Kachemak Bay were below NOAA's sediment quality guidelines for sediment toxicity to benthic communities. Elevated levels of arsenic (As), Cu, and Ni, and variations in concentrations between the locations were attributed to differences in local geology and large coal deposits in the region.

4.4.2 Environmental Consequences of the Proposed Action

4.4.2.1 Discharges

Post-lease activities conducted as a result of LS 258, as described in the E&D Scenario, which disturb the seafloor, generate a resuspension of sediment or discharge directly to the water which could impact water quality through introduction of suspended solids, turbidity, and other pollutants. Such activities include drilling of exploration, delineation, production, and service wells; anchoring; installing and removing nodes, cables, and sensors; trenching activities for subsea/shoreline pipelines; preparation of the seabed for exploration and/or production platforms; and pipeline decommissioning.

Total Suspended Solids, Turbidity, Metals, and other Pollutants

Turbidity, and its associated TSS in the water column, would be temporarily and locally increased from seafloor disturbance activities decreasing over time as suspended solids settle to the ocean floor. Resuspended sand would settle rapidly from the water column, while finer-grained materials would travel further before settling to the seafloor; settling rates and the strength of the ambient currents would determine the transport distances of the finer-grained sediment. Elevated TSS levels from temporary seafloor disturbance activities are highly unlikely to exceed ambient TSS levels that naturally occur from riverine and stream inputs draining into Cook Inlet (Saupe et al., 2005). Strong and fast tidal currents characteristic of Cook Inlet would rapidly disperse and resettle additional suspended sediment with natural, ambient water quality conditions expected after operations cease.

Seafloor disturbance and an increase in TSS (as described above), metals, and other pollutants would be expected with the discharge of approximately 5,000 cubic yards (cy) of rock cuttings and 72,000 bbls of drilling fluids from exploration and delineation well drilling (Section 4.1, Table 4-1). Drill cuttings and fluids discharged into the marine environment disperse in the water column increasing turbidity, accumulate on the seafloor potentially smothering benthic organisms, elevate concentration of some trace metals, and alter sediment characteristics (NRC, 1983, 2003, 2005). Under CWA Section 402, all discharges to surface waters are subject to NPDES permitting regulations. Any discharge found to cause unreasonable degradation of the marine environment will not be permitted. BOEM expects that all discharges from lease activities associated with LS 258 would comply with permit limits set forth by the NPDES program.

Some commercially available drilling fluids contain elevated concentrations of several trace metals and, if bioavailable (absorbed and utilized by a living system), can harm the local marine ecosystem (Neff, 2008). Barite, a mineral used in water-based drilling fluids, contains the trace metals Ba and Cr in concentrations above what is typically found in marine sediments (Melton et al., 2000; Neff, 1988). Other metals associated with barite can include Cu, Ni, Pb, and Zn, and hydrocarbons are also introduced to the environment with the discharge of drilling fluids (Breuer et al., 2004; Neff, 2008). Metals associated with solid barite particles that are present in the drilling fluids plume – which is suspended in the water column and also in the rock cuttings pile on the seafloor – are not bioavailable (Neff, 2008). Metals in solution in the sediment porewater (the water that fills the pores between the grains of sediment) or in the drilling fluids plume are more bioavailable and toxic than the solid, particulate metals (Simpson and Batley, 2007). For metals to cause harm to the aquatic ecosystem, they must be both bioavailable and of high enough concentrations to be potentially toxic (Neff, 2008). Results of almost four decades of field and modeling studies suggest that dissolved compounds and particulate matter from water-based drilling fluids are rapidly diluted (Neff, 2010). In the high-energy environments of Cook Inlet, little of the rock cuttings and fluids associated with drilling would be expected to accumulate near well sites because deposits are quickly transported away by strong currents (Hannah and Drozdowski, 2005). Consequently, drilling solids and fluids would be dispersed over large areas in low concentrations depending upon the hydrodynamics near the discharge (Neff, 2010). In areas lacking strong bottom currents, drill cuttings are typically concentrated within 500–1,000 m (820–1,640 ft) of the seafloor discharge location (Continental Shelf Associates, 2006; Neff, 1988, 2010), with the majority of drill cuttings deposited within 100 m (328 ft) (EPA, 2015a). The total seafloor area affected by exploration drilling discharges would depend on the number of wells drilled and local hydrodynamics. The temporary, short-term discharge of exploration and delineation rock cuttings and fluids coupled with rapid dilution with little to no seafloor accumulation of rock cuttings and fluids, would result in localized and short-term impacts to water quality.

Temperature and salinity are also considered pollutants and drilling fluids are typically warmer and more saline than marine waters. Localized and temporary increases in temperature and salinity would immediately be attenuated in the marine environment as drilling fluids are mixed with ambient seawater, with little to no impacts to water quality.

Other Discharges

An NPDES permit must be obtained from the EPA for all oil and gas operational discharges (including vessel discharges), during exploration, production, and decommissioning. Aside from exploration cuttings and fluids discussed above, discharges such as bilge water, ballast water, fire control system test water, cooling water, sanitary and domestic wastes, and deck drainage could contain a variety of nutrients, trace metals, and other pollutants. While these pollutants have the potential to impact water quality near the point of discharge, these discharges are expected to represent only small pollutant loadings when properly designed and functioning equipment is used, and little to no impacts would be expected. Production and development cuttings and fluids would not be discharged, but are assumed to be reused, reinjected, or barged to shore for onshore disposal (see Section 4.1.2 for E&D Scenario production and development assumptions); subsequently, no impacts to the marine environment would result from these specific discharges.

4.4.2.2 Oil Spills Impact Summary

Effects of spills, spill drills, and spill response activities on water quality are described in Section A-3.2 of Appendix A. Most accidental spills would be small, localized, and have relatively temporary and inconsequential impacts to water quality. Localized and short-term impacts to water quality could occur as a result of spill drill activities such as surf washing, shoreline flushing, in-situ burning and application of dispersants (see Section A-3.2.3 of Appendix A). A large oil spill would impact water quality in the area of the release and if the spill occurred under broken ice, it might have long-lasting, albeit localized, impacts. Long-term impacts could result should the spill reach the shoreline affecting estuarine and riverine waters. Spill response and cleanup activities could degrade water quality in the immediate area resulting from any flooding, washing, flushing, or other mechanical activities during the removal of shoreline contamination. A large gas release would temporarily displace oxygen in the water column, but this impact would be brief because gas migrates upward and ultimately dissipates into the atmosphere.

4.4.2.3 Conclusion

Post-lease activities, as described in the E&D Scenario, accidental spills, and spill drills would result in impacts to marine and estuarine water quality. The increase in TSS from construction activities would cause temporary impacts to water quality during, and for a short duration following, the construction period. Discharge of exploration and delineation well rock cuttings and fluids and other operational discharges would have short-term and localized impacts on the overall water quality. The overall impact of elevated TSS levels along with impacts from small spills and spill drills to water quality would be minor over the life of LS 258 exploration and development, as described in the E&D Scenario, and would not result in any long-lasting change to water quality nor its function in the ecosystem. The addition of a large oil spill and any ensuing spill response would increase the overall impact on water quality to moderate because the effects could be long-lasting and widespread. Hydrocarbon contamination could persist in sediments or ice and be reintroduced into the water column by weather, storm events, or tidal currents. Long-term persistence of hydrocarbon contamination in marine or shoreline sediments could continue for decades, particularly in remote locations.

4.4.3 Environmental Consequences of the Alternatives

Potential impacts on water quality under all action alternatives would not differ substantially from those described for the Proposed Action. These alternatives would not change the total level of activity considered in the E&D Scenario, and none of the restrictions identified in these alternatives would be expected to change the likelihood or severity of impacts on water quality. Consequently, impacts of these alternatives on water quality would be the same as those for the Proposed Action – minor over the life of the E&D Scenario, accidental small spills, and spill drills. The addition of a large oil spill and any ensuing spill response would increase the overall impact on water quality to moderate because the effects could be long-lasting and widespread.

4.4.4 Cumulative Effects

Past, present, and reasonably foreseeable future actions that could cumulatively impact the water quality of Cook Inlet and fresh or estuarine waters on surrounding lands include oil and gas operations, mining, marine transportation, ports and terminals, vessel traffic, and oil spills. Climate change is considered another source of cumulative effects on water quality. Potential impacts to water quality could result from increases in TSS, turbidity, and pollutants; increases in vessel discharges; an increased occurrence of large hydrocarbon spills; and climate change.

Localized and intermittent increases of TSS, turbidity, and pollutants directly into the water column resulting from routine and operational discharges during the exploration, production, and decommissioning stages of offshore oil and gas activities have occurred in the past and would be expected to occur for present and reasonably foreseeable future actions. The types of cumulative impacts from these activities would be the same as those described in Section 4.4.4. Resuspension of seafloor sediments and the introduction of suspended solids into the water column from discharges and seafloor disturbances resulting from pipeline installation and placement of anchors, nodes, cables, and sensors would create temporary localized sediment plumes.

Vessel activity in support of these activities would also diminish water quality on a seasonal and localized level. Although an increase in turbidity, TSS, and pollutants from these reasonably foreseeable future actions would be expected, the mandatory permitting requirements set forth by EPA's Vessel General Permit and the U.S. Coast Guard's (USCG) ballast water management regulations (33 CFR 151(D)) minimize and mitigate these discharges serving to assure that little to no impact occurs to the aquatic ecosystem.

Large oil spills have the greatest potential of all oil- and gas-related activities to affect water quality. The introduction of hydrocarbons into the water column in a dissolved, emulsion, and/or particulate phase would result in immediate exceedances of physical, chemical, human health, and aquatic life water quality criteria, and may result in acute or chronic effects to marine life. Although highly unlikely, Appendix A also considers the possibility of up to two additional large spills from sources other than those related to LS 258 post-lease activity. The magnitude of impact to water and sediment quality could be long-lasting, and widespread, depending upon the timing, location, environmental conditions, and other factors surrounding the release event(s).

Long-term and widespread impacts from the warming trend of climate change affecting the North Pacific Ocean (including Cook Inlet's marine and freshwater environments), include ocean acidification, rising sea levels, shoreline erosion, warming of surface water temperatures, and an overall decrease in levels of onshore surface waters. Ocean acidification has the potential to alter marine chemistry both by lowering the pH of the surface ocean and the saturation states of biologically important calcium carbonate ($CaCO_3$) (Cross et al., 2018). This reduction in calcium carbonate saturation state has direct impacts on marine life and threatens to fundamentally impact the marine ecosystem. Based on multiple lines of evidence, ocean acidification will continue to increase in the 21st century at rates dependent on future emissions (IPCC, 2021). Projections for the open ocean particularly at high latitudes could reach low calcium carbonate levels where dissolution of biogenic carbonate minerals preventing shell and skeleton formation in aquatic organisms occurs by the end of the century (Feely et al., 2009). Highlighting the vulnerability of Alaska's higher latitude marine waters, the global biogeochemical models have suggested that surface water corrosivity resulting from ocean acidification in the Chukchi and Beaufort seas will exceed the range of natural variability within the next 10–15 years (Mathis et al., 2015). Cook Inlet could also experience higher corrosivity levels, potentially impacting calcifying organisms such as clams, molluscs, and other organisms. Ocean acidification is projected to have negative effects on many species and the biological response to ocean acidification will be determined by the frequency, magnitude, and duration of variability in carbonate chemistry that result in conditions crossing important thresholds for specific biological organisms and life states (Mathis and Cross, 2014).

Mandatory water quality criteria require that state and federal permitted discharges, specifically those with limits on pH, temperature, and salinity, meet standards even as background pH levels potentially decrease over the 40-year E&D Scenario timeframe. Acidified, corrosive areas would impact offshore and onshore operations by driving new permit limits, particularly for these parameters. More stringent requirements for permit limitations would be imposed to mitigate against localized ocean acidification hot spots with the long-term goal of maintaining water quality suitable for aquatic life and human health. Should ocean acidification in nearshore waters reach threshold levels that would impact aquatic life, the State of Alaska would be obligated to list the Cook Inlet as an impaired waterbody in accordance with Section 303(d) of the CWA's listing requirements. This designation would in turn affect all point and non-point source discharges.

The effects of climate change, specifically earth's warming temperature and the increased uptake of CO_2 in oceanic waters, have the greatest potential for widespread, long-term disruptions on the biological, chemical, and physical quality of water. Rapid deglaciation increases freshwater runoff and associated TSS into the marine ecosystem affecting chemistry, biology, and flow dynamics into the marine environment. Coupled with the increase of hydrogen ions resulting from ocean acidification, chemical changes to marine water quality from climate change have the potential to cause disruptive impacts to the marine ecological system and the communities that depend on these coastal resources. Large, glaciated mountains, complex bathymetry, seasonally varying cycles of winds, high-sediment freshwater discharge, and extreme tidal currents set the stage for high physical, chemical, and biological spatiotemporal variability across the Gulf of Alaska, including Cook Inlet (Hauri et al., 2020). The large natural variability of this region makes it challenging to understand the inorganic carbon, nutrient, and ecosystem dynamics and to predict the potential impacts of the regional manifestation of climate change and ocean acidification on water quality, fisheries, and communities (Mathis et al., 2014). Attempting to analyze or predict more precise impacts resulting from the Proposed Action to climate change, particularly based on projections provided in the E&D Scenario, would be highly theoretical, lacking scientific rigor necessary for a robust impact analysis. Cumulative impacts to water quality, primarily due to climate change, are likely to be major, although the incrementally additive impact of the Proposed Action in the context of these past, present, and reasonably foreseeable future actions is negligible; however, when considering the long-lasting, widespread impacts resulting from a large oil spill, moderate cumulative effects could result.

4.5 Coastal and Estuarine Habitats

4.5.1 Affected Environment

Cook Inlet is a subarctic estuarine system approximately 350 km (218 mi) from north to south, and 200 km (124 mi) at its widest extent from east to west. Four major bays branch off Cook Inlet: Kamishak Bay, Kachemak Bay, and Turnagain and Knik arms (Renner et al., 2017). The inlet's waters are affected by numerous land-locked glaciers feeding streams and four major rivers (the Kenai, Knik, Matanuska, and Susitna) and constitutes the largest riverine drainage into the Gulf of Alaska (Benke and Cushing, 2010; Brabets et al., 2009).

Cook Inlet encompasses a wide range of coastal wetland habitats including along-shore and across-shore areas from the high to the low intertidal zones. Large rock platforms are found throughout Kamishak Bay, while steep rock shorelines are more common along the eastern shorelines of lower Cook Inlet. Many shorelines of upper and central Cook Inlet support extensive salt marsh habitats. Much of Cook Inlet is bordered by extensive intertidal mud and sand flats that grade into equally extensive vegetated tidal and supratidal wetlands. Supratidal, intertidal, and subtidal wetland communities are an important conduit of energy, nutrients, and pollutants between terrestrial and marine environments, and provide resources for subsistence, sport, and commercial harvest. They also are important for recreational activities such as wildlife and nature viewing.

4.5.1.1 Coastal Habitat Types and Wetland Ecology

The wetlands of Cook Inlet perform essential physical, chemical, biological, and ecological processes and functions. Some of the most prevalent functions served by wetlands include flood flow moderation and conveyance, production and export of organic matter, maintenance of soil thermal regime, shoreline erosion and sediment control, bird and mammal support, and resident and diadromous (migratory between salt and fresh waters) fish support. Not all wetlands perform all these functions, but most wetlands contribute to one or more in varying degrees (Hall, 1994).

Estuarine and marine deepwater habitats extend across nearly the entire upper Cook Inlet and are the predominant wetland/habitat type of lower Cook Inlet. Three estuarine wetlands located along the western coast of the lower Kenai Peninsula in the general vicinity of the Proposed Action's subsea pipeline landfall, include the mouths of the Anchor River, Stariski Creek, and Deep Creek. These estuarine wetlands and deepwater habitats are influenced by adjacent tidal wetlands and water runoff with a variable salinity. From the high tide line to a depth of 30 m (98 ft), rocky habitat in lower Cook Inlet supports kelp forests of split kelp (*Saccharina groenlandica*), and bull kelp (*Nereocystis luetkeana*) (Chenelot et al., 2001). The extent of the kelp forest occurrence along this coastal area was recently mapped by Zimmermann and Prescott (2014); they also illustrated smaller and less frequent kelp beds on the western side of Cook Inlet. The majority of the other kelp forests occur further south between MacDonald Spit and Port Graham, outside of the lease sale area.

Marine intertidal habitats of Cook Inlet consist of rocky substrates juxtaposed with sandy beaches, salt marshes, and tidal mud flats ranging from completely protected beaches to those with extreme wave exposure. Salt marshes are highly productive estuarine habitats that support a wide range of animal species including intertidal invertebrates, fish, birds, and mammals (Baird et al., 2007). Located on both the eastern and western coastlines of lower Cook Inlet, expansive salt marshes are found in low energy, tidally dominated areas such as heads of protected bays and fjords, behind spits, and in fringing coastal lagoons. Tidal inundation is critically important, delivering nutrient-rich sediments and water to the salt marsh. Coastal salt marshes include a wide range of plant community types dominated by dense stands of terrestrial salt-tolerant plants such as herbaceous sedges (*Carex spp.*) grasses (*Puccinellia spp)*, and low shrubs (*Potentilla spp*). Baird et al. (2007) extensively mapped three salt marshes in Trading Bay, Redoubt Bay, and Chickaloon Bay. The total area mapped comprised 7,640 ha (18,880 ac), however salt marsh vegetation can be difficult to determine particularly where salt marshes gradually transition into extensive freshwater marshes (Baird and Field, 2008).

Tidal flats appear at low tide largely as unvegetated expanses of mud or sand (Field and Walker, 2003). Intertidal flats often are mixed with areas of emergent estuarine wetlands or rocky shores and are associated with major river deltas such as those found on the west side of Cook Inlet. Mudflats are a common habitat in Cook Inlet and can extend for tens of kilometers (or miles) and be >1.6 km (1 mi) wide in the intertidal zone (Saupe et al., 2005).

4.5.1.2 Freshwater Wetlands

Along the western side, immediately adjacent to and north of the lease sale area, expansive mudflats and wide estuarine wetland environments are in Trading Bay, Redoubt Bay, Tuxedni Bay, and Chinitna Bay. Beyond the reach of tidal inundation, these wetlands transition into freshwater emergent wetlands where they are saturated by upland runoff, freshwater streams (including melt water from glaciers), rain, and/or groundwater. Freshwater wetlands are located along the western and eastern shores and uplands of Cook Inlet adjacent to estuarine coastal habitats and marine wetlands. The majority of freshwater wetlands are palustrine emergent wetlands characterized by erect, rooted, herbaceous hydrophytes (excluding mosses and lichens) present for most of the growing season and dominated by perennial plants. Further upland are scrub-shrub palustrine wetlands dominated by woody vegetation less than 6 m (20 ft) tall including true shrubs, young trees (saplings), and small and stunted trees exposed to severe environmental conditions.

4.5.2 Environmental Consequences of the Proposed Action

4.5.2.1 Habitat Alteration

Post-lease activities conducted as a result of LS 258, as described in the E&D Scenario, could impact deepwater habitats, estuarine, coastal, and freshwater wetlands. As discussed previously in the context of water quality, an increase in TSS and pollutants would be expected from drilling exploration and delineation wells; installation and removal of nodes, cables, sensors, production platforms, and pipelines; vessel anchoring, and vessel and other operational discharges. Construction of the onshore pipeline and associated landfall tie-in described within the E&D Scenario, while conducted within an established pipeline right-of-way and tying into existing infrastructure, would directly impact coastal estuarine and terrestrial wetland habitat by physical disturbance resulting from land clearing and trenching activities.

Many wetlands in freshwater, coastal, and marine areas are regulated by the USACE, and CWA permitting requirements mandate avoidance and minimization of impacts, which would likely decrease impacts to high-value wetland habitat. BOEM expects that all activities conducted in jurisdictional wetlands would be compliant with required permits and stipulations.

Resuspension of sediments following seafloor disturbance would temporarily increase TSS deeper in the water column (Section 4.4). Small, localized turbidity plumes resulting from scouring around seafloor structures and anchors could also result. Although elevated levels of TSS reduce light availability necessary for primary production throughout the water column (Anthony et al., 2004), the upper water column should not be impacted by elevated TSS levels unless activities occur in shallow water (approximately less than 10 m). The areal extent of turbidity increase resulting from seafloor disturbance activities would be unlikely to approach the levels associated with the input of glacial flour from streams draining into Cook Inlet (Saupe et al., 2005; Segar, 1995), or the highly fluctuating ambient levels of TSS that occur daily during tidal cycles and riverine runoff (Feely and Massoth, 1982). The strong and fast tidal currents of Cook Inlet would rapidly disperse and resettle TSS resulting in short-term, localized impacts to estuarine and marine deepwater habitat (Saupe et al., 2005).

Seafloor disturbance is expected to be minimized/attenuated because of the high-energy marine environment of Cook Inlet (Section 4.4), and therefore smothering of any intertidal and marine habitats would be minimized. The total area of seafloor and estuarine and marine wetland habitat affected by drilling discharges from exploration and delineation drilling would depend on the local hydrodynamics in the immediate discharge location. Short-term and localized impacts may result, in close proximity to the discharge, as a loss of essential wetland functions, such as supporting fish and benthic organisms, birds, and mammals, which could be interrupted until the discharge ceases and the impacted seafloor recovers (Sections 4.6, 4.7, and 4.8).

Other operational discharges from well drilling, field development and operations, and vessel discharges are authorized by the appropriate EPA NPDES permit. Specific to each discharge are testing requirements, compliance mandates, and other permit conditions required for approved offshore operations. Regulatory oversight and permit mitigations serve to ensure that little to no impact to coastal and estuarine wetland habitats are expected.

Onshore Pipeline Construction and Support Activities

Physical disturbance to estuarine and freshwater wetlands by land clearing, removal of water, native soil, rock and vegetation, and trenching activities would directly impact wetland habitat and disrupt their associated functional ecological services during and following construction. Approximately 119 ha (295 ac) of coastal intertidal, palustrine emergent and palustrine scrub-shrub wetlands (including stream and river crossings) and their functional ecological services would be directly impacted by construction of new pipeline landfalls and 80 mi of onshore pipelines.

Habitat disturbance could result from altered surface and subsurface water flow to wetlands and vegetation resulting in localized flooding, drying, impounding, and increased sedimentation. Relatively small changes in water balance can alter surface soil or groundwater sufficiently to reduce wetland size or initiate conversion of a wetland to an upland (Klein et al., 2005). Reclamation of wetland habitat is complex, site-specific, and the duration of recovery highly dependent upon the wetland type, plant species, and the local hydrologic regime (Zedler, 2000). Vegetation recolonization in successional stages would be expected with pioneering grass and weed species initiating colonization the following growing season, followed by upland vegetation and shrubs within 2–3 years, and up to 10 years for native tree species.

Impacts to wetlands from landfall and pipeline construction during development resulting from post-lease activities conducted as a result of LS 258, as described in the E&D Scenario, would result in localized effects to coastal and freshwater wetlands, albeit with slower recovery expected for select wetland habitats.

4.5.2.2 Oil Spills Impact Summary

Effects of spills, spill drills, and spill response activities on coastal and estuarine habitats are described in Section A-3.4 of Appendix A. Most small, accidental spills of crude oil would have localized and relatively slight impacts. Slight damage to shorelines, vegetation, and wetlands could occur during spill drill activities as discussed in Section A-3.4.3 of Appendix A, but impacts would be localized and temporary. Heavy oiling of shorelines, substrate, and emergent vegetation resulting from a large crude oil spill would be damaging and cause long-term impacts to coastal and estuarine habitats. Spills during the winter would cause far less impact to vegetated wetlands than spills that occur during the active summer growing season. Diesel or refined product spills of any size would damage or be lethal to exposed vegetation on contact. Spill response activities could cause impact by damaging vegetation and/or spreading oil contamination further into shoreline sediments. A gas release would be expected to volatilize quickly and not result in ignition and burning of vegetation.

4.5.2.3 Conclusion

Short-term and localized impacts to coastal and estuarine habitat resulting from seafloor disturbance activities, discharges, pipeline landfalls, and onshore construction would be expected. Impacts from accidental small spills and spill drills would range from none to short-term and/or localized for coastal and estuarine habitats. The localized impacts from post-lease activities associated with LS 258 as described in the E&D Scenario would be minor. These minor impacts would not result in any long-lasting detrimental effects on the overall ecological functions, species abundance, or composition of marine or freshwater wetlands or plant communities of Cook Inlet, and most wetland habitat would be expected to recover following decommissioning.

The addition of a large oil spill and spill response could increase the impact to coastal and estuarine habitats to major, depending upon the location and timing (Section A-3.3, Appendix A). Contamination of freshwater and marine wetland sediments could continue to expose wetland vegetation to potentially toxic levels of hydrocarbons, particularly in remote areas where access for immediate spill response is limited. Oil stranded in freshwater and marine wetland sediments that is not in contact with flowing water is resistant to biodegradation and could be expected to persist for decades.

4.5.3 Environmental Consequences of the Alternatives

Potential impacts on coastal and estuarine habitats under all action alternatives would not differ substantially from those described for the Proposed Action. Coastal and estuarine habitats are transitional habitats located between deepwater and upland habitats and are more influenced by their association with land than the marine systems. These alternatives would not change the total level of activity under the E&D Scenario, and none of the restrictions identified in these alternatives would be expected to change the likelihood or severity of impacts on coastal and estuarine wetlands. Consequently, impacts of these alternatives on coastal and estuarine habitats would be the same as those for the Proposed Action — minor for E&D Scenario activities, accidental small spills, and spill drills. The addition of a large oil spill and associated spill response could increase the impact to coastal and estuarine habitats to major, depending upon the location and timing of the spill.

4.5.4 Cumulative Effects

Past, present, and reasonably foreseeable future actions that could affect coastal and estuarine habitats include oil and gas, vessel traffic, marine transportation, ports and terminals, mining, residential and community development, oil spills, and climate change. Coastal and estuarine habitats surround Cook Inlet and consequently, all nearshore and onshore activities have the potential to disturb or harm coastal and estuarine habitats and terrestrial wetlands. Potential impacts to coastal and estuarine habitats have occurred in the past, are presently occurring, and are anticipated to continue in the future. These stem from an increase in TSS, turbidity, and pollutants from operational, vessel, residential and municipal discharges; habitat loss and impacts from nearshore and onshore facility and community related construction; and changing climate.

Increases in TSS, turbidity and pollutants from operational discharges from oil and gas activities, mining activities, vessel discharges, effluent from existing municipal and industrial discharges, and routine operations at port facilities all increase pollutant loadings in marine coastal and estuarine habitats. Most current discharges are not in the immediate vicinity of the lease sale area, but the effects of additional operational discharges occurring in Cook Inlet could overlap in time and space, having an additive effect. The types of cumulative impacts from elevated TSS levels would be as those described for the activities associated with the E&D Scenario (Section 4.1). Operational discharges, including vessel discharges, are regulated and require either a federal (NPDES) permit authorized by the USEPA, or a state (Alaska Pollutant Discharge Elimination System (APDES)) permit authorized by the Alaska Department of Environmental Conservation. Regulatory oversight coupled with the rapid dispersion and dilution of wastewater discharges in Cook Inlet are anticipated to result in minimal cumulative impacts.

Nearshore and onshore development of oil and gas facilities and pipelines, mining, residential, commercial, public and military facilities, airstrips, and other infrastructure have impacted coastal and estuarine habitats and terrestrial wetlands. Loss and irreversible impacts to coastal and estuarine habitat and terrestrial wetlands have resulted from ground disturbance, removal of vegetation, wetland fill, and alteration of water and wetlands resulting in ponding and/or drying. The 119 ha (295 ac) of wetland disturbance resulting from 129 km (80 mi) of onshore pipeline construction identified in the E&D Scenario, although localized and of minimal size, is additive to wetland disturbance and loss from other activities, increasing the total acreage of coastal and estuarine habitats and terrestrial wetlands affected. The USACE has regulatory authority over jurisdictional wetlands in freshwater and nearshore coastal wetlands. Permitting requirements mandate avoidance and minimization of impacts, which would likely decrease impacts to wetland habitat from pipelines or shore based facilities.

The impacts to coastal and estuarine habitats from a large oil spill would have short- to long-term and localized to widespread impacts (Section 4.5.2). Although highly unlikely, Appendix A considers the possibility of up to two additional large spills from sources other than those related to LS 258 post-lease activity. The magnitude of impacts expected from such repetitive spills may increase to severe depending on the timing, location, environmental conditions, and other factors surrounding the spill and release event(s). Contamination to estuarine wetlands and sensitive shorelines from hydrocarbons has the greatest potential for long-term, widespread impacts by impacting highly productive wetland habitat and marine sediments.

Impacts from a warming climate that have been observed in Alaska include earlier snowmelt, reduced sea ice, glacial retreat, warmer/melting permafrost, drier landscapes, increased wildfires, and more extensive insect outbreaks. These changes may result in lower soil moisture due to increased evaporation during warmer summer months. Additionally, a precipitation shift from snow to rain could lead to less water stored as snowmelt, which is an important water source for wetlands in the spring and summer. In turn, less water storage could lead to drier meadows or bogs, and possibly fewer terrestrial wetlands. Also, projected rising sea levels could lead to the loss of tidal wetlands and the ecological services they provide.

Warmer temperatures and less precipitation during the growing season would potentially affect the onshore vegetation and wetlands in the drainage of, and adjacent to, Cook Inlet. The forested Cook Inlet lowlands that currently cover the western half of the Kenai Peninsula could become a dryer grassland with mixed grass-shrub prairie (SNAP, 2012). This portion of the Kenai Peninsula includes the 119 ha (295 ac) of wetlands expected to be impacted from the 129 km (80 mi) of onshore pipeline construction associated with the E&D Scenario.

Overall, the cumulative impact to estuarine and coastal habitats resulting from past, present, and reasonably foreseeable future actions and a changing climate, including the incremental contribution from LS 258, as described in the E&D Scenario, would be minor. This includes both offshore activities and the short-term, localized contribution of onshore wetland disturbance from pipeline construction associated with the E&D Scenario. Although temporary, short-term, localized impacts would be expected from E&D activities, federal and state regulatory mitigation would ensure that little to no measurable impacts to coastal and estuarine habitats would ensue. When considering the impacts from large oil spills, the impact to coastal and estuarine habitats could increase to major.

4.6 Fish and Invertebrates

4.6.1 Affected Environment

Cook Inlet is home to many species and communities of fish and invertebrates in habitats ranging from the intertidal zone to the open ocean. Lower Cook Inlet is an upwelling area influenced by fresh and marine water mixing (Abookire et al., 2000; Sambrotto and Lorenzen, 1987). Pelagic species are associated with the water column and include very small algae (phytoplankton), zooplankton, and fish. Nutrient availability and tidal activity heavily influence the distribution of these organisms. Benthic communities include the plants, fish, and invertebrates that live on or in the seafloor; depth and sediment composition play important roles in their distribution. Some species of fish and invertebrates are harvested for subsistence, personal, or commercial use, while other non-harvested prey species help support a healthy ecosystem structure.

Individual population sizes for fish and invertebrates can vary throughout Cook Inlet geographically and over time. Broad community changes can be the result of climate changes, and these shifts in community structure can have wide-ranging effects on the food web. In the 1970s, the coastal ecosystem of the Gulf of Alaska underwent a shift from a community dominated largely by crustaceans to one dominated by several species of fish (Anderson, 2000; Anderson and Piatt, 1999; Ware, 1995). Range expansions can bring new species of fish and invertebrates into Cook Inlet, and community structures can be highly malleable. Changes in the lower trophic community due to regime shifts during the timespan considered in the E&D Scenario are likely to echo throughout the food web (Hare and Mantua, 2000).

4.6.1.1 Pelagic Fish and Invertebrates

Organisms that live in the water column include plankton, which are transported by currents, and free-swimming animals like fish. Plankton can include small algae called phytoplankton that rely on light availability, and zooplankton, which are the small animals that eat phytoplankton. Some species are only pelagic during larval stages. The pelagic habitat of Cook Inlet is highly productive, especially in the spring and summer when plankton blooms occur. Productivity remains high throughout the summer due to tides and nutrient-rich benthic sediment mixing (Piatt, 2002). Plankton tend to have rapid growth and reproduction rates coupled with short life spans (Abbriano et al., 2011), and are an important part of the food web because they provide energy and prey for higher-level predators like fish and birds.

Many species of fish occupy the pelagic region of Cook Inlet. Seasonal migrations are common. Some pelagic fish are anadromous, which means they live part of their life in freshwater and part in the marine environment; other species live their entire lives in the ocean environment. Forage fish, which can be either anadromous or marine residents, are a particularly vital link in the regional food web because they are energy-rich prey for fish, birds, and mammals (Abookire and Piatt, 2005; Springer and Speckman, 1997).

Anadromous fish such as salmon, smelt, and eulachon, are often seasonally abundant due to their spawning migrations when adults return to freshwater streams to reproduce. The timing of these migrations are species dependent but can also be affected by temperatures and environmental conditions. For example, longfin smelt are influenced by the temperatures of the freshwater streams and their migration timing can vary from April through December, while eulachon runs are mostly in April and May (ADF&G, 2020b; Bartlett, 2012). Salmon run migration depends on species and can occur from May through November, but the highest abundances are generally in June–August. Eggs develop in freshwater streams, hatch, and then the juveniles drift downstream where the young fish enter the marine environment to grow to maturity. Cook Inlet is a migratory corridor and early life rearing area for all five species of Pacific salmon (NPFMC, 2018) and sub adult and adult salmon are present in the area year-round. Additionally, Cook Inlet contains many freshwater streams that are important for spawning. Sockeye salmon support one of the most important commercial fisheries on the Pacific coast of North America and are increasingly sought after in recreational fisheries. However, all species of Pacific salmon are an important mainstay of many subsistence users.

Pelagic marine resident fish include Pacific sand lance, capelin, and Pacific herring. These fish live in the marine environment year-round but may still be concentrated in specific areas during spawning. These fish, along with smelt and eulachon, are also classified as forage fish because they are an important food source for higher-level predators. Forage fish tend to school, often in nearshore areas, and spawn in or near the intertidal zone. They feed on zooplankton and are in turn fed upon by other fish, birds, and mammals, especially when they are present in large spawning aggregations. Changes in forage fish ecology have been linked to changes in predator populations (Brown, 2002; Piatt, et al., 2020; Robards et al., 1999). While abundance and distribution of these schooling fish varies, forage fish occur throughout Cook Inlet with fish densities greatest during summer. Both capelin and Pacific sand lance have ranges over most of Alaska (Mecklenburg et al., 2002). Pacific sand lance are abundant in shallow, nearshore areas that are typically sandy or fine gravel in the intertidal zone and will sometimes bury themselves in the sand. Pacific herring occur in large schools in Cook Inlet from the spring through the fall. Spawning occurs in the spring in shallow intertidal and subtidal zones, including Kamishak Bay. Herring spawn extensively along much of the Shelikof coast of Kodiak Island and the southern Alaska Peninsula, areas that are outside the lease sale area but could be impacted by a large oil spill (Hollowell et al., 2016; Mecklenburg et al., 2002).

4.6.1.2 Benthic Fish and Invertebrates

Intertidal and shallow subtidal communities of eastern lower Cook Inlet are similar to those in the Gulf of Alaska, while communities in western lower Cook Inlet more closely resemble those in subarctic and Arctic seas (Foster et al., 2010; Lees et al., 1980), although some overlap occurs. Dominant invertebrate species within intertidal and shallow subtidal communities include grazers (e.g., sea urchins, chitons, and limpets), filter feeders (e.g., mussels, clams, anemones, and sponges), and predators/scavengers (e.g., sea stars, snails, and crabs) (Foster et al., 2010; Jones et al., 2019). More specifically, rocky habitats are dominated by sedentary filter feeders, like anemones and mussels, but also have crabs, snails, sea stars, and urchins. Sandy, silty, and muddy intertidal substrates also have grazers and filter feeders, but are more likely to have worms, amphipods, and clams (Mundy, 2005). Deeper sandy areas are dominated by razor clams and muddy beaches are typically dominated by several species of clams and worms. Areas with a lot of shell debris generally have the most diverse communities (Lees et al., 1980; NOAA, 1977). Deeper communities, which exist beneath the normal tidal flux zones, often have crabs, sea urchins, shrimp, kelp, and fish as well as molluscs and worms (Lees et al., 1980; NOAA, 1977). Generally, these varied communities are prey for groundfish and mobile scavengers, like crabs, and are therefore necessary components of the ecosystem. Several species of invertebrates found in Cook Inlet are the targets of subsistence, sport, or commercial fisheries.

Many species of crabs and shrimp found in Cook Inlet are important for human use. Tanner, king, and Dungeness crabs, which are all harvested commercially in Alaska, are found in the lease sale area. Tanner crabs are widely distributed throughout the region on the continental shelf and in coastal waters. King crabs occur year-round in and around Kachemak and Kamishak bays, with the rocky shallow outer portions of Kachemak Bay acting as nursery areas (Feder and Jewett, 1988; NOAA, 1977). Dungeness crabs are widely distributed subtidally and prefer a sandy or muddy bottom in the sea but can be found in estuarine environments. Northern and humpy shrimp are captured in the commercial trawl shrimp fishery in Alaska. Coonstripe and spot shrimp are commonly found in Cook Inlet and are the target of various pot shrimp fisheries around Alaska.

In addition to the previously discussed crustaceans, littleneck, razor, and butter clams are bivalve molluscs commonly found in commercial and sport fisheries. They live in the sediments of sandy and rocky beaches, where they can filter feed during high tides. Cook Inlet has many areas, such as Kachemak Bay, where clams are harvested for the personal use fishery. Weathervane scallops, another filter feeding mollusc, are found on seafloors of sand, gravel, and rock in subtidal areas. Like most filter feeders, molluscs are sensitive to changes in water quality, especially from oil.

Fish, both benthic and pelagic, are important components of the food web because they feed on lower trophic organisms such as plankton, and serve as prey for other fish, birds, and mammals. In contrast to pelagic fish, benthic fish remain near the seafloor for much of their lives. Spawning and early life development, however, may be in pelagic waters. Commonly occurring species or families of fish in Cook Inlet include cods, flatfish, rockfish, sculpins, lingcod, greenlings, poachers, skates, and pricklebacks (Mecklenburg et al., 2002; NPFMC, 2019). Most benthic fish are resident year-round. Generally, they prey on invertebrates or fish and are found in a variety of habitat types and depths throughout Cook Inlet. Some species are commercially important, like Pacific cod, Pacific hake, Pacific halibut, and walleye pollock. Pacific cod form aggregations during the peak spawning season, which extends approximately from January through May (NPFMC, 2019). Walleye pollock occurs throughout the lease sale area, with a large spring spawning aggregation in Shelikof Strait. This commercially harvested species can sometimes inhabit pelagic waters but is managed as a groundfish. Pacific halibut, which are found throughout Alaskan waters, inhabit much of the lease sale area. Spawning takes place in waters deeper than 350 m (1,148 ft) along the continental shelf in the winter. Rockfish, a grouping that can include several species, are present throughout most Alaskan waters, often in rocky areas. They are long lived and are present in Cook Inlet year-round.

4.6.2 Environmental Consequences of the Proposed Action

4.6.2.1 Noise

Post-lease activities conducted as a result of LS 258, as described in the E&D Scenario, which produce noise impacts to invertebrates and fish include seismic surveys, platform installation, drilling, and vessel traffic. Fish rely heavily on sensory perceptions of sound and pressure to feed, avoid predation, swim, and communicate, but the impacts of anthropogenic noise on fish and invertebrates is still varied (Popper and Hawkins, 2019). In general, there could be behavioral and physical effects to mobile fish at less intense sounds, and acute effects for individuals within a few meters of an intense sound source (McCauley et al., 2003). Death or physical damage can occur if animals are unable to escape close range exposure to intense noise, particularly from activities like seismic surveys or pile-driving (Day et al., 2017; McCauley et al., 2017). Injury to the auditory nerve, hair cells, or swim bladder can be temporary or permanent (Halvorsen et al., 2012). If recovery from injury is slow or does not occur, individuals would be susceptible to physical impairment, disease, and predation. Planktonic organisms and immobile invertebrates would not be able to leave the area of noise exposure, but fish capable of swimming away will likely escape the area. Generally, noise impacts would affect a few individuals but would not result in changes to overall population or community structure.

Noise from drilling tends to be stationary, less intense, and persistent when compared to noise from seismic surveys, which are in motion, more intense, but short-term. General vessel noise tends to be transient and very localized but doesn't have the acute noise associated with seismic surveys. Although exposure to intense noise may harm planktonic organisms within a few meters of the sound (Dalen and Knutsen, 1987; McCauley et al., 2003), these communities have short lifecycles with high reproductive potential and can recolonize from adjacent areas through currents, so population-level impacts are unlikely (Abbriano et al., 2011). The intensity of drilling sound is less than airgun arrays, and fish and mobile invertebrates may avoid the area around the wellsite until they become habituated (Fewtrell and McCauley, 2012). If this zone of displacement is located in important spawning or feeding habitat, affected species may not be able to access preferred habitat.

Impacts from noise to fish and invertebrate communities may have acute effects on individuals close to the noise source, but overall population impacts are not expected because the noise will be temporary, and individuals will habituate or leave the area. Seasonal restrictions on seismic surveys may limit some of the effects of noise on organisms near spawning grounds. The area of impact is dependent on a variety of factors, including distance from the source and the bathymetry of the local area, but impacts from noise would generally be localized and short-term.

4.6.2.2 Habitat Alteration

Alteration of habitat for fish and invertebrates could occur from installation of drilling structures and pipeline trenching. These impacts, aside from the presence of drilling platforms, would primarily occur during construction and decommissioning and would not be present throughout the life of the E&D Scenario. Changes in fish and invertebrate communities would be short-term relative to the E&D Scenario lifespan and would generally be limited to the area immediately around the footprint of the activity. The area of habitat altered would be a very small portion of the overall fish and invertebrate habitat available in the lease sale area.

Placement of drilling structures and pipeline trenching would alter the seafloor habitat and could crush benthic species, resulting in injury or mortality to individual organisms (Daigle, 2011; Manoukian et al., 2010; Montagna et al., 2002). Fish are likely to swim away from the area of disturbance, which would decrease the number of individuals affected by drill structure placement and pipeline laying. Many benthic invertebrate species are immobile or slow moving and cannot leave the area. Construction could kill or injure any animals caught in the footprint of the activities, although the area affected would be very small (~0.14 ac/platform, and 291 ac for pipelines) relative to the area of the Cook Inlet lease sale area. Platform installation and pipeline trenching may locally and temporarily increase turbidity as sediments on the seafloor are mixed into the water column (Section 4.4). This could affect marine invertebrates and fish by decreasing visibility, impacting predation success, clogging gills, and smothering seafloor communities (De Robertis et al., 2003). Turbidity would likely return to ambient levels once construction activities are completed; for the majority of the life of the project, local turbidity would not be increased.

Although some habitat may be lost when drilling structures are placed, addition of structures as new habitat may mitigate impacts of benthic habitat loss for some species (Daigle, 2011; Fujii, 2015). Platforms, once in place, could provide hard substrate habitat for some species, though the immediate area around the structures may have very different habitat functions and biological communities than in the pre-construction period (Gallaway and Lewbel, 1982), especially if hard substrate is added to an area that was previously sandy or muddy. Fish and benthic organisms likely would resume use of the area around and on platforms after the initial construction is over (Fabi et al., 2004; Stachowitsch et al., 2002). Lights associated with structures would illuminate surrounding waters and could attract prey organisms, providing an enhanced foraging environment (Keenan et al., 2007; Shaw et al., 2002).

Based on post-lease activities described in the E&D Scenario, a small area of the seafloor habitat, relative to the overall area of habitat available to fish and invertebrates in Cook Inlet, could be altered by platform installations or pipeline trenching. Although presence of drilling structures will span the life of the E&D Scenario, impacts would be highly localized to the structures.

4.6.2.3 Disturbance

Post-lease activities resulting from LS 258, described in the E&D Scenario may disturb fish and invertebrates through water intake structures, discharges associated with exploration drilling, and vessel traffic. Activities causing disturbance would occur throughout the life of the E&D Scenario.

Water intake structures on platforms can trap plankton as well as larval or weak-swimming juvenile fish, resulting in localized impacts including decreased biomass, diversity, and productivity (Choi et al., 2012). Water intake structures usually do not affect benthic species, which live on the seafloor and away from the intake area, and adult pelagic fish, which can swim away. Section 316(b) of the CWA requires USEPA to issue regulations on the design and operation of intake structures in order to minimize adverse impacts. Discharged water may be a different temperature than the ambient levels, and may contain trace amounts of chemicals, which could shock or kill some individual organisms that are right next to the discharge point. Discharged water would rapidly dilute, mixing to background levels. Cooling water intake requirements are included in USEPA's NPDES permit regulations at 40 CFR Parts 122 and 125 Subpart N. Overall, water intake structures may negatively affect zooplankton and larval fish throughout the life of the scenario, as described above, but these impacts would be limited to a discrete area around the intake structures and minimized through USEPA's permitting requirements. Additionally, discharges found to cause an unreasonable degradation of the marine environment will not be permitted, thus minimizing the effect of water treatment discharges on plankton and fish larvae.

Discharge of drilling fluids and cuttings can disturb the water column and seafloor immediately around the drilling area (Section 4.4). Where drilling fluids and cuttings settle on the seafloor, there could be localized impacts on the benthos and prey organisms through chemical toxicity, change in sediment texture, or burial of individual organisms (Blackburn et al., 2014; Neff, 2010). An increase in suspended particle concentrations from the discharge of drilling fluids and cuttings may clog the gills or digestive tracts of zooplankton or benthic filter-feeding invertebrates. Juvenile and adult fish, which would swim away and eventually reoccupy the area, are not likely to experience lethal effects from exposure to permitted discharges (Neff, 1987). The discharge of drilling fluids and cuttings is regulated and is not likely to cause persistent toxic effects in fish or invertebrate communities near the discharge. In high-energy environments such as Cook Inlet, where accumulations of cuttings and toxic concentrations are not expected (Section 4.4), impacts to fish and invertebrate populations are unlikely, since only small numbers of individuals may be affected. Biological effects of offshore developments would be limited and highly localized, with benthic recovery occurring after drilling ceases. Changes in benthic communities could change the prey availability for predators, but bioaccumulation of contaminants is not likely (Neff, 2002). Benthic communities would likely recover once drilling has ceased, which would minimize long-term impacts to fish and other invertebrates.

Fish and invertebrates in the coastal and marine environments could be disturbed by the presence and passing of vessels associated with the E&D Scenario. Pressure waves from vessel hulls could displace or injure larval fish and plankton (Hawkins and Popper, 2012, 2017). Vessel traffic impacts would be short-term, transitory, and limited to the areas immediately surrounding a vessel. Plankton are very common throughout Cook Inlet, so the impacts on individuals would not result in impacts to the overall populations.

4.6.2.4 Oil Spills Impact Summary

Effects of spills, spill drills, and spill response activities on fish and invertebrates are described in Section A-3.5 of Appendix A. Most accidental small spills or spill drills would be localized, and have relatively limited impacts to populations of fish and invertebrates. In general, small spills would not have population-level impacts and would impact relatively few habitats. A large oil spill could have similar toxic effects on fish and invertebrates as described for small spills, but the magnitude and severity would be greater, and could result in multi-generational effects. Toxic effects on organisms could occur in the immediate area of a spill or in areas where oil accumulates. Exposure to oil can cause abnormal development and growth, reproductive damage, and behavioral changes (Section A.3.5, Appendix A) that can affect the fitness of a population of fish or invertebrates. A large spill, depending on the season and location, could be difficult to contain and might result in longer-term habitat impacts, as well as affecting more individuals than a small spill. Prolonged exposure, whether through repeated small spills or extended exposure to a large spill, could have an increased adverse effect on fish and invertebrates because residual oil can build up in sediments. Migratory fish could be affected by a large oil spill in spawning and rearing habitats. Effects of a large spill in nearshore intertidal areas could persist for generations and may be compounded by affecting more than one life stage. One study into the effects of the 1989 Exxon Valdez oil spill in Alaska shows that embryonic salmon and herring exposed to very low levels of crude oil can develop hidden heart defects that compromise their later survival, indicating that the spill may have had much greater impacts on spawning fish than previously recognized (Incardona, J., Carls, M., Holland, L. et al., 2015). The impacts of a large spill could be widespread, long-lasting, and would require spill response and cleanup, which itself can affect organisms through use of dispersants and mechanical recovery methods (Section A-3.5, Appendix A). These long-lasting effects would not be likely to affect the majority of the lease sale area or cover the entirety of available habitat in Cook Inlet, thus limiting the severity of effects to the specific areas of oiling on a regional scale. Recovery would be expected in the affected area, possibly after many years, while unoiled areas would not be impacted. A large gas release could cause death or physical damage to organisms in the immediate vicinity.

4.6.2.5 Conclusion

Impacts from noise, habitat alteration, disturbance, accidental small oil spills, and spill drills on fish and invertebrates in Cook Inlet would be short-term and localized to the area of activity. While certain impacts would occur over many years (such as habitat alteration through addition of platforms or presence of vessels in the region), the area of effect would be limited to the immediate vicinity of the structure or activity. While impacts may be acute for individuals present in the area of an impact (for example, damage caused by drill structure placement), changes to the overall population dynamics are unlikely given the high likelihood of recolonization from adjacent areas. In general, most impacts are not anticipated to result in a clear, long-lasting change in the resource’s function in the ecosystem. A large oil spill may increase impacts on fish and invertebrates since population structures may change, resulting in long-lasting and/or widespread effects. The post-lease activities described in the E&D Scenario, which generally are expected to have minor impacts, could have up to moderate impacts on fish and invertebrates if a large oil spill occurs.

4.6.3 Environmental Consequences of the Alternatives

4.6.3.1 Alternatives 3A, 3B, and 3C – Beluga Whale Critical Habitat Exclusion, Critical Habitat Mitigation, and Nearshore Feeding Areas Mitigation

Potential impacts on fish and invertebrates under Alternatives 3A, 3B, and 3C would not differ substantially from those described for the Proposed Action. Excluding some OCS blocks from LS 258, as with Alternative 3A, would preclude impacts from occurring in the excluded area. Limiting seismic surveys and decreasing noise from platforms near major anadromous streams, as with Alternatives 3B and 3C, would eliminate or decrease the impact of seismic sounds for a large part of the year, which could be beneficial to anadromous fish on spawning migrations. However, since the organisms in this area are similar to those throughout Cook Inlet, the mitigation alternatives do not change the types or severity of overall impacts on fish and invertebrate communities for Cook Inlet compared to the Proposed Action. Under these alternatives, impacts to fish and invertebrates from E&D Scenario activities, accidental small spills and spill drills would remain minor, but could range up to moderate if a large spill occurs.

4.6.3.2 Alternatives 4A and 4B – Northern Sea Otter SW Alaska DPS Critical Habitat Exclusion or Mitigation

Potential impacts on fish and invertebrates under Alternatives 4A and 4B would not differ substantially from those described for the Proposed Action. Excluding some OCS blocks from LS 258, as with Alternative 4A, would preclude impacts from occurring in the excluded area. Prohibiting drilling discharges within 1,000 m (3,280 ft) of critical sea otter habitat, as with Alternative 4B, may benefit those areas of benthic habitat. However, since the organisms in this area are similar to those throughout Cook Inlet, this alternative does not change the types or severity of overall impacts on fish and invertebrate communities for Cook Inlet compared to the Proposed Action. Under this alternative, impacts to fish and invertebrates from E&D Scenario activities, accidental small spills and spill drills would remain minor, but could range up to moderate if a large spill occurs.

4.6.3.3 Alternative 5 – Gillnet Fishery Mitigation

Potential impacts on fish and invertebrates under Alternative 5 would not differ substantially from those described for the Proposed Action. Reducing the level of seismic activities during peak salmon spawning times would benefit those fish populations. However, since the organisms in this area are similar to those throughout Cook Inlet, this alternative does not change the types or severity of overall impacts on fish and invertebrate communities for Cook Inlet compared to the Proposed Action. Under this alternative, impacts to fish and invertebrates from E&D Scenario activities, accidental small spills and spill drills would remain minor, but could range up to moderate if a large spill occurs.

4.6.4 Cumulative Effects

Sources of cumulative impacts on fish and invertebrates include oil and gas operations, vessel traffic, oil spills, and climate change (Section 3.2). Most effects of the post-lease activities described in the E&D Scenario are temporary and unlikely to substantially overlap in time and space with the actions described in Past, Present, and Reasonably Foreseeable Future Actions (Section 3.2). However, where the actions do overlap, impacts from noise, habitat alteration, and disturbance may be expected, and are likely to be similar to the effects described for the E&D Scenario. Although highly unlikely, Appendix A also considers the possibility of up to two additional large spills from sources other than those related to LS 258 post-lease activity. Large or chronic oil spills could have a cumulative effect on fish and invertebrate communities in Cook Inlet through reduced fitness or, if chronic exposure occurs in a given area, changes in population and community structure.

Climate change is likely to have a widespread, persistent impact on the habitat and distribution of fish and invertebrates. Warming oceans, increased acidity, and other factors associated with climate change could cause or contribute to further regime shifts in fish and invertebrate communities of Cook Inlet (Cheung et al., 2009; Sherman et al., 2009). Ocean acidification can increase mortality, disrupt seasonal plankton production, make it more difficult for fish and invertebrates to grow and reproduce, and increase the effects of harmful algal blooms (Fabry et al., 2008; Tatters et al., 2012). Range expansions may bring new species into Cook Inlet, while other species may become less prevalent. These changes could also allow invasive species to colonize previously unavailable areas. Invasive species, if established in Cook Inlet, could disrupt the local food web through increased competition for resources, preying on native species, or introduction of pathogens. These cumulative modifications can result in changes in prey and nutrients available for predators higher in the food web such as fish, birds, and mammals. Shifts in the food web as a result of changing climate could result in major ripple effects, with some predators forced to eat non-optimal prey items, or preferred feeding spots becoming unavailable. Some species may benefit from shifts in the environment. The presence of different species in Cook Inlet would affect how the E&D Scenario's effects are observed. However, a more precise description of such changes is unduly speculative at this time given the complexity of these issues and the lack of precision in climate change models. Any changes in fish and invertebrate communities that occur through time would be assessed in each successive EP- and DPP-specific NEPA review process.

While many cumulative impacts are foreseeable, the addition of the Proposed Action to the past, present, and reasonably foreseeable future actions (Section 3.2) is not expected to have widespread or persistent impacts to the health or community structure on the fish and invertebrates living in Cook Inlet. The potential impacts of the Proposed Action would likely be small, incremental contributions to the overall cumulative effects that are limited to localized areas and times. Where impacts may overlap the life of the E&D Scenario, such as climate change or increased vessel traffic, the Proposed Action will have no discernable additive or synergistic effect that was not already considered in the effects analysis. Although the cumulative impacts to fish and invertebrates is likely to be major, primarily due to climate change, the incrementally additive impact of the Proposed Action in the context of these past, present, and reasonably foreseeable future actions is negligible.

4.7 Birds

4.7.1 Affected Environment

Cook Inlet is diverse in habitat types and is a flight corridor for migrating birds. This habitat diversity supports a wide variety of marine birds, landbirds, raptors, and other birds (Arimitsu, Schoen et al., 2021; Day et al., 2005a).

Almost 250 bird species, half of Alaska's total, use lower Cook Inlet during some part of the year (West et al., 2011). Large populations fly up and across Cook Inlet during spring and fall migrations. Many stop to rest and feed in large aggregations, to stage in preparation for migration, or to gather to molt post-breeding. Many also breed in summer in coastal habitats of lower Cook Inlet and winter in its open waters. Several bird species are considered endemic to Cook Inlet in that this is the only place in the world that they typically occur during all or part of their life cycle. Kenai song sparrow, breeding Tule white-fronted goose, and wintering Pribilof Island rock sandpiper[20] are all restricted to Cook Inlet in this way (The Nature Conservancy, 2003).

“Marine birds” as referenced herein are waterbirds that use lower Cook Inlet marine habitats: seabirds, waterfowl, loons and grebes, and shorebirds. The density of marine birds is generally high throughout the year, although community composition varies considerably between seasons (Renner et al., 2017). Marine birds consume a variety of prey, are sometimes top predators, and are highly responsive to a dynamic marine environment (Arimitsu, Schoen et al., 2021; Schmutz, 2014). Many marine bird communities in Cook Inlet are somewhat stratified in their distribution along an east/west gradient, reflecting Cook Inlet’s stratification (i.e., profiles) of water flow and salinity/temperature, and the corresponding productivities of lower trophic food sources (Renner et al., 2017; Piatt and Harding, 2007).

Large numbers of seabirds depend on lower Cook Inlet marine waters throughout the year (Piatt and Harding, 2007). Seabirds depend on marine foods using a variety of foraging techniques at surface or depth depending on bird species and prey types. Seabirds only come to land to breed, typically from May to August in Cook Inlet (Ganedo and Hollmen, 2020; Schultz et al., 2009). In summer (June and July), several large breeding colonies total hundreds of thousands of common murre, black-legged kittiwake, glaucous-winged gull, and puffins (e.g., Chisik Island, Gull Island, Barren Islands), with the parents dependent on nearby marine waters to provision their chicks (Stephensen and Irons, 2003). Additionally, tens of thousands or more other seabirds that breed in the southern hemisphere (e.g., sooty shearwater) spend their nonbreeding months feeding in Cook Inlet during our northern hemisphere summer (West et al., 2011).

Seabird populations in Alaska are strongly influenced by food supply (Arimitsu, Piatt et al., 2021; Piatt et al., 2020). Most lower Cook Inlet seabirds depend on small forage fish and some feed on both fish and plankton. Fish-eaters include some of the most abundant lower Cook Inlet seabird populations: surface-feeding black-legged kittiwake, diving common murre, and diving Kittlitz’s and marbled murrelets. Common seabirds that typically feed on invertebrates as well as fish include diving tufted and horned puffins, and surface-feeding or shallow-diving glaucous-winged gull, northern fulmar, and shearwater species (which can dive to 60–70m; Burger, 2001). Several seabird populations in Cook Inlet have recently been undergoing extreme fluctuations in mortality, productivity, and foraging patterns. These responses, and a general relationship to food availability, have also been tied to environmental and anthropomorphic perturbations in the Gulf of Alaska (GOA), including the largest marine heatwave on record (2014–2016) and the lingering effects of the1989 *Exxon Valdez* Oil Spill (EVOS) (Cushing et al., 2018; Goyert et al., 2018; Esler et al., 2018). Birds that are narrowly dependent on forage fish may be particularly vulnerable to food-related population impacts; in 2015–2016 a massive die-off of common murres, along with repeated reproductive failure, was documented in the GOA, while the omnivorous tufted puffin appeared to be more resilient (Piatt et al., 2020; Schoen et al., 2018).

Waterfowl include ducks (both diving sea ducks and “dabbling” surface-feeding ducks), geese, and swans. Waterfowl, especially sea ducks, are abundant in the waters of lower Cook Inlet. Waterfowl summer breeding and spring and fall migration are associated with the plentiful mudflat, coastal salt marsh, and other lower Cook Inlet wetland habitats. Wintering areas depend on availability of open water, especially in nearshore marine habitats. Sea ducks such as scoters and harlequin duck are diving ducks that depend on marine benthic invertebrates for food most of their lives. Scoters are common in lower Cook Inlet and often observed in flocks or “rafts” of up to a few hundred birds. In April and May, waterfowl move to adjacent or distant (beyond lower Cook Inlet) terrestrial or freshwater habitats to breed

[20] Pribilof Island rock sandpiper is the nominate subspecies (*Calidris ptilocnemis ptilocnemis*) of the four recognized subspecies of rock sandpiper.

(USFWS, 2011; Safine, 2005). Some non-breeders or failed breeders remain in lower Cook Inlet marine waters year-round.

Lower Cook Inlet is also important to Steller's eider, a sea duck that may be particularly vulnerable because of its limited population. The Alaska breeding population, numbering a few thousand birds at most, is listed as threatened under the ESA (62 FR 31748, June 11, 1997). Recently, the USFWS predicted that the resiliency of this geographically limited, low-population bird is likely to remain low (USFWS, 2019; 2021). It nests in the Arctic and subarctic tundra beyond the lease sale area. However, these Alaskan-breeding birds molt and winter in southwest Alaskan waters, as far east as lower Cook Inlet and Kodiak. They mingle indistinguishably with many more thousands of non-listed Steller's eiders from Russia. The eiders begin a 3-week molt in late July, gathering in large, flightless flocks in nearshore shallow areas of eelgrass beds, intertidal muds and sandflats (USFWS, 2019). Then from late August to late April or early May, they are more broadly dispersed in these marine waters. Over-wintering numbers typically peak in January through February (Larned, 2006). In the winter in lower Cook Inlet, Steller's eider are typically seen in largest numbers in nearshore waters, especially off Ninilchik, Kachemak Bay, and northern Kamishak Bay, but do regularly also occur miles offshore (Martin et al., 2015; NOAA, 2002).

Coastal salt marshes are particularly important lower Cook Inlet habitat for other types of waterfowl, including dabbling ducks (e.g., mallard and pintail), geese, and trumpeter swan. The only known breeding habitat of the Tule white-fronted goose (largest bodied and most limited population subspecies of greater white-fronted goose), is in Cook Inlet (Wilson, Ely, and Talbot, 2018). This population arrives in Cook Inlet coastal marshes from Oregon between mid-April through May. Important late summer and fall molting areas for the Tule white-fronted goose were also found on the west side of Cook Inlet, although recent volcanic activity has apparently led them to abandon that area for upper Cook Inlet habitats (Ely et al., 2006). A significant portion of the world population of the Wrangell Island snow goose also uses Cook Inlet during spring migration.

Loons and grebes are diving birds that share characteristics of both seabirds and waterfowl. Pacific and common loons and red-necked grebes are mainly marine birds, but breed in territorial pairs on freshwater lakes all around the Cook Inlet area in the summer months (Renner et al., 2017; West et al., 2011). These species and the red-throated loon, which is believed to be declining, winter in marine waters, including offshore Cook Inlet (Schmutz, 2017). Loons and grebes are typically found singly or in small groups diving for forage fish.

Shorebirds are typically long-legged wading birds that, like waterfowl, are known in coastal Alaska for the large flocks many of them form during north and south migrations. In spring, Cook Inlet often provides the last significant area of ice-free shoreline habitat for many shorebirds migrating to Western Alaskan and Arctic breeding grounds: hundreds of thousands can "stack up" in coastal wetlands of Redoubt, Kachemak, and other bays awaiting better conditions to the west and north (Gill and Tibbetts, 1999). Cook Inlet hosts the highest seasonal concentration of shorebirds in the entire biogeographical region known as the Northwest Interior (or Boreal) Forest, stretching from the Yukon Flats to Kachemak Bay (ASWG, 2019). Over 30 species of shorebirds, including great numbers of western sandpiper, dunlin, and long- and short-billed dowitchers, depend on the intertidal habitats of lower Cook Inlet, to replenish fat stores during migration. Virtually the entire population of Pribilof Island rock sandpiper winters along the shores of Cook Inlet (Gill and Tibbetts, 1999). A significant percentage of the world population of Hudsonian godwit breeds in upper Cook Inlet, passing through lower Cook Inlet on migration, and several shorebird species breed in the lower Cook Inlet area itself. In the spring months, red-necked phalarope is among the most common lower Cook Inlet marine bird species, and a few may stay year-round (Renner et al., 2017). Phalaropes are a unique type of shorebird that swim in open water as they forage on plankton at or near the surface.

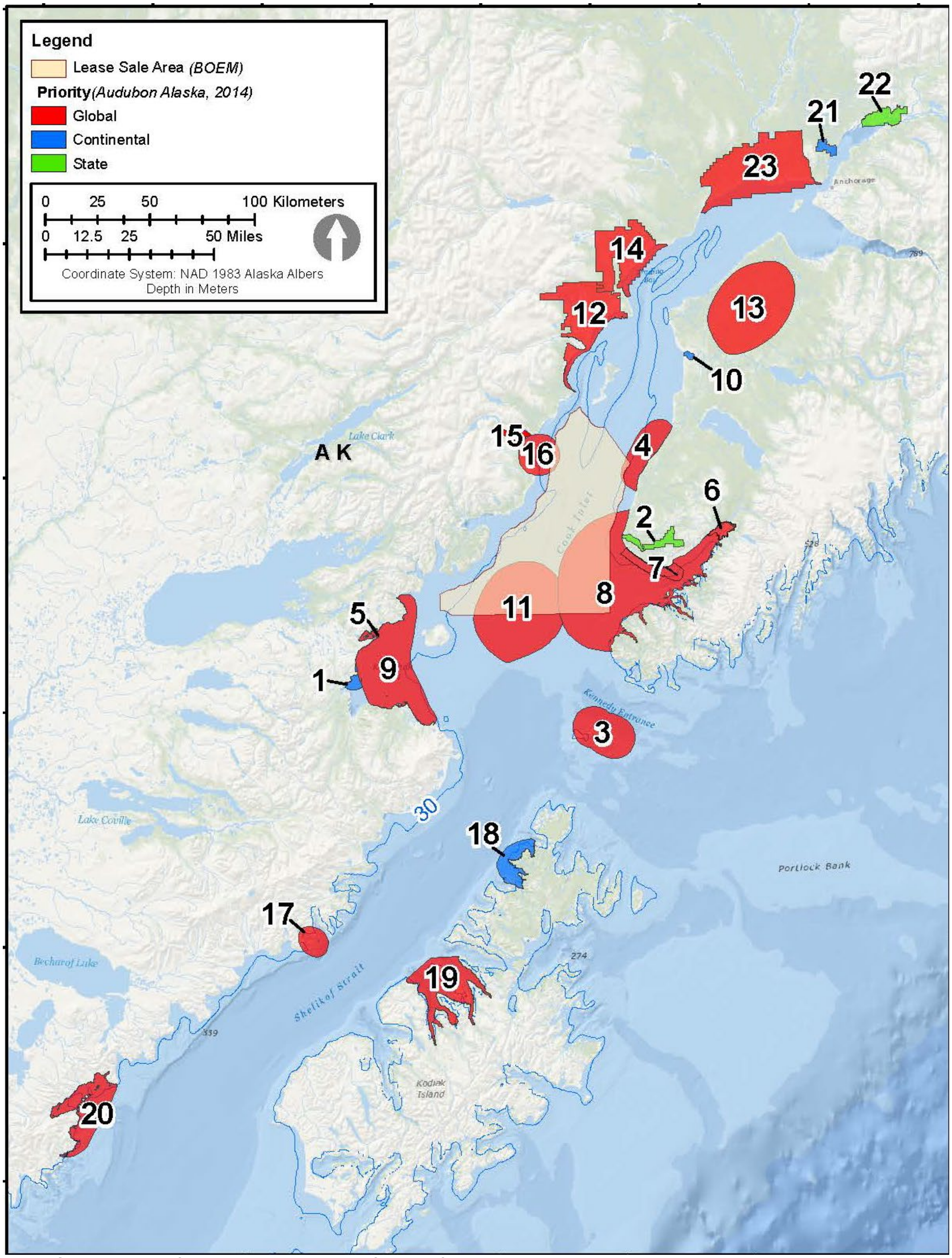
Besides waterbirds, the lower Cook Inlet area supports large numbers of landbirds like passerines (perching birds), raptors and owls, and sandhill crane. Dozens of species of passerines, including warblers, thrushes, and sparrows, stopover in coastal habitats during their largely nocturnal migrations. Many are summer-breeding or year-round residents in the lower Cook Inlet area too (e.g., kinglet and chickadee species, common raven) (Day et al., 2005a; ADF&G, 1988). Neotropical migrants that are considered Alaskan or North American species of special conservation concern, including rusty blackbird (undergoing a steep, range-wide decline), blackpoll warbler, and olive-sided flycatcher, also migrate through and breed locally in the Kenai lowlands and other coastal areas (ADF&G, 2015; Greenberg, et al., 2011). Many species of raptors, all top predators, migrate through or breed near Cook Inlet (e.g., northern goshawk, osprey, great horned owl, and northern hawk-owl). Lower Cook Inlet supports large year-round concentrations of bald eagle where they feed on fish and countless other small vertebrates. Thousands of sandhill crane migrate annually through lower Cook Inlet and many also breed in summer in the low wetlands around the inlet.

The Important Bird and Biodiversity Areas (IBAs) Program was established by the National Audubon Society as a global effort to identify and conserve areas vital to birds and biodiversity (NAS, 2010; Smith et al., 2012). At least 23 IBA sites are designated along the coast, in nearshore waters, or offshore in Cook Inlet (Figure 4-7), as listed and described in Table 4-19. Kachemak Bay and the Fox River Flats in particular, with tides of as much as 9 m (30 ft), provide an abundance of intertidal habitat for the geese, ducks, swans, and over a million of 36 species of shorebirds that annually pause on the mudflats (ADF&G, 1993). Kachemak Bay is recognized as the second most important shorebird staging area in Alaska (following the Copper River Delta) (WHSRN, 2009).

Table 4-19: Important Bird Areas in or near the Lease Sale Area

IBA	Priority	Recognized Importance
Amakdedulia Cove	Continental	Seabird nesting colony; summer waterfowl congregation area.
Anchor River	State	Migratory passerine concentration area.
Barren Islands Colonies	Global	Seabird nesting colonies, supporting 14 species and more than 400,000 birds, e.g., pelagic cormorant, glaucous-winged gull, black-legged kittiwake, tufted puffin, and fork-tailed storm-petrel.
Clam Gulch	Global	Steller's eider wintering area; black scoter, long-tailed duck, and common eider present.
Contact Point	State	Seabird nesting colony for 6 species; spring waterfowl congregation area.
Fox River Flats	Global	Spring migration stopover area for many shorebird species; spring, fall, and winter waterfowl congregation area.
Homer Spit	Global	Wintering area for Steller's eider and other sea ducks, rock sandpiper
Kachemak Bay	Global	Seabird and sea duck wintering habitat; waterfowl and shorebird migration stopover habitat; and seabird foraging habitat.
Kamishak Bay	Global	molting habitat for Steller's eider; breeding habitat for glaucous-winged gull
Kenai River Flats	Continental	Spring staging area for Wrangell Island snow goose; seabird nesting colonies; migrant shorebirds, waterfowl and sandhill crane also use the area.
Lower Cook Inlet 59°N, 153°W	Global	Non-breeding habitat for glaucous-winged gull and other seabirds.
Redoubt Bay	Global	Supports large population of spring migrant shorebirds; waterfowl, including multiple species of ducks, geese, and swans.
Swanson Lakes	Global	Trumpeter swan; red-throated loon; one of highest densities of common loon in North America.
Trading Bay	Global	Wrangell Island snow goose spring staging area; rock sandpiper nominate race wintering area; spring migrant stopover area for Hudsonian godwit, whimbrel, and American golden-plover; used by red-throated loon.
Tuxedni Bay	Global	Fall migration stopover for geese; summer and fall concentration area for scoters; spring migration stopover for long-tailed duck and western sandpiper; black scoter, black oystercatcher, black turnstone, surfbird, and whimbrel present.
Tuxedni Island Colony	Global	Seabird nesting colony hosting multiple species, including black-legged kittiwake. Shorebird migration stopover habitat for western sandpiper; waterfowl migration stopover habitat for Canadian geese; and waterfowl molting habitat for surf scoter and white-winged scoter.
Amalik Bay Colonies	Global	Seabird nesting colonies, hosting 10 species, including red-faced cormorant.
Northwest Afognak Island	Continental	Breeding area for black oystercatcher; nesting and foraging habitat for other shorebirds and seabirds.
Uganik Bay and Viekoda Bay	Global	Several seabird nesting colonies; breeding area for black oystercatcher and other shorebirds; wintering area for multiple species of seabirds and waterfowl.
Wide Bay	Global	Several seabird nesting colonies; waterfowl, including emperor goose and Steller's eider routinely congregate in this area; bald eagle nesting sites present.
Goose Bay	Continental	Spring and fall stopover for waterfowl.
Palmer Hay Flats	State	Spring and fall stopover area for waterfowl.
Susitna Flats	Global	Spring migration stopover area for waterfowl and shorebirds; critical rock sandpiper (nominate race) wintering area.

Source: Audubon Alaska, 2014.



Notes: See Table 4-19 for key to IBA names and further information.
Source: Audubon Alaska, 2014.

Figure 4-7: Important Bird and Biodiversity Areas in and around the Lease Sale Area

4.7.2 Environmental Consequences of the Proposed Action

4.7.2.1 Noise

Post-lease activities conducted as a result of LS 258, as described in the E&D Scenario, which could cause noise impacts to birds include seismic surveys (deep penetrating and geohazard surveys). During the course of normal feeding or escape behavior, some diving seabirds, sea ducks, or loons could be injured or disturbed by underwater airgun noise (Turnpenny and Nedwell, 1994). Many of these waterbirds routinely dive to 10 or more meters in depth and can spend more of their foraging time submerged than on the surface. During the seismic surveys, a few foraging birds or flightless molters that dive in alarm from the survey vessel could forage at depths near enough to firing airguns that they receive a pulse strong enough to cause injury (Brown and Adams, 1983). More typically, the effect on birds would be displacement either when they detect underwater surveys or in response to localized seismic sound-caused changes in prey availability (Section 4.5; Pichegru et al., 2017; Leopold and Camphuysen, 2009). Effects on birds would be localized and brief around the survey vessels that are continually moving toward new areas. Brief displacement for some birds in overall abundant populations would have only short-term, and no population-level, effects.

4.7.2.2 Habitat Alteration

Post-lease activities described in the E&D Scenario could alter marine and terrestrial habitats of birds, ultimately impacting birds themselves. Activities that would potentially cause marine habitat alteration impacts include anchoring of drilling units and vessels, platform and pipeline installation, and discharge of drill cuttings in the marine environment. Onshore pipeline construction would cause terrestrial habitat impacts.

Marine habitat where diving birds would be potentially affected includes both benthic and water column foraging areas. Pipeline trenching and platform installation, anchor chain sway from vessels or exploration drilling units (MODUs), and discharge of drilling fluids and cuttings would disturb or cover several localized areas of benthic habitat and any invertebrate prey present. Most of these activities may occur year-round, so benthic-feeding birds may be affected while breeding (e.g., long-tailed duck), molting (e.g., Steller’s eider, scoter species), or wintering (e.g., Steller’s eider, scoter species).

Benthic impacts from post-lease activities described in the E&D Scenario would, however, occur primarily offshore and be limited to the footprint of construction, trenching, and vessel anchoring. Most of this activity would be outside the habitat of molting Steller’s eider and other sensitive waterfowl on the west side of lower Cook Inlet. Finally, benthic impacts are expected to be typically short-term and localized for invertebrate prey (Section 4.6). For these reasons, benthic habitat impacts to birds are also expected to be generally no more than short-term and localized.

Marine activities that increase turbidity in the water column could affect some pelagic birds by reducing their ability to visually forage or by temporarily decreasing abundance of invertebrate and fish prey. Such activities include anchoring, pipeline trenching, and drilling discharges; the latter two limited to the few exploration and construction years. Levels of impact would vary with locations and season. Vulnerable bird populations could be further stressed by a loss of foraging efficiency if it occurred over a few days of repeated elevated turbidity in a preferred area. For example, multiple lower Cook Inlet colonies of water column-foraging murres and black-legged kittiwakes have had mass breeding failures linked to starvation stress and marine heatwaves during a few recent years, and repeated failures could lead to long-term effects (Section 4.7.1; Piatt et al., 2020). Declining red-throated loons are another vulnerable species that forages in the water column. In general, however, the level of impact to birds would be no more than short-term and localized, similar to invertebrate and fish prey resources (Section 4.6.2).

Terrestrial pipeline construction could impact birds through loss of staging or breeding habitat, or by direct mortality. Depending on location and season, construction activities could disrupt time-sensitive foraging during spring and fall staging of waterfowl, shorebirds, and cranes when birds from widespread breeding populations are concentrated in lower Cook Inlet coastal areas. Birds that would permanently or temporarily lose some nesting habitat from pipeline construction include many species of landbirds, waterfowl, shorebirds, raptors, and sandhill crane. Densities of diverse breeding birds in southcentral Alaska are such that loss of a few hundred acres of nesting habitat would typically impact hundreds or thousands of birds until some habitat, potentially of lesser quality for some of them, was restored (Matsuoka et al., 2001; Manning and Cooper, 2004). Most nests are camouflaged on the ground or in low vegetation, and many birds such as sparrows and warblers are so small and secretive as to be overlooked while nesting. If land clearing was conducted during spring or summer, destruction of a few hundred active nests, eggs, or flightless chicks would be expected. Most local populations are robust enough to incur no more than short-term (i.e., single season, impacts from this level of loss). Depending on timing and location of activities, however, some migratory birds that are declining or otherwise vulnerable (e.g., rusty blackbird, sandhill crane) could experience long-term effects to breeding or staging populations.

Siting onshore and shoreline pipelines and associated construction activities outside of critically important habitat areas, especially estuarine and salt marshes, and coastal IBAs, would mitigate terrestrial habitat impacts. Also, avoiding land clearing during the peak local breeding season (April 20 through July 15) would minimize unnecessary destruction of active nests, eggs, and flightless chicks (USFWS, 2020). If these mitigation measures were both applied, bird habitat impacts would be no more than short-term and localized for all species.

4.7.2.3 Disturbance

Post-lease activities described in the E&D Scenario would produce disturbance impacts (up to and including mortality) to lower Cook Inlet birds via vessel, aircraft, and vehicle operations, as described below.

The bright artificial lighting of vessels, MODUs and production platforms, and gas flaring can, under certain environmental conditions, attract and disorient migrating birds. These lit objects on the otherwise dark and featureless sea then become collision hazards to some birds during migration (Day et al., 2005b; Ronconi et al., 2015; Montevecchi et al., 1999). Many species are known to be disoriented by lights and gas flaring, and ultimately collide with ships and platforms in Alaska, especially under conditions of poor visibility like fog, precipitation, and darkness (Day et al., 2015; Greer et al., 2010). At-risk birds include those that are nocturnally migrating or otherwise nocturnally active, like passerines and many seabirds (Bruinzeel et al., 2009; Merkel and Johansen, 2011).

Because birds are known to commonly collide with vessels in Alaska, they would be expected to collide with seismic survey and support vessels, MODUs, and production platforms associated with activities resulting from LS 258 as described in the E&D Scenario. Many types of birds experience these collisions, including gulls, fulmars, shearwaters, storm petrels, jaegers, eiders, phalaropes, other shorebirds, and many species of passerines (BOEM, 2020; Day et al., 2017; Greer et al., 2010; USFWS, 2012). Flocks of eiders also have a history of colliding with ships in Alaska, and the low, fast-flying Steller's eider may be especially vulnerable (NOAA, 2020; USFWS, 2012). Up to hundreds of bird collisions would be expected to be observed annually throughout the decades of the E&D Scenario (BOEM, 2020; USFWS, 2012). For this analysis, all collisions are assumed to be fatal. Most are likely to occur during migration but strikes of locally breeding and wintering birds would be expected as well. Several fatalities may be incurred from a single breeding population, but most would be expected to be from birds that move through together on migration from disparate, widespread breeding populations. All would be breeding-age adults, the chronic loss of which could potentially have long-term consequences for a few vulnerable or declining populations. If a mitigation protocol of reduced and shielded lighting, monitoring, and adaptive management that identified and mitigated any specifically identified strike-attractant were implemented, fewer collisions and a lowered chance of chronic loss of vulnerable-population birds would be expected. Collisions would still occur, however, and collision impacts would still range from localized to potentially widespread. The proposed monitoring and lighting measures are explained below and further detailed in Section 3.4.

A lighting plan and operating protocol that includes lighting (and flaring) design and control, collision monitoring, and adaptive management is commonly recognized as an appropriate strategy for tracking and reducing bird collisions, particularly on drilling units and platforms. Mitigation protocols from prior Alaskan lease sales have included changes to light direction and shading, where safe and feasible, to reduce disorientation of passing birds (BOEM, 2015a). Light directed inward and downward, for example, is believed to be less disorienting to birds than lighting schemes that radiate outward and upward, and platforms have also been fitted with bird-repellant lighting schemes (Ronconi et al., 2015; Miles et al., 2010; Day et al., 2017). Comprehensive monitoring, following scientifically approved protocols, of collisions and ultimate fates of grounded birds, improves assessments of the site-specific factors that may cause attraction (Wiese et al., 2001; Ellis et al., 2013). The as-needed implementation of adaptive management could be aimed at further reducing the risk of collision. It may be possible to implement a change in lighting operations if real-time monitoring reveals the occurrence of heavy migration and strike risk or that, for example, a specific light source is causing multiple strikes.

Besides being potential sources of underwater noise and in-flight collisions, the operation of vessels could disturb birds at sea. Individual and flocks of birds generally move away from vessel activity. Many species, including flight-capable eiders and scoters, typically take flight to avoid a fast-approaching vessel, and flightless (molting) birds at sea remain capable of paddling away from disturbances (Hentze, 2006; Petersen et al., 2006; Schwemmer et al., 2011). Readiness to flush (fly or swim away from disturbance) may vary according to many things including species, vessel speed, sea state, and how successful a bird has already been that day at foraging (Hentze, 2006; Weber, 2014). Many birds would return quickly; some murrelets, sea ducks and loons, however, could be displaced from preferred foraging habitats for 6–8 hours or more (Agness et al., 2008; Lacroix et al., 2003; Schwemmer et al., 2011). Flushing of breeding and non-breeding birds while foraging or resting can have fitness impacts, i.e., on reproductive success and survivorship (Agness et al., 2013).

Over 40 vessel trips per week could occur during open water months of the few years of heaviest activity when development (i.e., platform installation) and production overlap (Table 4-4 and Figure 4-3). Typically, however, vessel activity levels would be much less, and most trip miles would be confined to roughly straight routes from Kenai or Homer. Most exposed birds would experience a one-time vessel disturbance, potentially a brief displacement from foraging, and would quickly recover without measurable impacts as vessels moved out of the area. Flocks of white-winged scoters and other sea ducks that winter in groups in nearshore habitat between Kenai and Kachemak Bay would be the most vulnerable. Wintering Steller's eiders could be among those sea ducks experiencing longer-term impacts to their population if disturbance stressed their already small and potentially declining numbers. If murres or other seabirds are experiencing a year of extreme starvation and low or no productivity, as has been the case in some recent years, their numbers or fitness levels could be so low that they cannot quickly recover from vessel disturbance. Flushing of dense seabird colonies by vessels (or aircraft) can result in mass loss of eggs and chicks inadvertently kicked into the sea or left unprotected from predators, substantially impacting a colony's reproductive success. Such flushing and colony failure is expected to be avoided, however, with proposed requirements for all traffic to observe a buffer area around seabird colonies (Section 3.4), as well as existing practices and guidance including FAA guidance to maintain an altitude of at least 610 m (2,000 ft) when flying over sensitive areas such as national parks, wildlife refuges, and wilderness areas (FAA/AIM, 2019; Denny and Hobi, 2017).

Air traffic disturbs some birds, primarily waterbirds, in coastal and pelagic areas. Komenda-Zehnder et al., (2003) found that disturbance effect of helicopters is typically greater than that of fixed-wing aircraft and increases with decreasing flight altitude. They found that flushing, at least for non-nesting birds, is greatly reduced when fixed-wing aircraft are above 300 m (984 ft) and helicopters above 450 m (1,476 ft). Seabirds do not necessarily habituate, but often return quickly to foraging or other interrupted behavior (Komenda-Zehnder et al., 2003; Mallory, 2016). The greatest numbers of impacted birds would include those that are particularly concentrated for migration staging, molting, or in breeding colonies. Productivity of some densely nesting seabird species can be affected, as noted in the above discussion of potential vessel disturbance, if flushing occurs early in the nesting cycle or if opportunistic predators like eagles are present.

Aircraft associated with the E&D Scenario activities would fly year-round from Kenai and Homer, so populations vulnerable to disturbance include spring staging waterfowl and shorebirds at the Kenai River Flats and Kachemak Bay, wintering Steller's eider and other sea ducks at Clam Gulch and Kachemak Bay, and nesting seabirds at dense colonies in Kachemak Bay and the Kenai River Flats. Staging and migrating birds turn over often in coastal areas, however, and individuals are unlikely to be repeatedly displaced from preferred coastal habitat. In summary, with overflights expected to be brief, large overall populations, and colony buffer zones, aircraft effects on most breeding birds would be limited to short-term foraging or resting disturbance in the immediate area. Seabird colonies are typically avoided by pilots, and standard minimum buffer zones of 610 m (2,000 ft) above ground level are expected (FAA/AIM, 2019; Denny and Hobi, 2017). (This minimum flight altitude necessary to protect colonies is greater than the 1,500 ft typically required to avoid disturbance to marine mammals.)

Increased ground traffic on existing roads in support of E&D Scenario activities is expected year-round in terrestrial environments. In summer, this may have the effect of killing a small number of brooding hens and flightless chicks of waterfowl and shorebirds crossing roads. Vehicle traffic would also occasionally impact natural movement patterns of some broods, including preventing access to preferred foraging habitats and shelter from predators. Numbers of affected birds of any given species would be low enough that no more than short-term and localized impacts to any population would result.

4.7.2.4 Oil Spills Impact Summary

Effects of spills, spill drills, and spill response activities on birds are described in Section A-3.6 of Appendix A. Most accidental spills would be localized and limited in area. A large spill that contacts many marine birds or reaches coastal areas would have impacts that are more persistent, require remediation, and impact a greater number of birds and species. If it occurred during a period of high bird use in coastal waters, it would be expected to foul large numbers of staging and migrating birds from widespread populations. Foraging, resting, and sheltering habitat for staging, migrating, and nesting birds would be fouled, with mechanical damage to foraging habitat and possibly nests during the cleanup process. Some populations that experience spill-related effects to large numbers of birds would be expected to take several years to recover. Long-term damage to otherwise vulnerable seabird breeding populations (e.g., chronically failing murres and black-legged kittiwakes) would be possible. The long-term and widespread impacts from a large spill would not be categorized as severe for most species because the various populations affected would be expected to eventually recover. Depending on location and timing, however, contact with wintering rock sandpipers or their habitat would have potentially severe population-level impacts. Spill drills are localized and limited in time and place and would have little effect on birds. Spill response would typically have short-term and localized displacement-related impacts, but impacts would range up to long-term if involving both marine- and land-based activities when large concentrations of birds are present or nesting. In the unlikely event that migrating or staging birds were within the vicinity of a gas explosion, a few hundred individuals from disparate populations could be killed, which would have a localized level of impact.

4.7.2.5 Conclusion

Most lower Cook Inlet birds would experience no more than short-term and localized, i.e., minor, impacts from any activity or combination of activities, accidental small spills, and spill drills described in the E&D Scenario. For example, marine birds would typically be expected to experience little effect from one-time displacements associated with underwater noise, marine habitat alterations, and vessel and aircraft operations, and most populations would not be affected by a few collisions. In most cases, individual birds and populations would be exposed to no more than one or two instances of the activities considered in the E&D Scenario, and different birds would be exposed to different impacts so the impacts would not be additive. A few vulnerable or declining populations could experience long-term and/or widespread, i.e., moderate, impacts from E&D Scenario activities. In particular: a) vessel operations or marine habitat alterations could displace birds or interfere with foraging, and starvation-stressed murres or other weakened waterbird populations could experience impacts lasting beyond a single season, and b) the bright artificial lighting or gas flaring from vessels and platforms could cause collisions of migrating birds from widespread populations at a rate of collisions that certain vulnerable populations may find difficult to withstand without long-term impacts. The long-term presence of vessels and platforms means that these hazards would be on-going, and the rate of impact could eventually have long-lasting effects on a few vulnerable, declining, or sensitive populations. Also, some local nesting populations would potentially have long-term consequences from terrestrial pipeline construction, if not reduced to short-term by proposed timing and site-selection mitigation measures. No more than a few populations of any one species would be affected, so the overall impact level from activities described in the E&D Scenario would not rise to the level of “severe” (i.e., “major”). When considering the effects of a large spill and related response efforts added to the activities described in the E&D Scenario, there would still be a range of impact level that depends on species and populations involved. The overall impact level would be minor to major with the addition of a large spill and related response because a much greater and more widespread group of species could experience long-term impacts.

4.7.3 Environmental Consequences of the Alternatives

4.7.3.1 Alternative 3A – Beluga Whale Critical Habitat Exclusion

Alternative 3A excludes 10 of the 224 OCS blocks offered under the Proposed Action. The exclusion is small enough that it would not change the overall level of impact to birds in the lease sale area. The impact level would remain small, localized, and therefore minor, for most birds. However, the exclusion proposed in Alternative 3A would be expected to result in somewhat fewer individual impacts. In particular, impacts to marine birds present in the exclusion area would be eliminated. Those marine birds would typically include several types of wintering marine birds, and, in the summer, breeding Kittlitz’s murrelet and colonial breeding seabirds from the large colonies at Chisik Island and Tuxedni Bay. Most of these birds likely range beyond the exclusion area, including south into habitat in OCS lease blocks still offered under Alternative 3A. Many of them, including the Chisik Island colonies, however, have also recently experienced multiple breeding failures and die-offs, and so any lessening of impacts may be considered beneficial to these vulnerable birds (Arimitsu, Schoen et al., 2021; Piatt and Roseneau, 1997). Overall effect level to marine birds from E&D Scenario activities, including accidental small spills and spill drills, would still be minor for most populations, with potentially fewer vulnerable populations at risk of moderate impacts as a result of the Alternative 3A exclusion. When also considering a large spill and spill response, the overall level of impact for Alternative 3A would be moderate (i.e., essentially the same as that of the Proposed Action) because of the larger and more widespread groups of birds experiencing long-term impacts from a hypothetical large spill.

4.7.3.2 Alternative 3B – Beluga Whale Critical Habitat Mitigation

Alternative 3B, prohibiting seismic surveys and exploration drilling activities in the 10 northernmost OCS lease blocks of the lease sale area from November 1 to April 30, is unlikely to result in a measurably different overall avian level of effect than the Proposed Action. This is because only wintering birds, not the summer breeding colonies in the area, could experience a reduction in anticipated impacts, and only during a few of the E&D Scenario years. Lower Cook Inlet is important wintering habitat for many marine birds, but in winter their foraging range may be larger, more variable, and not restricted by distance from the breeding site (Meehan, et al., 2019; Ashmole, 1963; Jovani et al., 2016; Ballance et al., 1997). Under Alternative 3B, wintering birds would only avoid impacts in a limited area of their foraging range, and only for those years in which seismic survey and exploratory drilling take place. The overall impact level from E&D Scenario activities including accidental small spills and spill drills would therefore be essentially the same as that of the Proposed Action — a range of minor to moderate for the various populations. When also considering a large spill and spill response, the overall level of impact for 3B would be essentially the same as that of the Proposed Action — moderate.

4.7.3.3 Alternative 3C – Beluga Whale Nearshore Feeding Areas Mitigation

Wintering marine birds would not be exposed to underwater noise, vessel disturbance, and collision risk if no on-lease seismic surveys occurred on any OCS lease blocks in the lease sale area between November 1 and April 1. If seismic surveys were additionally excluded between July 1 and September 30 in the zone within 10 mi of anadromous streams, those marine birds that forage in the area during much of the breeding season would also be spared seismic survey injury and disturbance risks for the few years in which seismic surveys take place. Under Alternative 3C, seismic surveys would still be allowed October 1–31 and April 1–June 30 and both of those are critical time periods for many lower Cook Inlet marine birds. In particular, May and June are critical times for seabirds and sea ducks preparing to nest, and molting sea ducks including Steller's eider and mergansers would still be present in abundance in October in the west Cook Inlet habitat they depend on (Larned, 2006). In summary, there would potentially be fewer negative effects on birds relative to the Proposed Action, but the overall impact level would be essentially the same — minor to moderate for E&D Scenario activities, including accidental small spills and spill drills. When adding the effects of a large spill and spill response, the overall level of impact for 3C would be essentially the same as that of the Proposed Action and the other Beluga Whale Mitigation Alternatives — moderate.

4.7.3.4 Alternative 4A – Northern Sea Otter Critical Habitat Exclusion

Alternative 4A would eliminate all E&D Scenario impacts for marine birds while they are foraging in the 7 OCS blocks that overlap with northern sea otter critical habitat. This would include breeding and non-breeding seabirds in summer and winter, but no measurable protections for any particular sizeable colony. The reduction in affected foraging area for the entire period of the E&D Scenario would mean somewhat less impact for these birds, but foraging range for many of these frequently food-stressed birds likely extends into the surrounding OCS blocks available for lease where they could still be measurably impacted. The overall level of effect would be a similar range as that of the Proposed Action (i.e., mostly short-term and minor, with some vulnerable populations potentially experiencing long-term and moderate impacts). When adding the effects of a large spill and spill response, the overall level of impact for Alternative 4A would be essentially the same as that of the Proposed Action — moderate.

4.7.3.5 Alternative 4B – Northern Sea Otter Critical Habitat Mitigation

Alternative 4B considers mitigation in 14 OCS lease blocks spread out at various sites along the western lower Cook Inlet Planning Area boundary. Under this alternative, which prohibits seafloor disturbance and discharge of drilling fluids and cuttings in the 14 lease blocks, there would be fewer impacts than the Proposed Action for birds breeding from Kamishak Bay to Tuxedni Bay, and sea ducks that depend on a footprint similar to the northern sea otter southwest Alaska DPS Critical Habitat Area. Birds in these areas have particular sensitivities, as reflected by, for example, the importance of Kamishak Bay to benthic-feeding birds like molting Steller's eider and molting and wintering scoters, and recent Kamishak Bay die-offs of adult birds (e.g., shearwaters, storm petrels, fulmars, and murres) (USFWS, 2018; Renner et al., 2017). Because of the importance of these sites to an abundance of birds, and because the waterfowl are benthic foragers, an alternative that protects seafloor habitat here would mean fewer impacts to birds relative to the Proposed Action. Affected birds, however, likely range beyond the relatively small areas of the OCS mitigation blocks and therefore would be subject to impacts from the activities described in the E&D Scenario for at least part of each season. Therefore, the overall impact level would be a similar range as that of the Proposed Action (i.e., mostly short-term and minor, with some vulnerable populations potentially experiencing long-term and moderate impacts). When adding the effects of a large spill and spill response, the overall level of impact for Alternative 4B would be essentially the same as that of the Proposed Action — moderate.

4.7.3.6 Alternative 5 – Gillnet Fishery Mitigation

This alternative would avoid impacts to foraging breeding marine birds and non-breeding shearwaters during the summer, but only those impacts resulting from seismic surveys. While impacts would therefore be a bit fewer, the overall impact level for birds would not differ substantially from those described for the Proposed Action — minor to moderate for E&D Scenario activities, accidental small spills, and spill drills. When adding the effects of a large spill and spill response, the overall level of impact for Alternative 5 would be essentially the same as that of the Proposed Action — moderate.

4.7.4 Cumulative Effects

Birds using lower Cook Inlet have been or will be affected by past, present, and reasonably foreseeable future actions including oil and gas and renewable energy operations, traffic, mining, commercial fishing, community development, and military activities. Many birds are also affected by climate change, as discussed below. Lingering effects of the 1989 EVOS have contributed to the lack of recovery of lower Cook Inlet pigeon guillemot and common murre numbers (Esler et al., 2018). (Other impacts and stressors are incurred by lower Cook Inlet birds, most of which are migratory, on other continents or oceans, but those details are outside the scope of this analysis.) The array of relevant cumulative impacts to birds in lower Cook Inlet include disturbance and displacement; habitat loss; light attraction and collision risk; and decreased fitness, survivorship, and reproduction from contaminants and oil spills. Because of the wide variety of bird types and habitat uses, most birds and bird populations experience no more than a single type of effect from E&D Scenario activities or other past, present, and reasonably foreseeable future actions. This means that cumulative effects on birds are not typically additive, except with climate change-related impacts which potentially affect most birds.

The impact on birds of past, present, and reasonably foreseeable future oil and gas activities in lower Cook Inlet are similar in type, but typically collectively larger in geographic and/or temporal scope, than the impacts of analogous activities related to LS 258 and as analyzed in Section 4.7.2. This is particularly true for traffic disturbance and habitat-related impacts. In a few localized offshore areas with little other traffic, vessel and aircraft traffic described in the E&D Scenario may be the dominant source of some short-term impacts, but they would be only a small increment of the cumulative impacts expected to be experienced by all lower Cook Inlet birds. Habitat loss from other past, present, and reasonably foreseeable future oil and gas activities have or will have effects similar to those described above in relation to E&D Scenario activities. Cumulative habitat loss primarily affects birds that are staging and migrating, and cumulative habitat losses are, and would be, relatively small compared to unimpacted habitat still available to most lower Cook Inlet birds. Habitat losses are composed of an array of localized alterations that would not result in population-level effects for most birds. Some declining or otherwise vulnerable birds could experience long-term effects from cumulative noise, traffic disturbance, and habitat alterations.

Current impacts from oil and gas and renewable energy activities in Cook Inlet include migratory bird light attraction and collision hazards from the existing 11-turbine Fire Island wind farm, 18 lighted production platforms, and platform-associated vessel traffic in Cook Inlet state waters. Many of the same birds would be at risk from the incremental addition of a maximum of 6 platforms resulting from LS 258 post-lease activity (described in the E&D Scenario) to the south of the existing turbines and platforms, because all of Cook Inlet is a single important migration corridor for many birds, especially northward-bound migrants in the spring (Day et al., 2005a). Cumulatively, the collision risk of all oil and gas and renewable energy activity would be ongoing and long-term due to the long-term nature of the installed facilities. The incremental addition of LS 258-related platforms would, however, increase the cumulative size of the risk area because they would be the first long-term light attraction hazards in lower Cook Inlet's currently featureless waters. Numbers of avian collisions would increase with increasing numbers of platforms and associated vessel activity. Also, some vulnerable species do have substantially more of their migratory pathway (or exposure risk) area in the vicinity of the Lease Sale Area than in upper Cook Inlet. These vulnerable species include a rare, marbled godwit subpopulation (*Limosa fedoa beringiae*) which is believed to fly across central and lower Cook Inlet from its only breeding ground on the Alaska Peninsula south to wintering areas in the contiguous United States. Also, most other past, present, and reasonably foreseeable future platforms and the Fire Island Wind Project are, unlike the Lease Sale Area, outside of the normal wintering range of the Steller's eider. Steller's eiders that winter in Kodiak may be particularly at risk from the incremental addition of LS 258-related platforms because these birds likely migrate across lower Cook Inlet from Kodiak to southwest Alaska (ADF&G, 2015; Rosenberg et al., 2014). In summary, the incremental addition of LS 258-related platforms is expected to increase the cumulative light attraction and collision risk for birds substantially and measurably.

The types of impacts related to a large oil spill and related spill response on birds are discussed in Section A-3.6 of Appendix A. Although highly unlikely, Appendix A also considers the possibility of up to two additional potential large spills from sources other than those related to LS 258 post-lease activity. If those spills are also considered, the impacts to birds, their habitats, and prey could be long-lasting over years but are unlikely to overlap in space and time with each other. Increased numbers of spills would, however, increase the chances of impact to a large breeding colony or stopover site during migration. If a large spill and associated response were to occur at such a place and time, large numbers of birds would be affected, their habitat would incur long-term impacts, and birds at migration stopovers that are gathered from many different breeding populations (i.e., from a widespread area) could be affected.

Cook Inlet birds have been impacted in large part by past, present, and reasonably foreseeable future actions unrelated to the energy industry. The planned Donlin Gold mine natural gas pipeline would have habitat loss, and disturbance and displacement effects on birds using the west side of Cook Inlet (USACE, 2018a). The Diamond Point Rock Quarry would have habitat and disturbance impacts from dredging and traffic, also on the west side of Cook Inlet. Commercial fisheries impact lower Cook Inlet seabirds through ongoing gillnet bycatch and occasional light attraction and collision (Carter et al., 1995; USFWS, 2006; Piatt et al., 2007; NOAA, 2020). Community development has resulted in proportionally greater habitat loss than energy-industry activities, particularly in upper Cook Inlet and on the east side of lower Cook Inlet (North, 2001). Past, present, and reasonably foreseeable future military aircraft collisions have caused and will continue to risk loss of human and bird life. Military activities also have unique contributions to cumulative effects in the form of past and potential future poisoning, via spent munitions, of thousands of migrating waterfowl stopping at Eagle River Flats in upper Cook Inlet (85 FR 14928, March 16, 2020; Racine, et al., 1992; EPA, 2008).

Climate change and past and predicted ecosystem regime shifts are anticipated to be the largest source of impacts to birds in lower Cook Inlet in the coming decades (Cushing et al., 2018; Anderson and Piatt, 1999). Seabirds, which are high trophic level organisms with complex seasonal and other life history requirements, are anticipated to demonstrate high sensitivity to climate change (Urban et al., 2017; Van der Putten et al., 2010). Population regulation is strongly influenced by food supply for Alaska seabirds, and foraging-related impacts are among those effects observed and anticipated (Goyert et al., 2018). For example, the magnitude of a recent common murre die-off in the GOA (and lower Cook Inlet) is unprecedented—even larger than that caused by the EVOS—and the immediate cause of mortality was starvation (Piatt et al., 2020). This event was one of multiple die-offs and breeding failures of both locally breeding (e.g., murres and kittiwakes) and wintering (shearwaters) seabirds that have occurred in the GOA in the last few years (NPS, 2019). Recent studies show that these events are linked to large-scale, complex ecosystem processes including increases in sea surface temperatures and decreasing availability of high-energy content forage fish, and that these events are likely to continue (Section 4.6; Piatt et al., 2020; von Biela et al., 2019). Climate change impacts birds in other ways besides through seabird foraging. For example, increases in rain and storms would increase impacts to nests of seabirds, raptors, and landbirds via erosion, flooding, and exposure. Drying of freshwater habitats is expected to adversely affect species such as the rusty blackbird which depend on these as breeding habitats. In the Cook Inlet area, the cumulative impacts of climate change on birds will vary somewhat depending on species but are expected to be long-lasting and widespread for many.

Overall, the cumulative impact to birds from past, present, and reasonably foreseeable future actions, and a changing climate, including the incremental activities resulting from post-lease LS 258 activities, as described in the E&D Scenario, would be moderate, with a few populations potentially incurring severe or major impacts. Complex, climate-related changes are expected to have the most widespread and long-term contribution of impacts on many species. Some populations will likely experience ongoing and synergistic effects from climate-related impacts and repeated or annual exposure to a suite of factors such as collisions and other disturbances, and habitat loss. Declining and limited populations are expected to persist but ultimately may be so affected by climate change and, potentially in some cases, large spills, and associated spill response that they would experience major impacts. For one or two vulnerable populations particularly at risk from offshore collisions in lower Cook Inlet, such as the marbled godwit subpopulation and Steller's eider, the installation of offshore structures and vessel activity described in the E&D Scenario could actually pose a relatively large proportion of the cumulative offshore collision risk, potentially changing their impact risk level from moderate to major. For most birds, however, post-lease activities that occur as a result of LS 258 are not expected to contribute measurably to the moderate to major cumulative impacts.

4.8 Marine Mammals

4.8.1 Affected Environment

Marine mammals most likely to be affected by post-lease activities resulting from LS 258 include beluga, killer, fin, gray, humpback, and minke whales; Dall's and harbor porpoises; Pacific white-sided dolphins; harbor seals; Steller sea lions; and sea otters (Table 4-20). Species such as blue, sei, sperm, and beaked whales; northern fur seals, and elephant seals were considered, but they are rare or uncommon in the project area and unlikely to be affected by the post-lease activities.

4.8.1.1 Whales and Porpoises (Cetaceans)

Cook Inlet beluga whales are white, toothed whales found in upper Cook Inlet when sea ice is absent, and farther south into lower Cook Inlet after sea ice formation. During spawning runs of anadromous fishes, they congregate near the mouths of larger streams to feed, particularly on salmon and smelt. Satellite data from tagged whales suggest some belugas feed in deeper waters south of the Forelands during winter (Hobbs et al., 2005). They have broad diets that include fish such as salmon, cod, smelt, eulachon, and flounder, as well as crustaceans and cephalopods (Quakenbush et al., 2015; Saupe et al., 2014; Fall et al., 1984; Huntington, 2000; Hobbs et al., 2005). A recent study suggests Cook Inlet beluga whale reproductive success is tied to king salmon abundance in the Deshka River (Norman et al., 2020). Calving and breeding primarily occur between mid-May and mid-July in the upper inlet (NMFS, 2008c). The beluga population estimate dropped precipitously in the 1990s due to overhunting by subsistence practitioners (Muto et al., 2020). Subsistence hunting was voluntarily suspended in 1999, however the Cook Inlet population has continued to decline to the currently estimated 279 individuals. Beluga whales were listed as endangered under the ESA in 2008 (73 FR 62919, October 22, 2008; 76 FR 20189, April 11, 2011). Despite ESA and MMPA protections, belugas continue to decline at a rate of 2.3 percent annually (Gill 2020; NMFS 2016; Muto et al. 2020; Shelden and Wade 2019).

Table 4-20: Marine Mammals Occurring in Cook Inlet, Alaska

Common Name	Status ESA (MMPA)	Seasonal Presence in Cook Inlet	Estimated Hearing Range	Minimum Abundance Estimate
Toothed Whales				
Beluga Whale (Cook Inlet Stock)	Endangered (Depleted)	Year-long	150 Hz – 160 kHz[f]	279[e]
Resident Killer Whale (Alaska Resident Stock)	N/A (Not Depleted)	Year-long in ice free waters.	150 Hz – 160 kHz[f]	2,347[b]
Biggs Killer Whale (Gulf of Alaska, Aleutian Islands, and Bering Sea Transient Stock)	N/A (Not Depleted)	Year-long in ice-free waters.	150 Hz – 160 kHz[f]	587[b]
Dall's Porpoise (Alaska Stock)	N/A (Not Depleted)	Year long	275 Hz – 160 kHz[f]	UNK[a, b]
Harbor Porpoise (Gulf of Alaska Stock)	N/A (Not Depleted)	Year-long in lower inlet. Ice-free season in upper inlet.	275 Hz – 160 kHz[f]	26,064[a]
Pacific White-sided Dolphin	N/A (Not Depleted)	Year-long in lower inlet.	275 Hz – 160 kHz[f]	26,880[b]
Baleen Whales				
Fin Whale (Northeast Pacific Stock)	Endangered (Depleted)	Spring, Summer, and Fall in lower inlet.	7 Hz – 35 kHz[f]	2,554[a]
Gray Whale (Eastern Pacific Stock)	N/A (Not Depleted)	Spring and Fall in lower inlet.	7 Hz – 35 kHz[f]	25,849[c, d]
Humpback Whale (Central and Western North Pacific Stocks)	Endangered (Depleted) Endangered (Depleted)	Spring, Summer, and Fall in lower inlet.	7 Hz – 35 kHz[f]	2,222[b] 865[a]
Minke Whale	N/A (Not Depleted)	Spring, Summer, and Fall in lower inlet.	7 Hz – 35 kHz[f]	UNK[a, b]
Pinnipeds				
Harbor Seal (Cook Inlet/Shelikof Strait Stock)	N/A (Not Depleted)	Year-long in lower inlet. Ice-free season in upper inlet.	50 Hz – 86 kHz[f] (in-water)	26,907[a]
Steller Sea Lion (Western DPS)	Endangered (Depleted)	Year-long in lower inlet. Ice-free season in upper inlet.	60 Hz – 39 kHz[f] (in-water)	53,624[a]
Fissipeds				
Northern Sea Otter (Southcentral Alaska Stock, and Southwestern Alaska Stock)	Southcentral Stock N/A (Not Depleted) ----------------- Southwestern Stock Threatened (Depleted)	Lower Inlet. Southcentral AK Stock in Eastern Inlet waters and Southwestern Alaska Stock in Western Inlet waters.	60 Hz – 39 kHz[f]	14,661[b] 45,064[b]

Notes: ESA = Endangered Species Act MMPA = Marine Mammal Protection Act Hz = hertz kHz = kilohertz

[a] 2019 Alaska Stock Assessment
[b] 2018 Alaska Stock Assessment
[c] 2019 Pacific Stock Assessment
[d] 2018 Pacific Stock Assessment
[e] Gill, Verena. 2020. Cook Inlet Beluga Whale Management, Research, and Partnership Opportunities Workshop. 2020 Alaska Marine Science Symposium, Anchorage, AK.
[f] NMFS, 2018.Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing.

In 2011, NMFS designated two marine and estuarine areas (Area 1 and Area 2) in Cook Inlet as Critical Habitat for beluga whales (76 FR 20180, April 11, 2011). The areas, totaling 7,809 km^2 (3,016 mi^2), are considered essential to the survival and recovery of the Cook Inlet beluga whales. Critical Habitat Area 1 encompasses all marine waters of Cook Inlet north of a line connecting Point Possession and the mouth of Three Mile Creek. Although this area is not within the lease sale area, it provides important habitat during ice-free months and is used intensively by Cook Inlet beluga between April and November. Critical Habitat Area 2 includes marine waters of Cook Inlet south of Critical Habitat Area 1 to the mouth of the Douglas River; Kachemak Bay east of 151°40.0′W; and waters of the Kenai River downstream of the Warren Ames bridge at Kenai, Alaska. A small portion of Area 2 is located in the northern portion of the lease sale area and is shown in Figure 2-1.

New aerial survey data from NMFS (Gill, Sheldon, and Sims, 2022; Gill and Seymore, unpub. data, 2022) indicates that Cook Inlet beluga whales are consistently using the Tuxedni Bay and Kalgin Island areas in spring, and that the use of this area is higher than previously observed. This appears to be an important area where belugas feed on herring as they move up the west coast of Cook Inlet. Herring are the first concentrated food source for beluga in the spring after hunting flatfish and other more dispersed food resources in winter. Herring provide an important food source for belugas before they head into upper Cook Inlet for summer breeding and calving. Groups of up to 24 belugas were in the Tuxedni Bay and Kalgin Island areas in March and April, with most of the belugas leaving the area by May.

Two species of killer whales are present in lower and upper Cook Inlet on a regular basis. They are the resident killer whales and the Bigg’s (transient) killer whales, both of which are black and white, toothed whales, with differences in diet, appearance, and behavior. Resident killer whales preferentially eat salmonids (particularly Chinooks), sablefish, herring, halibut, cod, and other large fishes (Matkin et al., 2010; ADF&G, 2020c). Bigg’s (transient) killer whales hunt and consume other marine mammals such as belugas, baleen whales, sea otters, porpoises, harbor seals, and Steller sea lions (Shelden et al., 2003; Saulitis et al., 2015; ADF&G, 2020c).

Dall’s porpoises occur year-round in Cook Inlet. They prefer deep water and use underwater canyons and deep channels to approach coastal areas when possible. Although present during all months of the year, some seasonal nearshore-offshore movements and winter movements of populations from coastal areas into and out of the GOA and Bering Sea likely occur (ADF&G, 2020c). Harbor porpoises are also common year-round in Cook Inlet where sea ice does not impede them. They often enter bays, harbors, estuaries, and large rivers, usually at depths of less than 91 m (300 ft) but will occasionally travel to deeper offshore waters in the winter. Both species feed on squid and a wide variety of small schooling fishes. Pacific white-sided dolphins are another toothed whale present in Cook Inlet year-round, feeding primarily on small schooling fishes.

Fin whales are baleen whales that have been observed throughout the year in lower Cook Inlet and the areas around Kodiak. The Barren and Semidi islands and lower Cook Inlet are recognized as important feeding areas for them, especially during summer (Zerbini et al., 2006; Mizroch et al., 2009; Ferguson et al., 2015). Fin whales feed on krill, small schooling fish (e.g., herring, capelin, and sand lance), and squid (https://www.fisheries.noaa.gov/species-directory; Mizroch et al., 2009).

Migrating gray whale individuals and groups pass through Cook Inlet during their spring and fall migrations (Carretta et al., 2019; NOAA, 2020). They are mainly bottom feeders, getting their food by scooping up sediment and straining their food from the sediments using their baleen (ADF&G, 2020c)

Humpbacks are baleen whales that typically feed on small schooling fishes, euphausiids, and other large zooplankton. Humpback whales are regularly present and feeding in Cook Inlet and adjacent waters during the summer, with many remaining in or near Cook Inlet through the end of autumn (Muto et al., 2019; ADF&G, 2020c).

Minke whales are also baleen whales that have been observed off Cape Starichkof and Anchor Point year-round, with some becoming sedentary (i.e., do not migrate over long distances), occupying localized feeding ranges (Dorsey, 1981; BOEM, 2015b; Allen et al., 2013). However, they become scarce in the GOA in fall, and most whales probably leave Cook Inlet and the GOA by October (Consiglieri et al., 1982). They primarily consume krill, and small schooling fishes (ADF&G, 2020c).

4.8.1.2 Seals and Sea Lions (Pinnipeds)

The Cook Inlet/Shelikof Stock of harbor seals is distributed throughout Cook Inlet in the summer and from lower Cook Inlet through Shelikof Strait to Unimak Pass during winter months (Boveng et al., 2012). Large numbers concentrate at the river mouths and bays of lower Cook Inlet, including the Fox River mouth in Kachemak Bay, and several resting areas (haulouts) have been identified on the southern end of Kalgin Island with over 200 haulouts in lower Cook Inlet (Rugh et al., 2005; Boveng et al., 2012; Montgomery et al., 2007). Marine mammal monitoring efforts have observed large aggregations of harbor seals hauled out at the mouths of the Theodore and Lewis rivers (NMFS, 2015). The greatest concentrations of harbor seals occur in Kachemak Bay, Iniskin and Iliamna bays, Kamishak Bay, Cape Douglas, and Shelikof Strait (Boveng et al., 2012). Harbor seals have higher population densities, more haulouts, and more breeding and pupping areas (rookeries) along the western coastline of Cook Inlet than along the eastern coastline (Boveng et al., 2012). Harbor seals favor coastal areas in spring and summer, and shift to areas outside of Cook Inlet in fall and winter (Boveng et al., 2012). In April and May, the seals return to Cook Inlet where they give birth and nurse their young (Boveng et al., 2012; London et al., 2012; Pitcher and Calkins, 1979). Harbor seals feed on fish such as salmon, squid, octopi, and crustaceans (Pitcher and Calkins, 1979; Jemison, 2001).

Steller sea lion habitat includes rookeries, haulouts, and marine foraging areas. Nearly all rookeries are at sites inaccessible to terrestrial predators on remote rocks, islands, and reefs. A few rookeries and haulouts occur in the southernmost coastal areas of Cook Inlet, and there are many haulouts and rookeries along the coast of Shelikof Strait, Kodiak, and the Kenai Peninsula. Steller sea lions from both the eastern and western DPS frequently cross the 144°W longitudinal demarcation line between their population ranges, creating a mix of individuals from both populations in lower Cook Inlet. Because the eastern DPS population is greater than the western DPS, there would be a greater likelihood of encountering members of the eastern DPS along the Kenai coastline and in the center of Cook Inlet (Raum-Suryan et al., 2002). Disturbances and environmental conditions in Cook Inlet can affect individuals from either stock regardless of where impacts occur. Steller sea lions feed on a variety of fish and invertebrate prey, indicative of a broad spectrum of foraging behaviors likely based on prey availability (NMFS, 2008b). Fecal analyses found pollock, Pacific cod, herring, and salmon are major prey species in the GOA and Cook Inlet (Merrick et al., 1997; Sinclair and Zeppelin, 2002). Pup counts, in the central Gulf of Alaska Steller sea lion subpopulation, declined sharply (-18 percent) between 2015 and 2017 (contrary to the continuous increases observed in both regions since 2002), possibly due to changes in availability of prey associated with warm ocean temperatures in years 2014–2016 (Muto et al., 2019; Bond et al., 2015, Peterson et al., 2016).

The critical habitat designation for the western DPS of Steller sea lions includes a 37-km (20-nmi) buffer around all major haulouts and rookeries and other areas (50 CFR 226.202, August 27, 1993, as amended in 1999). One such critical habitat area lies close to the southeastern corner of the lease sale area. Although the critical habitat is located outside of the lease sale boundaries, the impact of certain activities associated with the E&D Scenario could extend into this area (e.g., noise associated with seismic surveys).

4.8.1.3 Northern Sea Otters (Fissipeds)

Two distinct stocks of northern sea otters occur in the Cook Inlet region: the ESA-listed southwest Alaska DPS, which is threatened, and the non-ESA listed southcentral stock. The southcentral stock's range extends from Cape Yakataga to eastern Cook Inlet; the southwest Alaska DPS' range extends from the west side of Cook Inlet, along the Alaska Peninsula to Bristol Bay, and includes the Aleutian, Barren, Kodiak, and Pribilof island groups (USFWS, 2014).

Sea otters generally inhabit nearshore waters <35 m (115 ft) deep and rarely range beyond the 55-m (180-ft) depth contour (Kenyon, 1969; Garshelis, 1987). They are year-round residents within the affected environment, including nearshore areas in parts of western and eastern lower Cook Inlet and associated bays, and nearby waters. During summer, sea otters have been observed using areas within 40 m (131.2 ft) of shore where their best foraging opportunities exist (Bodkin et al., 2003; Riedman and Estes, 1990). Deep, wide channels with strong currents can act as partial barriers to their movements. Sea otters are commonly found in lower Cook Inlet, particularly in coastal areas where they can access food and cover. Diving depth of sea otters is highly variable and ranges from 2–75 m (5–250 ft) and, depending on the prey species, may forage in shallow rocky and soft-sediment communities, typically close to shorelines (ADF&G, 2020c; Estes, 1980; VanBlaricom and Estes, 1988; Bodkin et al., 2004). Sea urchins, crabs, clams, mussels, octopuses, other marine invertebrates, and fish make up their diet. The maximum possible productivity rate for the southwestern DPS of northern sea otters was estimated to be 20 percent and up to 26 percent per year for the southcentral stock (Muto et al. 2019).

Critical habitat for the southwest Alaska DPS of the northern sea otter was designated in 2009 (74 FR 51988, October 8, 2009). The total area of the critical habitat is 15,164 km^2 (5,855 mi^2). The lease sale area includes 7 OCS lease blocks overlapping critical habitat (Figure 2-3). The geographic extent of sea otter critical habitat within the lease sale area is a small percentage of all northern sea otter critical habitat. Although most of the critical habitat is located outside of the lease sale boundaries, the impact of certain activities associated with the E&D Scenario could extend into this area (e.g., noise associated with seismic surveys).

4.8.2 Environmental Consequences of the Proposed Action

4.8.2.1 Noise

Anticipated noise impacts from post-lease activities conducted as a result of LS 258, as described in the E&D Scenario, include those from seismic surveys, pile-driving, installation of platforms and pipelines, drilling, and traffic (vessel and aerial). Potential effects on marine mammals will depend upon the sound sources introduced, the temporal and spatial characteristics of those sound sources, and the extent and duration of the development activity.

Marine mammals use sound, sight, smell, and somatic (orientation of the body) senses to interact with their environment. Activities that produce sound can affect marine mammals by disrupting or changing behavior, masking sounds, and creating physiological stress and/or injuries such as temporary or permanent hearing loss. Behavioral responses to noise include tolerance, inquisitiveness, avoidance, or changes in other behaviors such as feeding, courtship, mating, swimming, or breathing. Such changes are usually temporary and lack consequence, particularly if the disturbance is brief (Richardson, 1995) although exceptions could occur if individual animals are prevented from using key habitats at critical times in their life cycles. Anthropogenic noise in some frequency bands can mask important sounds transmitted and received by individual marine mammals, potentially resulting in behavioral changes that could temporarily compromise an individual animal's ability to communicate, navigate, find food, or avoid hazards or predators. Injuries to hearing could be temporary or permanent depending on the circumstances and severity of the exposure.

Post-lease activities with the greatest potential to harm marine mammals are seismic surveys and pile-driving. Seismic surveys use airguns to produce impulsive, loud, low-frequency noise up to 237 decibels root mean square (dB_{RMS}) at the source in brief pulses every 6–10 seconds, primarily in narrow frequency bands around 200 hertz (Hz). It is assumed species with the best low frequency hearing, such as baleen whales, would be more sensitive to airgun noise than species who hear best at higher sound frequencies (above 300 Hz), such as harbor porpoises (Table 4-20). Other species with amphibious hearing capabilities (having both aerial and underwater hearing capability), such as seals, sea lions, and sea otters, do not echolocate and are not as sensitive to low-frequency noise as whales and porpoises. This is thought to explain their greater tolerance to airgun noise (NMFS, 2017). NMFS (2017) determined seismic surveys in Cook Inlet can create a 9.5-km (6-mi) radius zone with enough noise to elicit behavioral changes among marine mammals at close range.

The loudest noises produced by seismic airgun arrays could temporarily or permanently compromise the hearing abilities of some nearby marine mammals. The zone of potentially harmful noise radiating out from an airgun array extends for several tens of meters, up to around 1,000 m (0.6 mi) depending on airgun array size (Richardson et al., 1995; Lomac-MacNair et al., 2014). The zone for potential injury for arrays used in Cook Inlet has been much smaller than 1,000 m, with a typical radii where noise is ≥190 dB_{RMS} extending out for no more than a few hundred meters from airgun arrays (NMFS, 2017). Mitigation measures that include, but aren't limited to, the use of PSOs and operational modifications, such as shutting off airguns in the presence of marine mammals that are too close to the survey, would prevent or reduce injuries to marine mammals (Baker et al., 2013; NMFS, 2017).

In general, it is expected that whales, seals, sea lions, and sea otters would avoid activities that disturb them; however, the distance at which they react can vary greatly by species and site-specific conditions (e.g., activity type, duration, timing). Whales can begin responding to seismic surveys at distances of about 9.5 km (6 mi), but distances vary with species. Beluga whales have been observed reacting at distances sometimes greater than 20 km (12 mi) (Richardson et al., 1995; 1999; Madsen et al., 2002), while others often do not respond until within a few kilometers (Richardson et al., 1995). Because the onset of behavioral disturbance from noise depends on both external factors (source noise characteristics, background noise) and the receiving animal's status (hearing, motivation, experience, demography, level of habituation, current activity, and reproductive state), predicting exact behavioral impacts among individuals may be difficult (NMFS, 2017).

Belugas can react to seismic operations at distances greater than 20 km (12.4 mi) depending on the airgun array, and data suggests they could be more sensitive to airgun noise than their known hearing abilities would indicate (Table 4-20; Gordon et al., 2004; Ellison et al., 2012; Richardson, 1995; Sysueva et al., 2018; Mooney et al., 2018, 2020; Miller et al., 2005) and, under certain conditions, behavioral responses may occur at even greater distances than expected (Potter et al., 2007; DeRuiter et al., 2006; Goold and Coates, 2006; Tyack et al., 2006). Belugas, if present in the vicinity of survey activities, would likely avoid the area unless they are engaged in feeding or social activity (Erbe and Farmer, 2000). Because of the assumed scarcity of beluga whales in open water areas of lower Cook Inlet, seismic surveys have a low likelihood of impacting them. However, aerial surveys from 2018 to 2021 suggest belugas are consistently using the Tuxedni Bay and Kalgin Island areas in March and April (Gill, Sheldon, and Simms, 2022; Gill and Seymore, unpub. data, 2022). This information suggests a few individual belugas could be present in lower Cook Inlet when seismic surveys occur, most likely in bays or coastal waters, and could be impacted by airgun operations occurring near them (Castellote et al., 2020; Fairweather Science, 2020).

Humpback, minke, fin, and gray whales generally avoid operating airguns, but their avoidance reactions also vary with species, location, current activities whales are engaged in, oceanographic conditions, and noise characteristics (Gordon et al., 2004; Richardson et al., 1995; Cato et al., 2013; Dunlop and Noad, 2017; Dunlop et al., 2018, 2020; Noad et al., 2011). Whales have also been reported to show no overt reactions to pulses from large seismic surveys at distances beyond a few kilometers, even though the noise pulses remain above ambient sound levels out to greater distances. Likewise, baleen whales have demonstrated some tolerance to vessels and sonar operations (Richardson et al., 1995; Buck and Calvert, 2005). However, when exposed to strong airgun noises, they often deviate from migration routes or cease feeding and move away (Gordon et al., 2004; Johnson et al., 2007; Malme et al., 1984; Malme and Miles, 1985; McCauley et al., 1998; 2000a, b; Nowacek et al., 2007; Richardson, 1995; Weir, 2008).

Seismic airgun operations have the greatest potential for noise impacts to sea otters, harbor seals, and sea lions due to differences in the distributions of these species and the larger population size for harbor seals (NMFS, 2017; USFWS, 2013, 2017). Steller sea lions mainly occur in the lower inlet. Based on existing marine mammal surveys and proximity to their critical habitat areas, Steller sea lions would likely be affected by seismic surveys, but less often than harbor seals. Monitoring suggests sea otters, seals, and sea lions typically do not react strongly to airgun operations, often watching from within 300 m (984 ft) of a survey until it passes them by (NMFS, 2016, 2017; Beland et al., 2013; 86 FR 30613).

Impacts from airgun operations would most likely consist of exposure to non-injurious intensities of low frequency noise that could result in temporary behavioral responses from marine mammals. This is because marine mammals tend to avoid the area when surveys are occurring, as well as the implementation of required mitigation measures, e.g., use of PSOs onboard vessels and the shutdowns of operating airgun arrays when marine mammals are detected in close proximity (Section 3.3.2). Overall, most marine mammals would avoid approaching seismic surveys before they could be physically affected. However, there is a remote likelihood some marine mammals could remain near seismic surveys and be adversely impacted or injured, but such encounters are not expected given the suite of mitigations NMFS requires (NMFS, 2017; Castellote et al., 2020).

Pile-driving, both impact and vibratory, which would occur during platform installation, can produce noise intense enough to injure marine mammals at close range (Richardson, 1995; CH2M, 2016; Castellote et al., 2019). Though the source levels from pile/pipe/sheet driving are usually above the injury thresholds established by NMFS (2018), noise levels drop considerably within a short distance from the source (Blackwell, 2005; Greene and Moore, 1995). Typically, the louder underwater noise levels from such activities do not radiate beyond one kilometer (0.6 mi) from the source, and as with airgun operations, the most common response from marine mammals is to avoid the noisiest areas until the activity ceases (Moulton et al., 2003; Malme et al., 1988; Richardson 1995; Castellote et al., 2016; DOSITS, 2020; Horwitz et al., 2015; Nehls et al., 2016; Denes et al., 2016). However, with prolonged and repeated exposure, within a few hundred meters of the source, pile-driving is capable of producing auditory injury to whales and seals (Blackwell, 2005; Greene and Moore, 1995; SLR, 2017). In general, marine mammals circumvent areas where pile-driving occurs and avoid injury.

Exposure to noise from the construction of platforms and pipelines may result in tolerance, avoidance, or displacement of marine mammals around operations (NMFS, 2015). Because construction and equipment noise would generally be ongoing and continuous until the structure has been completed, whales, seals, and sea otters would be alerted to increasing noise levels and should not intentionally enter an area where they would suffer from acoustic injury, or experience enough noise disturbance to risk their survival (NMFS, 2015, 2017; USFWS, 2017). Impacts from construction and equipment noise have been found to be restricted to the immediate vicinity of MODUs or platforms by a margin of generally less than 10 m (33 ft) (BOEM, 2015a; Austin et al, 2016; LGL/JASCO/Greeneridge, 2014). In nearshore regions, Greene and Moore (1995) found that dredging can introduce continuous noise at low frequencies that may be audible for distances of 20–25 km (12–16 mi) from the source. Generally speaking, Richardson (1995) found that construction/dredging associated with platform and pipeline construction would produce noise in a localized area that could affect marine mammals or their prey for the duration of the activity.

Richardson et al. (1995) summarized the results of numerous studies and decades of research that showed OCS drilling, particularly from drillships, produces continuous noise leading to avoidance by many marine mammals with no observable lingering effects. This assumption is further supported by more recent studies and syntheses of noise and marine mammal response data (Rossi-Santos, 2015; Bach et al., 2010; OSPAR Commission, 2009). The most probable type of drilling platforms that would be used in the lease sale area (Section 4.1) are jack-up rigs or other forms of MODUs that can remain stable in Cook Inlet. They are less noisy than drillships and other commonly used drilling platforms, and in Cook Inlet produce underwater noise close to or below ambient noise levels, making for a relatively small acoustic footprint (Richardson et al. 1995).

Marine mammals may exhibit various reactions to drilling operations depending on noise levels and the activities they are engaged in at the time. Although belugas have been shown to have greater displacement in response to a moving sound source (vessels, airgun surveys), they exhibit less displacement or behavioral change in response to a stationary sound source (drilling) (NMFS, 2015). When drilling sounds were played to belugas in industry-free areas, the whales showed a behavioral reaction only when received levels were high (Richardson and Würsig, 1997). Belugas have been regularly observed approaching to within 100–150 m (328–492 ft) of MODU drilling operations without perceived effect (Richardson, 1995). Based on previous observations cited above, the most likely effect drilling noise from Cook Inlet jack-up rigs or MODUs would have on other cetaceans, pinnipeds, or sea otters would be avoidance of the area immediately adjacent to drilling operations, to later resume their normal distribution and activity patterns when drilling ceases.

Vessels produce the loudest regularly occurring man-made noises in Cook Inlet (NMFS, 2017). For this analysis, most vessel traffic is assumed to occur along the Kenai coastline (NMFS, 2017; USFWS, 2017). Vessels used in industrial activities produce sound below the intensity required to cause injury to marine mammals. The most likely response to vessel noise from marine mammals would therefore be brief avoidance of the area around the vessel with temporary changes in vocalizations, as the vessel noise temporarily masks other environmental noises (Lesage et al., 1999).

Marine mammal responses to rotary and fixed-wing aircraft vary depending on flight altitude and received sound levels. Pinnipeds on haulouts often exhibit overt escape responses to helicopters and low-flying fixed-wing aircraft; however, aircraft noise quickly attenuates upon reaching the sea surface and has no known direct or indirect effect on marine mammals underwater, especially whales (Born et al., 1999; Richardson, 1995; Burns and Harbo, 1972; Fay, 1982; Patenaude et al., 2002; Richardson et al., 1985a, b). Seals could partially habituate to aircraft flights up to some point; beyond which, they could become more sensitive and responsive to an increase in air traffic (Richardson, 1995). Bodkin and Udevitz (1999) noted sea otters frequently dive to escape closely approaching aircraft. The minimum 457-m (1,500-ft) aircraft altitude requirement USFWS and NMFS typically require for OCS activities in Cook Inlet would ensure aircraft noise minimizes impacts on cetaceans, pinnipeds, or sea otters (Section 3.3).

With the exceptions of noise from airgun use and pile-driving, most noises stemming from post-lease activities lack the necessary sound levels and/or do not occur in frequency bands that would injure marine mammals (Richardson et al., 1995; OSPAR Commission, 2009; NMFS, 2018). Marine mammal responses would primarily amount to behavioral reactions that chiefly include avoidance, heightened alertness, and occasional temporary changes in diving activity. For all but the loudest noises, injuries to marine mammals would only occur if a marine mammal remained in an ensonified (filled with sound) area for an extended amount of time and even then, the injuries would most likely be temporary. In avoiding ensonified areas, some marine mammals may leave or temporarily avoid areas that would otherwise be considered important habitat. This could lead to small energetic costs to individual marine mammals that should not have meaningful effects on their health.

4.8.2.2 Habitat Alteration

Oil and gas activities can result in temporary or permanent alteration of habitat for marine mammals. Post-lease offshore activities conducted as a result of LS 258, as described in the E&D Scenario, which could physically alter marine mammal foraging habitat include seafloor disturbance during platform installation, pipeline installation, drilling, placement of equipment on the seafloor (e.g., nodes and cables for 3D surveys, anchors); increased turbidity that could affect prey distribution and smother benthic organisms; and discharges or releases of materials from vessels and platforms.

The installation of platforms, drilling, and placement of equipment on the sea floor would generally be short-term and have a small footprint, but in some cases the habitat alteration could be long-term (i.e., production platform). Impacts would be localized and would occur where the activity directly disturbs the seafloor. Seafloor disturbance could also increase turbidity, which could disturb pelagic species and, when the sediment particles settle, could smother benthic species. While a reduction in the amount or types of prey available to marine mammals may reduce marine mammal fitness or even lead to mortality (Burek-Huntington et al., 2015), the extent of marine mammal habitat affected by these activities would be small. Furthermore, there is some evidence that adverse impacts of seafloor disturbance and habitat alteration may be offset by the presence of production platforms. The installation of offshore production platforms in other cold seas has had a positive impact on fish-eating marine mammals because the production platform infrastructure provides vertical structure benefitting some fish and invertebrate species (Russell et al. 2014; Thomson and Johnson, 1996; Todd et al., 2009).Consequently, these platforms in Cook Inlet may provide feeding habitat for porpoises, harbor seals, Steller sea lions, and sea otters, providing trends from other cold water marine areas hold true.

Based on the E&D Scenario, one to two subsea pipelines could be constructed to transport oil and gas to shore. Pipeline landfall would occur between Homer and Nikiski, and connect to the existing oil refinery at Nikiski. The placement of pipelines in and on the seabed would change the character of the seafloor along pipeline routes for several years until the site returns to its original ecologic state (McKellar, 2014; ADF&G, 2020c; EPA, 2017; Ridgway et al., 2011). Burying pipelines would displace benthic habitat along the pipeline trench for several years. Benthic-feeding marine mammals such as sea otters, pinnipeds, and gray whales would not use the impacted habitat as efficiently until the disturbed seabed recovered. These activities would not affect food availability over the long-term because prey species have broad distributions, and marine mammals forage over large areas of Cook Inlet and the GOA.

The main impacts from discharges or releases of drilling muds, cuttings, or tailings would be localized alteration of the benthic environment around wellsites and temporary turbidity in the water column that could smother benthic organisms and disturb pelagic species. No production and development cuttings and fluids would be discharged, but rather they would be reused or reinjected into disposal wells (see Section 4.1.2 for E&D Scenario production and development assumptions). Additionally, an NPDES permit must be obtained from the EPA for all oil and gas operational discharges (including vessel discharges), during exploration, production, and decommissioning. While pollutants such as trace metals have the potential to impact water quality near the point of discharge, these discharges represent only small pollutant loadings when properly designed and functioning equipment is used, and little to no impacts would be expected. Furthermore, Cook Inlet's large currents and tides would serve to widely disperse discharge materials, eventually flushing the materials out of Cook Inlet and into the GOA.

4.8.2.3 Disturbance

Post-lease, non-acoustic activities described in the E&D Scenario that would disturb marine mammals include vessels and aircraft as described below.

The primary responses of marine mammals to disturbances include avoidance, habituation, and often visitations to identify the disturbance. Vessels could disturb and temporarily displace or strike whales, pinnipeds, and sea otters in transit routes. However, there are a number of variables that determine whether or not a marine mammal is disturbed by vessel activity. These include wind direction, the number of vessels, distance between a vessel and the animal, vessel speed and direction, vessel type and size, and the contextual habituation, threat association, and activity of the marine mammal (e.g., feeding, resting, sleeping). Vessel traffic is not expected to disrupt migrations or elicit responses greater than minor deflections by marine mammals as they avoid vessels. Furthermore, all critical habitat for Steller sea lions and most critical habitat for northern sea otters and beluga whales occurs outside of the lease sale area, so it is unlikely that vessels would traverse and adversely affect critical habitat areas.

Baleen whales (e.g., fin, gray, humpback, minke) often tolerate the approach of slow-moving vessels within a few thousand feet, especially when the vessel is not headed towards them and when there are no sudden changes in direction or engine speed (Heide-Jorgensen et al., 2003; Richardson et al., 1995; Wartzok et al., 1989). Vessel strikes on marine mammals are considered a possibility, particularly for fin and humpback whales. Since both fin and humpback whales rank at the top of the global list for vessel strikes, and noticeably react to erratically moving vessels, it is assumed they would be at greater risk for vessel strikes (NMFS, 2017). Dead whales occasionally wash ashore in Cook Inlet with indications they have been struck by vessels, however, no data suggests those injuries were associated with oil and gas activities in the Inlet.

Beluga whales have been shown to respond to vessels by altering call types, frequency use, and call rates, and avoiding ships (Finley et al., 1990; Lesage et al., 1999). The response of belugas to vessels is thought to be partly a function of habituation (NMFS, 2017). A recent study (McGuire et al., 2020) found approximately one third of Cook Inlet belugas sampled by photo identification or during stranding events showed evidence of lethal or non-lethal scarring related to some human activity. About a quarter of those sampled had scars attributed to punctures, vessel strikes, and entanglements, suggesting they may be struck by small vessels more often than has been previously assumed. The size and type of vessel used during oil and gas exploration, development, and production depends on the phase of activity. Smaller vessels would be used for transiting to and from areas, whereas mid-size and large vessels are used in more open environments and when transporting heavy materials. The low number of vessels associated with the E&D Scenario compared to the total number of vessels operating throughout Cook Inlet, the scarcity of beluga whales in the lower inlet for much of the year, and NMFS' standard requirements for vessels to avoid approaching marine mammals and reduce speed in the presence of whales, further lessens the likelihood of any cetacean being injured by vessel traffic.

Some marine mammals, such as toothed whales (except harbor porpoises), frequently investigate vessels, often "playing" in the wake of moving vessels, while pinnipeds and sea otters often show limited responses to vessels, with increased alertness, diving, moving from the vessel's path by up to several hundred meters (or feet), or by ignoring the vessel (USFWS, 2017; NMFS, 2017). Harbor seals and Steller sea lions frequently habituate to the presence of vessels, especially in places where vessel traffic is heavy. However, large, slow-moving vessels that would be used in the potential post-lease activities have been determined to present little threat to seals and sea lions (NMFS, 2017; USFWS, 2017; Bonner, 1982; Jansen et al., 2006).

Regarding the effects of vessel traffic on sea otters, the USFWS determined disturbances from vessel traffic were likely, particularly if drill sites were placed in sea otter critical habitat. Such disturbances would be greatest during summer when sea otter pups are in open waters, away from their nearshore wintering areas (USFWS, 2017). Because the likely shore bases are located on the eastern side of Cook Inlet, routine vessel traffic is not expected to transit through sea otter critical habitat. For this reason, sea otters occurring in the western portion of sea otter critical habitat would mostly remain unaffected by vessel traffic from post-lease activities (USFWS, 2017).

In their Biological Opinion for Lease Sale 244, which was similar to the Proposed Action, NMFS determined vessel strikes from post-lease activities have a remote likelihood of injuring marine mammals (NMFS, 2017). Furthermore, the application of existing USFWS and NMFS requirements should prevent potential impacts from vessel traffic (Section 3.3; NMFS, 2017), including: reduce vessel speeds to <5 knots in the presence of marine mammals, avoid approaching within 100 m (328 ft) of any marine mammal, avoid multiple direction changes within 274 m (900 ft) of marine mammals, and use PSOs to monitor and help avoid marine mammals.

In addition to aircraft noise (discussed above), the presence of aircraft can disturb marine mammals, particularly individuals resting on the sea surface. Observations made from low-altitude aerial surveys report highly variable behavioral responses ranging from no observable reaction to diving to changing swimming speed/direction (Efroymson et al., 2000; Smultean et al., 2008).

4.8.2.4 Oil Spills Impact Summary

Effects of spills, spill drills, and spill response activities on marine mammals are described in Section A-3.7 of Appendix A. Oil spill modelling indicates small spills can be expected, but large oil spills are unlikely. Small spills would not affect marine mammal populations but may temporarily affect a few individual marine mammals behaviorally or physiologically. Spill drills are short-term (generally one day) and introduce noise and physical disturbance into a localized area and for these reasons are generally considered to be unlikely to adversely affect marine mammals. A large offshore oil spill could temporarily or permanently affect marine mammal physiology and behavior and could alter their habitats until the oil is removed or disperses. These impacts could affect individuals but would not affect marine mammal populations due to the assumed volume of a large spill, the tendency of spilled oil to spread into smaller patches with time and distance from the point of release, and the likelihood of a gradual release of spill materials into the water, rather than an instantaneous release of the full spill volume. The effects could include avoidance of oiled areas, compromised thermoregulation for sea otters, skin/eye lesions, and ingestion or inhalation of oil and VOCs damaging the organs and compromising organ function, with a few potential marine mammal fatalities. Spill responses would produce highly localized areas of noise and physical disturbance, with brief, temporary behavioral effects to marine mammals from noise. Because of its limited size and the fact that a large gas release would quickly disperse, it would likely produce temporary behavioral and physiological responses among nearby individual marine mammals, but would be unlikely to impact marine mammal populations.

4.8.2.5 Conclusion

Impacts to marine mammals from any activity or combination of activities, accidental small spills, and spill drills described in the E&D Scenario would range from little to none, to short-term and localized impacts, i.e., negligible to minor. Increases in anthropogenic noise is one of the most potentially impacting effects stemming from LS 258. Of the noise sources attributed to the Proposed Action, seismic surveys and pile-driving have the greatest potential to harm marine mammals. Both types of activities could acoustically injure members of some species; however, it is anticipated that individual animals would avoid the most heavily ensonified areas, which should prevent injuries from occurring.

Furthermore, the sound levels needed for injuries to occur typically require a marine mammal to remain within the loudest noise zones for an extended period of time, which would be unlikely. Thus, the effects of noise on marine mammals are expected to be short-term and produce temporary behavioral responses. Implementation of NMFS' and USFWS' typical requirements (Section 3.3) established through ESA consultation or operator-obtained MMPA authorizations would further minimize impacts. These include the use of PSOs, vessel avoidance, and ramp-up/shut-down procedures.

Marine mammal habitat could be altered from seafloor disturbance during platform installation, pipeline installation, drilling, placement of equipment on the seafloor (e.g., nodes and cables for 3D surveys, anchors), and increased turbidity stemming from marine construction. Impacts would be localized and would occur where the activity directly disturbs the seafloor. Although some activities and associated impacts would be short term (i.e., seismic survey node placement and retrieval; drilling) long-term disturbances to marine mammal habitat would occur with the installation of production platforms and pipelines. Disturbances from pipeline installation and dredging would disturb linear swaths of habitat; however, those areas would eventually return to normal function, while discharges from drilling and other activities would not affect marine mammal habitats. The habitat loss from construction of platforms and pipelines, as well as associated turbidity, could also disturb benthic and pelagic feeding areas for some marine mammals. However, there is some evidence that adverse impacts of seafloor disturbance and habitat alteration may be offset by the presence of production platforms. The installation of offshore production platforms in other cold seas has had a positive impact on fish-eating marine mammals because the production platform infrastructure provides vertical structure benefitting some fish and invertebrates. Habitat alteration from discharges from drilling and other activities would not affect marine mammal habitats.

Vessels and aircraft associated with the Proposed Action could potentially disturb and/or injure marine mammals. Disturbance behaviors exhibited by marine mammals to these activities include avoidance, attraction, habituation, increased swimming speed, and increased diving behaviors. Vessel traffic could lead to injuries if a vessel was to accidentally strike an individual, which can occur with any size of vessel. NMFS and USFWS both require a suite of mitigations measures to minimize effects of vessels and aircraft on marine mammals, including but not limited to: PSOs on vessels monitoring for marine mammals, speed limits for vessels when in the vicinity of marine mammals, and requirements for aircraft to fly >457 m (1,500 ft) (Section 3.3).

Collectively, impacts on marine mammals from post-lease activities conducted as a result of LS 258 as described in the E&D Scenario, including accidental small spills and spill drills, would primarily consist of non-injurious, short-term impacts resulting in temporary behavioral reactions by affected individuals, and would not result in population-level effects. While seismic airgun use and pile-driving could potentially injure a few individual marine mammals, this is unlikely because the assumed mitigation measures (Section 3.2) would prevent injuries or deaths from occurring. Small amounts of benthic habitat could be altered for several years from the installation of pipelines and platforms, which could be slightly detrimental to benthic-feeding marine mammals. However, due to the broad distributions of marine mammal foods in Cook Inlet, any detrimental impacts would be localized and short-term. Likewise, vessel strikes could injure or kill marine mammals, but with the USFWS and NMFS mitigations, vessel strikes would be unlikely, though behavioral avoidance responses by marine mammals would continue. Overall, the impact of post-lease activities associated with the E&D Scenario, accidental small spills, and spill drills on marine mammals would be negligible to minor primarily resulting from anthropogenic noise and vessel traffic that would occur as a result of the Proposed Action. With the addition of a large spill, the impacts would be minor to moderate, with minor impacts for most marine mammal populations other than sea otters. Sea otters could experience a moderate level of impacts from a large spill which could produce hypothermia and deaths among some.

4.8.3 Environmental Consequences of the Alternatives

4.8.3.1 Alternatives 3A, 3B, and 3C – Beluga Whale Critical Habitat Exclusion, Critical Habitat Mitigation, and Nearshore Feeding Areas Mitigation

The overall impacts for marine mammals under Alternatives 3A, 3B, and 3C would remain unchanged from those described for the Proposed Action, although some reduction in impacts may occur for certain species or areas. Alternative 3A excludes 10 OCS blocks that overlap with "Area 2" beluga whale critical habitat within the lease sale area. The "Area 2" portion of the Cook Inlet beluga critical habitat largely consists of dispersed fall and winter feeding areas in waters where whales typically occur in lower densities. Excluding the critical habitat from leasing would protect the habitat from certain adverse effects of oil and gas development. This alternative would reduce impacts on beluga whales primarily in the winter months when belugas are using that area, but would also reduce impacts that could occur during the remainder of the year. Alternative 3B would reduce the risk of noise impacts on beluga whales by prohibiting seismic surveys and exploratory drilling in critical habitat. The timing restriction originally presented in the DEIS as November 1 through April 1 has been extended from April 1 to April 30 as a result of new information gained through the comment period. This serves to further limit possible noise impacts during times when beluga whales are likely to be present. Alternative 3B would be less effective than Alternative 3A in reducing overall impacts because exploration activities could still occur in beluga whale critical habitat during summer and fall months (from May 1 to October 31), and development and production activities could also occur. Alternative 3C, which limits seismic activities throughout the entire lease sale area from November 1 through April 1, would reduce the risk of noise impacts to beluga whales, Steller sea lions, harbor seals, and sea otters. Additionally, Alternative 3C restricts on-lease seismic surveys within 16.1 km (10 mi) of major anadromous streams when beluga whales are following food resources (July 1–September 30). Because of the scheduling restrictions on seismic surveys and the larger area protected, the mitigations outlined in Alternative 3C would protect more marine mammals compared to the Proposed Action or other alternatives, and lower the likelihood of disturbing them, especially beluga whales during spring and summer when they feed near river mouths. Because marine mammal populations would not be protected from impacts outside of the mitigated areas or months, the overall impact levels of Alternatives 3A, 3B, and 3C, though slightly less, would be the same as those for the Proposed Action, including accidental small spills, spill drills, and large spills – negligible to moderate. However, these alternatives would provide an additional measure of protection to beluga whales by limiting activities in or near beluga whale critical habitat and their feeding areas in Cook Inlet.

4.8.3.2 Alternatives 4A and 4B – Northern Sea Otter SW Alaska DPS Critical Habitat Exclusion or Mitigation

The overall impacts for marine mammals under these alternatives would remain unchanged from those described for the Proposed Action, although some small reduction in impacts is likely. Alternative 4A would reduce the risk of impacts on sea otters by excluding seven OCS blocks that overlap southwest Alaska DPS sea otter critical habitat from leasing. This exclusion would reduce the potential for interaction between sea otters and oil and gas activities in those blocks, and eliminate seafloor disturbing activities and reduce vessel traffic that could adversely affect northern sea otter habitat. Alternative 4B would also reduce impacts on sea otter foraging areas by prohibiting discharges and seafloor disturbance in and near sea otter critical habitat but certain oil and gas activities could still occur in or near those areas, e.g., seismic surveys with no discharge. Alternative 4A provides the most protection for sea otters by protecting their critical habitat, compared to the Proposed Action or Alternative 4B. However, impacts that occur outside of the excluded or mitigated areas would not be affected by these alternatives. For marine mammal populations, the overall impacts of Alternatives 4A and 4B would be the same as those for post-lease activities described in the E&D Scenario, including accidental small spills, spill drills, and large spills – negligible to moderate. However, these alternatives would protect the physical integrity of critical habitat in Cook Inlet for use by northern sea otters.

4.8.3.3 Alternative 5 – Gillnet Fishery Mitigation

Potential impacts on marine mammals under Alternative 5 would not differ substantially from those described for the Proposed Action. Under this alternative, impacts on marine mammals from active acoustic sound sources would be reduced due to the mid-June through mid-August restriction of seismic operations during important summer feeding and rearing times; however, seismic surveys could occur in this mitigation area at other times of the year. For marine mammal populations, the overall impacts of Alternative 5 would be the same as those described in the Proposed Action, including accidental small spills, spill drills, and large spills – negligible to moderate.

4.8.4 Cumulative Effects

Past, present, and reasonably foreseeable future actions (Section 3.2) that have affected, and will continue to affect, marine mammals include: oil and gas activities; marine transportation, ports, and terminals; mining; harvest activities; scientific research and survey activities; and military and homeland security activities. Climate change is another source of cumulative impacts on marine mammals, and its impacts are expected to have the greatest long-term effect on marine mammal populations. In addition, although highly unlikely, Appendix A considers the possibility of up to two additional large spills from sources other than those related to LS 258 post-lease activity.

As detailed above (Section 4.8.2), the effects on marine mammals of post-lease activities described in the E&D Scenario, including small spills and spill drills, range from negligible to minor. These impacts stem from noise, habitat alteration, and disturbance, and primarily consist of non-injurious, short-term impacts resulting in temporary behavioral reactions by affected individuals. No population-level impacts are anticipated. It is expected that some effects from noise, habitat alteration, and disturbance associated with past, present, and reasonably foreseeable future actions (Section 3.2) are expected to overlap spatially and temporally with those associated with the E&D Scenario.

Oil and Gas

Oil- and gas-related activities have been occurring in Cook Inlet federal and state waters since the 1960s (Section 3.1, Table 3-5 and Table 3-6). Future oil and gas activities are likely to be concentrated in the vicinity of nearshore state leases and on the federal leases owned by Hilcorp Alaska, LLC. Effects from oil and gas activities that would overlap with post-lease activities from LS 258 include exposure to loud noise, habitat alteration, and disturbance associated with maintenance of existing facilities or new construction involving the following: seismic surveys; pile-driving; drilling; platform and pipeline construction; and vessel and aircraft operations. While most noises produce behavioral responses from marine mammals, seismic surveys and pile-driving produce noise that could be loud enough to injure marine mammals nearby (Section 4.8.2). Other current and future oil- and gas-related noise would be associated with drilling, platform and pipeline construction, and aircraft and vessel traffic. The impacts from these activities, however, tend to be short-term and localized and loud enough that they could interfere with the ability of a marine mammal to hear, but generally not loud enough to produce injuries.

Oil and gas activities have altered marine mammal habitat through the construction, use, and maintenance of ports, platforms, and pipelines in the offshore and nearshore marine habitats of Cook Inlet. That trend is expected to continue because Cook Inlet is a regional hub of marine activity (described in Section 3.2.2 and below). To a lesser extent, the release of drilling muds, cuttings, tailings, and other contaminants into Cook Inlet have also altered marine mammal habitats. Though some habitat has already been altered and alterations are expected to continue into the future, collectively they constitute a small fraction of marine mammal habitats in Cook Inlet. Additionally, some disturbed habitats (i.e., pipeline routes, sediment deposition areas) often return to a state similar to that of unaffected areas (Henry et al., 2017; Mair et al., 1987; Manoukian et al., 2010). Finally, the existence of platforms in Cook Inlet may have had a positive impact on feeding opportunities for some marine mammals (Section 4.8.2).

Oil and gas activities have also resulted in non-acoustic disturbance of marine mammals. The construction and operation of facilities and infrastructure require workers to be present during the construction, maintenance, monitoring, and decommissioning phases of operations. The presence of workers, vessels, aircraft, and equipment would produce disturbances that could cause marine mammals to avoid areas where work occurs, which might displace them from their preferred habitat.

Marine Transportation, Ports, and Terminals

Marine transportation, ports, and terminals involve construction, operation, and maintenance activities that have effects similar to those described for oil and gas activities. Noise associated with ports occurs from pile-driving, dredging, facility construction and maintenance, and vessel and aircraft traffic. Marine habitat alteration has occurred during construction and maintenance of marine ports and facilities. That trend is expected to continue as Cook Inlet is regionally important as a hub of marine activity which includes six deepwater ports (Anchorage, Port MacKenzie, Nikiski, Homer, City of Seldovia, and Drift River Terminal), and several light-draft ports (e.g., Port Graham, Tyonek, and Williamsport). Nikiski is the second largest port in Alaska by cargo tonnage (AAPA, 2018). The Port of Anchorage, the third largest port in Alaska, is designated a U.S. Department of Defense National Strategic Port and provides services to approximately 75 percent of the population of Alaska. The majority of vessel traffic in Cook Inlet is not associated with oil and gas activities but rather fishing, recreation, and commercial traffic (Eley and Nuka Research & Planning Group, 2006; Nuka Research & Planning Group and Pearson Consulting, 2015; Nuka Research & Planning Group, 2012; Kerkvliet et al., 2013). Cook Inlet’s fleet of commercial fishers includes nearly 1,000 smaller vessels registered on the Kenai Peninsula (Eley and Nuka Research & Planning Group, 2006). There is non-acoustic disturbance associated with marine transportation, ports, and terminals in the form of vessel strikes. Vessel strikes on marine mammals occur occasionally in Cook Inlet. Since maritime transportation should slightly increase in the future, to better support growing communities and industries (Section 3.2.2.1), the number of vessel strikes to marine mammals will likely slightly increase, though most likely not from vessels working for the oil and gas industry (Neilson et al., 2012). Protected species observers or application of appropriate timing windows for post-lease activities would reduce the potential for post-lease activities to contribute markedly to cumulative effects.

Mining

Mining in Cook Inlet has impacted marine mammals and their habitat and will continue to do so. The planned Donlin Gold Mine natural gas pipeline would result in habitat alteration and disturbance effects on marine mammals, especially the listed sea otter, using the west side of Cook Inlet (USACE, 2018a). The proposed Diamond Point Rock Quarry, also on the west side of Cook Inlet, would contribute to habitat and disturbance impacts from dredging and traffic.

Harvest Activities

Resource harvesting activities, including subsistence, commercial and sport fishing, and hunting have occurred and will continue to occur throughout lower Cook Inlet. These activities have the greatest direct mortality impact on marine mammals. Subsistence hunting has historically occurred for harbor seals, sea lions, beluga whales, sea otters, and other marine mammals. Presently it accounts for a harvest of about

104 Cook Inlet/Shelikof Strait harbor seals and a small number of Steller sea lions annually (Muto et al., 2020). The current trends in subsistence harvest numbers are likely to remain stable into the future. Impacts from commercial/sport fishing and hunting occur mainly from vessel and aircraft traffic. Additionally, marine mammal mortalities occasionally occur from commercial fishing as entanglements in fishing gear or as bycatch, although such mortalities are few and infrequent (Muto et al., 2020). A secondary effect of fishing, particularly commercial fishing, is the annual removal of large numbers of fish and invertebrates that marine mammals prey on, which decreases food availability. Resource harvest levels (and therefore their potential to contribute to environmental cumulative effects) will continue to rise and fall, being subject to regulations, co-management, or other decision-making efforts.

Scientific Research and Survey Activities

Impacts from present and future scientific research and survey activities also have the potential to disturb marine mammals. Research-oriented vessel and aircraft traffic may introduce noise or disturbance, but no substantial change in scientific aircraft or vessel activity is anticipated over the timescale of the lease sale and would not contribute substantially to the current level of air and vessel traffic already occurring in and near Cook Inlet.

Military and Homeland Security Activities

Past, present, and reasonably foreseeable future military impacts include disturbance primarily in the form of aircraft. Military activities also have contributed to cumulative effects in the form of past and potential future contamination. Future disturbances of these types are expected to continue in parts of Cook Inlet into the foreseeable future, as would the associated effects.

Oil Spills and Gas Releases

Accidental oil and gas releases have occurred in Cook Inlet and are likely to occur in the future, primarily when transporting oil or gas during lease development in state waters, and from infrastructure projects such as port developments. Most such spills have been and would continue to be small, easily managed and remediated, and of little consequence to marine mammals. Since oil and gas development began in Cook Inlet, large spills have occasionally occurred. Although highly unlikely, Appendix A considers the possibility of up to two additional large spills (Table A4) from sources other than those related to LS 258 post-lease activity. The lack of chronic or major effects from such spills suggest similar impacts would be expected from accidental spills now and in the future. The existence of spill response infrastructure, protocols, and a swift spill response would ensure adverse effects from large oil spills would have small impacts on marine mammal populations with the exception of sea otters. Some sea otters could be injured or killed after contacting an oil spill, mostly due to their physiology and habitat requirements that make them more vulnerable to oil spill impacts than other marine mammals.

Climate Change

Impacts of climate change on marine mammals would likely vary between species due to varying dependencies of each species on a range of resources. In recent years, a large warm water “blob” developed in the North Pacific which forced many shoaling fish deeper into the water column, most likely affecting foraging success for some marine mammals. Increasing ocean temperatures and/or acidification could increase the growth and toxicity of phytoplankton associated with harmful algae blooms (Tatters et al., 2012). Some species of harmful algae produce acidic neurotoxins capable of damaging brains and internal organs of marine mammals, causing seizures and sometimes death (Anderson et al., 2014; McHuron et al., 2013; Kirkley et al., 2014; Jensen et al., 2015). More acidic waters also adversely impact the development of molluscs, marine arthropods, and other invertebrates that use calcium carbonate-based shells and exoskeletons (Gazeau et al., 2013; Taylor et al., 2015; Whiteley, 2011). A compromised ability to form exoskeletons or shells could reduce the quality or quantity of bivalve and arthropod prey species available to marine mammals, particularly sea otters.

Conclusion

In sum, past, present, and reasonably foreseeable future actions have affected and will continue to affect, marine mammals. Effects from these activities include exposure to noise, habitat alteration, disturbance, and pollution from oil and gas activities; risk of strikes, noise, and/or pollution from vessel and aircraft traffic; and competition for prey with, potential entanglement from, and potential mortality associated with commercial, recreational, and subsistence harvesting. Nevertheless, despite exposure to these activities, most marine mammal populations remain stable to increasing in Cook Inlet. This includes the listed populations of fin whales, humpback whales, Steller sea lions, and sea otters, but does not include beluga whales whose population has continued to decline at a 2.3 percent annual rate in recent years to an estimated 279 individuals. However, complex, climate-related changes are expected to occur and would have the most widespread and long-term contribution of impacts on many species.

As described above, the overall impact of the post-lease activities described in the E&D Scenario would be negligible to minor for marine mammals. The post-lease activities would overlap both spatially and temporally with the past, present and reasonably foreseeable future activities as identified above. While post-lease activities have the potential to affect individual marine mammals in Cook Inlet, impacts would be short-term, localized, and non-injurious; no population-level impacts are anticipated. The overall cumulative impacts on marine mammals from the activities described in Section 3.2, and the activities associated with the E&D Scenario, would be minor to moderate. Depending on the extent and severity of changes to the ecosystem, as a result of a changing climate, cumulative impacts could range from moderate to major over the lifespan of the E&D Scenario. The impacts associated with the E&D Scenario would not represent a substantial incremental contribution to overall cumulative impacts.

4.9 Terrestrial Mammals

4.9.1 Affected Environment

Approximately 43 species of terrestrial mammals are known to occur in the lower Cook Inlet area. None of these species are currently listed as threatened or endangered, and most populations at the species level are considered stable (IUCN, 2015). Among the terrestrial mammals in the region, brown bear, black bear, caribou, and moose are most likely to be affected by post-lease activities that could result from LS 258, as described in the E&D Scenario.

4.9.1.1 Brown Bear

Coastal regions of Alaska support the highest densities of brown bears in the state and also the largest specimens (Glenn, 1980). Utilization of summer and fall salmon runs by brown bears to rapidly gain weight in preparation for hibernation is well known. In addition, the coastal environment provides important nutritional resources during the spring and early summer when bears need to rapidly replace body mass lost during hibernation. Coastal salt marshes provide a wide variety of herbaceous vegetation during the spring such as sedges (*Carex* spp.), grasses (*Elymus* spp.), and forbs (*Plantago* spp. and *Triglochin* spp.) that are an abundant source of highly digestible protein (Smith and Partridge, 2004). Susitna Flats State Game Refuge and Redoubt Bay on the west side of Cook Inlet are examples of important grazing areas for brown bears during the spring (ADNR, 2009; ADF&G, 2020a). In addition, Bruin Bay and Kukak Bay at the north end of the Alaska Peninsula provide important foraging areas supporting large brown bear concentrations during the spring (Glenn, 1980). Intertidal foraging also provides substantial nutrition in the form of mussels (*Mytilus* spp.), barnacles (*Balanus* spp.), clams (*Mya* and *Siliqua* spp.), marine worms (*Nereis* spp.), fish (*Ammodytes* spp.), and other species. Feeding on intertidal clams was observed to be particularly important to female bears with dependent young, as well as newly independent smaller bears, as they could maximize nutrition gained in relation to time expended (Smith and Partridge, 2004).

These intertidal areas support large concentrations of bears until the arrival of salmon draw the bears to fish spawning rivers. Examples include the Kustatan River on the west side of Cook Inlet, Susitna River at the north end of Cook Inlet, Anchor River on the Kenai Peninsula (ADNR, 2009), and McNeil River in the Katmai region of the Alaska Peninsula. The McNeil River area, designated as a wildlife sanctuary in 1967, hosts the world's largest concentration of brown bears (ADF&G, 2020a). Salmon runs are important for maintaining brown bear populations in the Cook Inlet region. Ungulates, such as moose or caribou, are also included in the diet of the brown bear (ADNR, 2009; ADF&G, 2020a).

4.9.1.2 Black Bear

Alaska supports a population of approximately 100,000 black bears (ADF&G, 2020a). Black bears range throughout the Cook Inlet area from sea level to alpine areas (ADF&G, 1994). Black bear populations tend to be highest in areas with lower brown bear populations, and they are absent from the Kodiak Archipelago and the Alaska Peninsula, the areas of highest brown bear density (ADF&G, 2020a). Black bears tend to avoid competition with brown bears by being more active in the daytime and by inhabiting more densely forested areas. In areas with abundant and varied food sources, feeding preferences also separate the two species (Mattson et al., 2005).

Like brown bears, black bears in the Cook Inlet area are heavily dependent upon coastal habitats from the time they emerge from their dens until they return in the fall. Upon emerging from hibernation, black bears mainly eat freshly sprouted green vegetation, but also prey on newborn moose calves (ADF&G, 2020a). Spring concentrations of black bears have been recorded along the shore at Redoubt and Trading bays, the Kustatan River, the upper McArthur River, the Susitna Flats State Game Area, and slopes between Drift River and the South Fork Big River on the west side of Cook Inlet (ADNR, 2009). During the summer and fall, black bears concentrate feeding activity on spawning salmon in areas where they are available (ADF&G, 2020a). Where salmon are absent, black bears rely heavily on vegetation, supplementing their diet with berries and insects (ADF&G, 2020a).

4.9.1.3 Caribou

Five herds of caribou are found in the Cook Inlet area, one on the north end of the Alaska Peninsula, and four on the Kenai Peninsula. The Kenai Lowlands Caribou Herd is the only herd that could potentially be impacted by post-lease activities resulting from LS 258 due to their proximity to the coast.

The Kenai Lowlands Herd, on the west coast of the central Kenai Peninsula, numbers 120 animals (Herreman, 2015). Unlike the other herds in the Cook Inlet area, the Kenai Lowlands Herd maintains separate summer and winter ranges and has the largest range of the Kenai Peninsula herds. The Kenai Lowlands Herd winters in the spruce forest and open muskeg of the Moose River Flats, about 27 km (17 mi) east of the mouth of the Kenai River. In April or early May, the herd moves down the Kenai River to calving areas in the wetlands north of the Kenai Airport, along the Kenai River flats, and wetlands in the Kenai gas fields. Calving takes place from mid-May through early June, and the herd remains on these calving grounds through the summer. In October, the herd migrates up the Kenai River to the Moose River Flats (ADF&G, 2003).

4.9.1.4 Moose

Moose are found throughout the Cook Inlet area except for the Kodiak Archipelago (ADNR, 2009). They are particularly abundant in riparian areas, recently burned areas with willow and tree saplings, and on timberline plateaus (ADF&G, 2020a; ADNR, 2009).

Flooding and fire maintain dense stands of willows and other fast-growing plants that provide abundant browse for moose (Woodford, 2006). Seasonal movements of moose are related to food availability as well as life cycle requirements. In spring, moose forage on graminoids, forbs, shrubs, and tree saplings, adding aquatic plants to their diet during summer. On wintering areas, such as coastal or riparian areas, moose browse willow, birch, cottonwood, aspen, and occasionally young spruce tips (ADF&G, 2020a; ADNR, 2018). Calving occurs in early spring, typically in shrubby or forested areas that provide forage for mothers and cover for calves (Bowyer et. al., 1999). On the Kenai Peninsula, calving areas include the coastal areas between the Kenai and Kasilof rivers, the head of Kachemak Bay, and the area northeast of Homer (ADNR, 2018). The Kenai Heliport is located near a moose calving area as well as an area where brown bears concentrate seasonally, and other species occasionally may be present in the area. The Kenai Airport is located close to calving grounds used by the Kenai Lowlands Caribou Herd as well as known moose calving areas located in wetlands northeast of the airport. The known moose calving area near Homer extends to within a few miles of the Anchor River (ADF&G, 1985). In spring, moose cows give birth to one or two calves which remain with their mothers for around one year.

4.9.2 Environmental Consequences of the Proposed Action

4.9.2.1 Noise

Terrestrial mammals may experience increased levels of disturbance from post-lease activities conducted as a result of LS 258, as described in the E&D Scenario, primarily due to increased noise from air traffic. The E&D Scenario considers 14 flights per week between the platforms and Homer or Nikiski during exploratory drilling and 7–42 flights per week during the peak development, production, and decommissioning phases. This additional air traffic would not represent a substantial increase in the aircraft traffic at Homer, which averages approximately 147 aircraft operations per day (AirNav.com, 2020a). No statistics were available for Nikiski air traffic.

Noise can affect animal physiology and behavior (Radle, 1998), and strong long-lasting noise can have long-term impacts on reproductive success and survival (Radle, 1998). For example, caribou have been shown to exhibit panic to aircraft flying at low elevations, and exhibit escape responses (trotting or running from aircraft) to aircraft flying at 150–300 m (500–1,000 ft) (Calef et al., 1976). Aircraft disturbance of brown bears can produce avoidance behaviors including alertness, flight, aggression, or temporary displacement from an area, depending on circumstances (MMS, 2007, 2008; BOEMRE, 2011). The FAA recommends that aircraft maintain an altitude of at least 610 m (2,000 ft) when flying over sensitive areas such as Katmai National Parks, Kenai National Wildlife Refuge, and other wilderness areas in order to minimize impacts from aircraft-produced sound. Adherence to this recommendation will serve to mitigate potential impacts from post-lease activities. All airports considered for potential use in support of exploration, development, and production activities have been in operation for decades, and animals utilizing habitats in proximity to these airports most likely are already desensitized to the noise produced by aircraft operations. In addition, minimum elevation requirements for aircraft and prescribed transit corridors for helicopters, intended to reduce impacts on marine mammals, would also minimize the exposure of terrestrial mammals to noise.

While support flights from the Kenai Heliport in Nikiski would represent a small increase in air traffic from this base, the heliport is located on the coast of the Kenai Peninsula and the duration of flights over land would be limited primarily to takeoff and landing. As most flights would involve approaching or departing the heliport from platforms or vessels located on the waters of Cook Inlet, some individual animals may be startled, but animals that forage routinely in the area would be expected to have become conditioned to the brief bursts of sound (Radle, 1998). The duration of the impact would be brief, lasting a matter of minutes.

Aircraft in support of post-lease oil exploration, development, and production in Cook Inlet resulting from LS 258 would not be expected to impact terrestrial mammal populations. Terrestrial mammals inhabiting the areas adjacent to airports would be expected to adapt to the increased noise levels in these areas and therefore would be unlikely to be disturbed by the increases in aircraft traffic (Kempf and Hüppop, 1996). FAA altitude requirements (610 m, or 2,001.3 ft) would also serve to reduce noise impacts to terrestrial mammals. For these reasons, noise from aircraft traffic potentially resulting from LS 258 and described in the E&D Scenario should have little to no effect on those species.

4.9.2.2 Habitat Alteration

Post-lease activities conducted as a result of LS 258, as identified in the E&D Scenario, which have the potential to remove or alter terrestrial habitat include construction of onshore or nearshore pipelines. Impacts would vary by wildlife species, the size and duration of the construction project, and the location of the constructed facility.

Habitat alteration would take place in terrestrial environments where pipelines from OCS platforms make landfall and where construction of a 128-km (80-mi) onshore oil pipeline corridor described in the E&D Scenario would occur. Landfall locations are likely to be on the Kenai Peninsula between Homer and Nikiski, with pipeline construction expected to take place between May and September. Depending on the exact location of landfall, pipeline construction could impact habitat areas for caribou, moose, brown, and black bear. The area impacted by construction activities related to pipeline landfall and corridor would be small, considering the availability of adjacent habitats of similar high quality.

Approximately 119 ha (295 ac) of coastal wetland habitats would be impacted by construction of offshore and onshore pipelines. Upon completion of the construction and installation of the pipelines, it is anticipated that the surrounding area would become recolonized by local vegetation or by reclamation plantings to partially return the area to some level of ecological function. Natural vegetation succession would happen within the next growing season for grasses and forbs, and 2–3 years for shrubs (Section 4.5). A small amount of habitat would remain unavailable for black and brown bears in the short-term, while other species such as moose and caribou would benefit from the fresh growth of willows and other browse species.

If pipeline construction landfall is within moose calving areas, moose would be displaced from the immediate vicinity of construction. If pipeline landfall were to take place within the Homer calving area near the coast, resulting in a displacement of moose landward, habitat from which moose would be excluded would be relatively minimal due to the availability of calving areas further inland. Moose calving areas near Nikiski are several miles inland of the expected landfall location and corridor and would not be expected to be impacted by activity related to pipeline construction.

Overall, habitat alteration resulting from pipeline construction would be expected to have a short-term and localized effect on terrestrial mammal populations. Impacts primarily would be loss of access to, and use of, limited areas along the shoreline and the pipeline corridor resulting in displacement of affected individuals.

4.9.2.3 Disturbance

Disturbances from onshore support activities, described in the E&D Scenario, most likely to affect terrestrial mammals include increased vehicular traffic on area roadways associated with the hauling of wastes, produced during the exploration and development phases, from barges to onshore disposal facilities, hauling of equipment and supplies to shore bases, and installing pipeline.

Highway 1 runs along the western coast of the Kenai Peninsula and comes close to calving and summer concentration areas for the Kenai Lowlands Caribou Herd (Herreman, 2015), and vehicular traffic would present an additional hazard to these animals. Highway accidents are the primary cause of mortality directly related to human activity as the hunting season for this herd has been closed since 1994 (ADF&G, 2003). Transport along Highway 1 (the Sterling/Seward Highway) would involve passing through the winter range of the Kenai Lowlands Caribou Herd (Herreman, 2015). Traffic along the Sterling/Seward Highway between Homer and Nikiski would pass through known moose calving areas and winter concentration areas between Kasilof and Soldotna (ADF&G, 1985). Roadkill of moose is high on the western Kenai Peninsula (Selinger, 2010; Herreman, 2018) as well as in the vicinity of Anchorage (Battle and Stantorf, 2018). Between 2013–2016 the Kenai Peninsula accounted for 26 percent of moose vehicle collisions for the state of Alaska (ADFG, 2016).

Loading and unloading equipment, supplies, and drilling wastes would occur at established shore bases that terrestrial mammals are already habituated to and thus are not expected to have any impacts on terrestrial mammals in the area. While these post-lease activities related to LS 258 would represent an increase in vehicular traffic, it is not on a scale that would be expected to be substantially above normal traffic levels, so disturbance activities described in the E&D Scenario would likely have short-term and localized effects on terrestrial mammals.

Springtime foraging on beaches by brown and black bears could be impacted by construction related to pipeline landfall. Construction activities would also present an increased potential for interactions between bears and humans, including confrontations. Although Homer and Nikiski are areas where human populations are concentrated rural habitats are abundant between these areas and bear-human interactions due to construction activity would be expected to be minimal.

4.9.2.4 Oil Spills Impact Summary

Effects of spills, spill drills, and spill response activities on terrestrial mammals are described in Section A-3.8 of Appendix A. Small onshore spills from pipelines have a potential to contact terrestrial mammals or their habitat, and impacts would be limited to a small, highly localized area. Spill drills would produce highly localized areas of noise and physical disturbance and would have temporary behavioral effects to terrestrial mammals. A large spill and associated response could affect terrestrial mammals and their habitats until the oil is removed or disperses. Depending on spill characteristics, a large spill could result in impacts to terrestrial mammals ranging from non-injurious brief behavioral responses, such as leaving the immediate area, to physiological injury. Physiological effects could include skin irritation, ingestion and inhalation of oil and VOCs, lesions, organ damage, and in severe cases, death. A gas release could affect terrestrial mammals by temporarily causing them to leave an area.

4.9.2.5 Conclusion

Generally, post-lease activities that may result from LS 258, as described in the E&D Scenario are not expected to result in substantial impacts to terrestrial mammals. Most project impacts would be geographically distant from terrestrial habitats, occurring largely offshore in the lease sale area. Impacts from noise, habitat alteration, and disturbance would have short-term and localized effects. Therefore, activities that may occur as a result of LS 258 as considered in the E&D Scenario are expected to result in minor impacts to terrestrial mammals. While some individual animals may be affected, severe impacts are not expected because population-level impacts are not anticipated. Taken together with accidental small spills and spill drills, effects would remain minor. If an onshore pipeline ruptured, the spill would remain concentrated in a small, highly localized area that would involve a rapid and complete spill response. Impacts on terrestrial mammals from a large spill, when combined with the minor impacts resulting from the activities described in the E&D Scenario, are also expected to remain minor due to the low potential for adverse impacts from oiling of individuals or habitats. While some individual terrestrial mammals could become oiled, there should not be any large-scale impacts that could be measured at the population or subpopulation-level.

4.9.3 Environmental Consequences of the Alternatives

Potential impacts on terrestrial mammals under all the action alternatives would not differ substantially from those described for the Proposed Action. These alternatives would not change the total level of post-lease activity expected to result from LS 258, as described in the E&D Scenario. The action alternatives address specific resources in Cook Inlet, including the beluga whale, northern sea otter, and gillnet fishery. Thus, none of the restrictions identified in these alternatives would be expected to change the likelihood or severity of impacts on terrestrial mammals. Overall, impacts of all these alternatives on terrestrial mammals would be essentially the same as those for the Proposed Action – minor for E&D Scenario activities, accidental small spills, and spill drills. Impacts to terrestrial mammals remain minor when a large spill is considered.

4.9.4 Cumulative Effects

Past, present, and reasonably foreseeable future actions that could affect terrestrial mammals include oil and gas operations, large oil spills, and other non-oil and gas activities to include mining projects, scientific research, and military activities. Climate change is another source of cumulative effects on terrestrial mammals in lower Cook Inlet. The potential impacts to terrestrial mammals from these activities come from habitat alteration as a result of construction activities (facilities, roads, and pipelines); noise from aircraft, vehicles, heavy equipment, and construction; disturbance from vehicles and heavy equipment; and climate change.

The Past, Present, and Reasonably Foreseeable Future Actions section (Section 3.2) identifies additional oil and gas operations and mining projects to include construction of facilities, roads, and pipelines, and increased air traffic. Terrestrial mammals could potentially be impacted by these activities. In undeveloped areas, facility construction could either curtail access or remove important seasonal habitat, but would still result in short-term and localized impacts. Persistent exclusion from foraging or calving areas would contribute to cumulative impacts and may be detrimental to survivorship and reproduction for some mammal populations. If construction were to occur in previously developed or in commonly available habitats, there would be little to no impacts.

Terrestrial mammals could be exposed to large oil spills accidentally released from platforms or pipelines and would be most susceptible to adverse impacts from spills occurring in coastal areas or that affect foraging habitats or resources. Large oil spills could occur in Cook Inlet from related activities such as the domestic transportation of oil, import of foreign crude oil, and the development of oil on state lands and in state waters. Although highly unlikely, Appendix A considers the possibility of up to two additional large spills from sources other than those related to LS 258 post-lease activity. Oil releases from these spills might expose terrestrial mammals via direct contact or through the inhalation or ingestion of oil or tar deposits or contaminated prey. Impacts from spilled oil could be synergistic with other impacts to prey items of terrestrial mammals. For example, if the salmon population is substantially impacted by an oil spill (Section 4.6), impacts on brown bears could increase beyond direct oil spill contact with synergistic impacts as brown bears are forced to abandon salmon food sources and search for alternate food supplies.

Other activities that could contribute to cumulative impacts to terrestrial mammals include continuing and increasing air traffic from military operations and scientific research. Impacts from aircraft traffic, human activity, and repeated disturbances in proximity to caribou, moose, and bears could have additional adverse effects on their populations. As human activity levels increase, so would the impacts on terrestrial mammal movements, foraging, and denning behaviors. Increased impacts associated with post-lease activities resulting from LS 258, as considered in the E&D Scenario, would likely be sporadic and spread out across the landscape. While some individuals could be displaced from habitats, most likely the area of displacement would amount to tens to hundreds of meters. Given the amount of area available to terrestrial mammals, impacts would be short-term and localized and are unlikely to affect population abundance or distribution.

The E&D Scenario lifespan overlaps with expected effects of climate change on the landscape. Changes in the physical environment resulting from climate change could impact coastal and estuarine habitats (Section 4.5) resulting in a change to the types of plants and habitats available for foraging. For example, spruce bark beetle infestations have impacted more than 900,000 ac in Southcentral Alaska (ADNR, 2020b), and are correlated with increasing temperatures. The volume of mortality caused by beetle infestation now exceeds the volume of growth (ADNR, 2001), and the large volume of dead trees can provide fuel for fires that would further alter habitat on the Kenai Peninsula. During the latter half of the twentieth century, an estimated 80 percent of wetland sites on the Kenai Peninsula experienced drying, and two-thirds of wetland sites decreased in size. This loss of wetlands was accompanied by a change from open, wet, and watered areas to wooded upland habitats (Klein et al., 2005). Moose may benefit in the short-term from an increase in post-fire browse, but over the long-term, loss of wetlands might reduce moose populations, and the decrease in suitable moose and caribou habitat would locally increase stress on those populations. Such an impact would be exacerbated by increased bear predation on moose calves, particularly if it interferes with salmon runs that local bear populations rely on. The incremental contribution of E&D Scenario activities on habitat quality may compound effects of climate change through synergistic interactions. The level of effects will depend on the degree that climate change impacts terrestrial habitat of the Cook Inlet region. Depending on the scale of the vegetation changes and the response of individual populations, effects could range from localized to widespread, and long-term.

The incremental contribution of post-lease activities that may result from LS 258, as described in the E&D Scenario, to the past, present, and reasonably foreseeable future actions on terrestrial mammals is not expected to contribute measurably to the level of effects. Most impacts from activities considered in the E&D Scenario would occur in the OCS and offshore waters, remaining geographically separate from terrestrial mammals and their habitat, and would not produce long-term disturbances or population-level effects. The addition of a large spill could have a minor level of effect on some terrestrial mammal populations and habitats in the contacted areas. The overall impact from past, present, and reasonably foreseeable future actions, when combined with post-lease activities that could occur as a result of LS 258, would be negligible and with the addition of large oil spills, effects would be minor. When considering climate change, the cumulative effects on terrestrial mammals could be varied ranging from minor to major.

4.10 Recreation, Tourism, and Sport Fishing

4.10.1 Affected Environment

Recreation, tourism, and sport fishing are important components of economic activity in Cook Inlet and the three are closely linked. Opportunities to participate in outdoor recreation are an essential element in the quality of life for residents of Alaska (Brooks and Haynes, 2001). Furthermore, tourism is one of the driving forces behind Alaska's economy (BLM, 2006), and recreation is the key component of tourism that attracts in-state and out-of-state tourists to Cook Inlet. The saltwater sport fishery in Cook Inlet, freshwater sport fishery on the Kenai Peninsula, and clamming are an important part of the total economy. Sport fisheries also are an important part of recreation and tourism experiences of the area. For more information on the economy of the KPB, see Section 4.12.

Alaskans generally participate in two broad categories of outdoor recreation: user-based recreation and "wildland" or resource-based recreation (ADNR, 2016). User-based recreation plays an important role in serving daily recreational needs. This type of recreation is often family- or school-oriented. Examples of user-based recreational activities include outdoor court and field sports (e.g., tennis, basketball, softball, soccer), golf, hockey or ice skating, and playground activities. Examples of resource-based recreation include fishing, hiking, biking, horseback riding, hunting, camping, boating, surfing, nature study, wildlife viewing, and visiting historical sites. In many of Alaska's primarily Native communities, activities often associated with recreation, such as hunting, trapping, fishing, or berry picking, are also important subsistence activities that are undertaken more for economic or cultural reasons than for recreation (ADNR, 2016).

Recreational activity can bring substantial additional income into local economies, including those around Cook Inlet. Recreational opportunities and environmental amenities are often significant factors in determining tourism (Brooks and Haynes, 2001). Alaska's reputation as wide open and undisturbed is so broadly appealing that people are willing to invest large amounts of time and money to visit Alaska and Cook Inlet. For example, in 2019 bear viewing generated approximately $34 million in sales in places such as Lake Clark National Park and Preserve, Katmai National Park and Preserve, and McNeil River State Game Refuge (Young and Little, 2019). Consequently, the tourism or visitor industry is the only private sector-based industry in Alaska that has grown continuously since statehood (Colt, 2001).

Cook Inlet's many year-round recreational opportunities require access to the outdoor environment. Many recreational activities involve public lands, whereas others use public water bodies. Activities that depend on the use of public water bodies may be classified as "coastal-dependent" or "coastal-enhanced" (MMS, 2003). Coastal-dependent activities require access to the coastline and water for the activity to take place. They include boating, sailing, kayaking, clamming, terrestrial and marine wildlife viewing, beachcombing, and fishing. In contrast, coastal-enhanced activities do not directly depend on access to the coastline and water. Rather participants in these activities derive increased experiential quality due to coastal proximity. Coastal-enhanced recreational activities include hiking, biking, running, nature appreciation, camping, photography, and horseback riding.

Within or near the lease sale area, a variety of resources exist that support outdoor recreational opportunities of regional, statewide, and national significance. These resources include national parks, national preserves, national wildlife refuges, and SOA resources (recreational areas, parks, and similar places). The SOA has a variety of resources related to tourism and recreation adjacent to the lease sale area. Alaska's state parks are the primary roadside gateways to outdoor recreation (ADNR, 2016). State park units near the lease sale area include the Captain Cook, Clam Gulch, Ninilchik, Deep Creek, Stariski, and Anchor River State Recreation Areas. Kachemak Bay State Park and Wilderness Park are also adjacent to the lease sale area.

Marine sport fisheries play an increasingly important role in Alaska's recreation-based economy. Directly, sport fishing benefits charter companies and fishing guides. Indirectly, marine sport fishing financially benefits tourism-related businesses including transportation, hotels, restaurants, gear shops, and other service sector concerns. In addition, residents of Alaska benefit from license fees collected by

ADF&G as these support enforcement, research, and preservation of sport and commercial fisheries resources.

In terms of catch, predominant marine sport fisheries of Cook Inlet target Pacific halibut, five species of Pacific salmon, and razor clams (ADF&G, 2013; 2018). Commonly, those engaged in sport fishing, especially for halibut or salmon, hire a charter or participate in a guided tour. Historically, sport fishing charters and shore-based fishing have included the Anchor River, Whiskey Gulch, Deep Creek, and the Ninilchik River; the Gulf of Alaska coast west of Gore Point; areas north of the Ninilchik River, Barren Islands, Seldovia, Homer Spit, Seward; and various points along the shoreline (Herrmann et al., 2001). The recreational halibut fishery is widely distributed throughout Cook Inlet. Charter and recreational sport fishers will frequent halibut holes, where halibut are known to concentrate. In 2020, there were 110,973 halibut harvested in Cook Inlet waters (ADF&G, 2022). Some of the most popular freshwater sport fishing occurs on the Kenai Peninsula to include Chinook and Sockeye Salmon runs in June and Coho salmon runs in late July through September.

Both freshwater and marine sport fishers include local fishers from the Kenai Peninsula, other Alaskans (from outside the Kenai Peninsula), and nonresidents. While recreational fishing is popular among residents, records indicate that chartered sport fishing is not. In 2013, 79 percent of angler days recorded on saltwater bottomfish charters were attributed to nonresidents, and only 14 percent were attributed to residents (Sigurdsson and Powers, 2014). Halibut was the most harvested species comprising 53 percent of fish takes. Similarly, 86 percent of angler days in the saltwater charter salmon sport fishery were attributed to nonresidents, and only 9 percent were attributed to residents. A similar breakdown was reflected in freshwater charter hires and residency: 89 percent of freshwater angler days of effort were attributed to nonresidents in 2013.

Sport fisheries also include gathering razor clams and other types of clams (for example, soft-shelled clam (*Myra* spp.) and the Baltic clam (*Macoma balthica)*) at various locations along the western side of the Kenai Peninsula, and other shoreline areas bordering Cook Inlet. Though not as popular as marine sport fishing, it is possible to book a guide or charter trip to hunt for razor clams or other bivalves in Cook Inlet. However, the sport fishery catch of razor clams has dropped in recent years; for unknown reasons, catch rates in 2018 were 95 percent lower than in 2009 (ADF&G, 2013, 2018). Residents and nonresidents alike collect steamer clams, mussels, and various other shellfish in Kachemak Bay.

4.10.2 Environmental Consequences of the Proposed Action

4.10.2.1 Noise

Post-lease activities conducted as a result of LS 258, as identified in the E&D Scenario, which produce noise impacts to recreation, tourism, and sport fishing include air traffic, seismic surveys, platform installation, and drilling. Impacts would vary by the size, duration, and the location of the activity.

Air traffic is the primary contributor of noise that could impact recreation and tourism resources, as it can change one’s perception of a landscape, depending on the duration and frequency. The potential for the noise originating from planes and helicopters to affect recreation and tourism depends on the volume, locations, and timing of the air traffic. One such disturbance would be near shoreline recreational use areas between Homer and Nikiski because the planes and helicopters described in the E&D Scenario would be transiting between these localities and the platforms

Overall, the potential for noise from aircraft related to post-lease activities conducted as a result of LS 258, as described in the E&D Scenario, to noticeably affect recreation and tourism in adverse ways during the lifespan considered in the E&D Scenario would be expected to have little to no effect up to short-term and localized. The number of trips between the platforms and Homer or Nikiski are projected to be relatively low in the E&D Scenario — 14 flights per week during exploratory drilling and 7–42 flights per week during the peak development, production, and decommissioning phases. This additional air traffic would not represent a substantial increase in the aircraft traffic at Homer, which averages approximately 147 aircraft operations per day (AirNav.com, 2020a). The onshore support bases that would be used are established and located in the more industrial parts of these localities, which do not immediately adjoin scenic recreational areas. Moreover, the travel corridors between the platforms and onshore support facilities would ensure that vessels and helicopters transit away from shore promptly, which would minimize the exposure of shorelines to noise. Some offshore recreational fishing may be impacted by noise if in the vicinity of platforms or flight corridors. However, these impacts are expected to be temporary and localized as the aircraft transport to the intended destination. Post-lease activities are not expected to generate large amounts of traffic over and above the level of air traffic that is already occurring, therefore, these impacts would be short-term and localized.

BOEM anticipates that noise transmitted above the water from fixed platforms (installation and operations) would be weak due to the elevation of the structure (BOEM, 2012). The nature of drilling and equipment noise would be vibrational, tonal, and at low frequencies, as opposed to acoustic noise and airgun uses, which would be more sporadic and acute. Noise from drilling tends to be stationary, less intense, and persistent when compared to noise from seismic surveys, which are in motion, more intense, but short-term. It is anticipated that any direct effects from either noise source to sport fishermen would attenuate and would therefore have little to no impacts.

Little or no direct effects to the razor clam sport fishery would be expected from active acoustic sound sources or from drilling and equipment noise associated with the E&D Scenario. Acoustic noise from seismic exploration, for example, is not expected to extend to the shallow tidal nearshore areas where razor clams are harvested. It is also not expected that noise from drilling and equipment activities would carry into the intertidal areas of Cook Inlet where razor clam harvesting is most popular. Therefore, the fishery is unlikely to experience decreases in the numbers or availability of targeted clams as a result of the lease sale. Effects to the overall clam fishery from noise associated with post-lease activities resulting from LS 258 are expected to have little to no impact.

4.10.2.2 Disturbance

Disturbance from vessels could cause space-use conflicts with waterborne recreational activities such as recreational marine sport fishing and waterborne wildlife viewing and sightseeing. Space-use conflicts would arise from vessels engaged in operations such as seismic surveys or other support activities, or the presence of platforms. These conflicts cause private or commercial recreational users and tourists to divert from an area to avoid conflicts, and no other areas nearby offer similar opportunities.

Overall, the potential for space-use conflicts between vessels that support post-lease activities conducted as a result of LS 258, as described in the E&D Scenario, and recreational vessels would be limited. Most waterborne recreational and tourist activities in Cook Inlet occur nearshore, especially in or adjacent to national and state parks or other special-use areas such as wildlife refuges. In contrast, exploratory activities and most development and production operations would occur far enough from these areas to avoid space-use conflicts. Through stakeholder involvement during subsequent permitting processes and plan reviews, it is unlikely that platforms and operations would be sited where they could obstruct navigable waters or areas of particular recreational value as referenced above. However, conflicts could occur in the area immediately around facilities during their construction, such as platforms and pipelines. With the exception of the platforms (0-6) described in the E&D Scenario, most conflicts would be temporary and short-term, ending after construction. Consequently, space-use conflicts between vessels that support post-lease operations resulting from LS 258 and recreational and touring vessels overall would have short-term and localized effects on recreation.

Onshore or nearshore support services could affect recreation and tourism activities if ongoing support activities at shore bases displace recreationists or tourist operations. For example, vessels could affect recreational users by displacing them from marine boating facilities and support services for which substitutes are not readily available. In addition, workers that support operations could displace recreationists and tourists if they occupy lodging or campgrounds or access to recreational fishing locations. The potential for displacement of and competition with recreationists and tourists could be long-term but localized over the 40-year duration considered in the E&D Scenario.

The helicopters would use existing airports that could accommodate the additional flights needed to support post-lease activities that may result from LS 258, as described in the E&D Scenario. Operations would have a limited physical presence on land due to pipeline maintenance, and local support services would be based in areas of Nikiski and Homer that already support similar oil and gas activities. Onshore operations resulting from activities described in the E&D Scenario are expected to have overall short-term and localized effects on recreation and tourism.

The primary effect to sport fisheries would be from temporary displacement of fishing boats and charters from sport fishing grounds during exploration and drilling activities. Support vessel traffic is estimated to consist of one to two trips per platform per day from Homer or Nikiski. Deep penetrating seismic and geotechnical surveys would likely require temporary restricted access to specific areas in Cook Inlet for sport fishers. For safety reasons, survey operators will maintain a stand-off safety exclusion zone around the source vessel if it is towing a streamer array; establishment of this zone, pursuant to USCG regulations, will result in a temporary and minor space-use conflict with other vessels including sport fishing boats. The size of the stand-off distance varies depending on the array configuration; however, a typical stand-off distance would be approximately 8.5 km (4.6 nmi) long and 1.2 km (0.6 nmi) wide. The length of time that any particular point would be within the stand-off distance would be approximately 1 hour. The USCG would issue a Local Notice to Mariners, which would specify the survey dates and locations and the recommended avoidance requirements for other vessel traffic, including sport fishing vessels.

4.10.2.3 Oil Spills Impact Summary

Effects of spills, spill drills, and spill response activities on recreation, tourism, and sport fishing are described in Section A-3.9 of Appendix A. Small spills are not expected to persist on the water long enough to affect waterborne recreational activities and may only have minimal impacts to sport fishing activities. Spill drills would produce highly localized areas of noise and physical disturbance from vessels, response equipment, and associated personnel. As a result, temporary effects to recreation and sport fishing from noise and space use conflicts could occur which would result in displacement of recreational users or targeted fish species, such as salmon and halibut. A large spill, depending on spill characteristics, could result in contamination of shorelines or coastal areas such as the western side of the Kenai Peninsula. Impacts could have moderate affects to recreation, tourism and fishing until the oil is removed or disperses by limiting the ability of recreationists, fishing charter operators, and recreational clam gatherers to use specific locations. Impacts from a large spill including response, would reduce the quality of the recreational experience and alter patterns of use of recreational and sport fishing areas.

A gas release could temporarily affect recreation, tourism, and sport fishing.

4.10.2.4 Conclusion

The effects of post-lease activities that may result from LS 258 as described in the E&D Scenario, accidental small spills, and spill drills on recreation and tourism would primarily arise from disturbance in the form of space-use conflicts. In most instances, these activities take place in different locations or at different times. However, in the instances when they coincide, the duration would be short lived. Activities described in the E&D Scenario could temporarily limit access to some regular sport fishing areas and also may also displace some populations of targeted sport species. Under these circumstances, it is likely that charters and individual sport fishers would be able to use alternative fishing grounds. Overall, the effects of post-lease activities that may result from LS 258, including small spills that do not persist on the water and are contained, on recreation, tourism, and sport fishing are expected to be minor.

An accidental large oil spill and associated response could cause long-lasting and widespread effects to recreation, tourism, and sport fishing, especially where oil contacts the shoreline. Overall, potential effects of a large spill on recreation, tourism, and sport fishing, when added to those effects expected from post-lease activities resulting from LS 258, are expected to be moderate.

4.10.3 Environmental Consequences of the Alternatives

Potential impacts on recreation, tourism, and sport fishing under all the action alternatives would not differ substantially from those described for the Proposed Action. These alternatives would not change the total level of post-lease activity expected to result from LS 258, as described in the E&D Scenario. These alternatives are directed at reducing impacts to certain important resources in Cook Inlet, and thus none of the restrictions identified in the alternatives would be expected to alter the likelihood or severity of effects on recreation, tourism, and sport fishing identified for the Proposed Action. Impacts of these alternatives would be essentially the same as those for the Proposed Action – minor for post-lease activities, accidental small spills and spill drills, and moderate with the addition of a large spill.

4.10.4 Cumulative Effects

Past, present, and reasonably foreseeable future actions that could affect recreation, tourism, and sport fishing include oil and gas operations, large oil spills, and other non-oil and gas activities to include marine transportation, ports and terminals, and commercial fishing. The potential impacts to recreation, tourism, and sport fishing from these activities would primarily come from space-use. Climate change is another source of cumulative impact on recreation, tourism, and sport fishing in lower Cook Inlet.

Vessel traffic resulting from LS 258 would increase in Cook Inlet, which currently also includes global cargo vessels docking at the Port of Anchorage, cruise ships, supply barges, and other such vessels including state oil and gas, military, commercial fishing, survey, and research. With additional marine vessel traffic comes the potential for groundings, increased operational discharges, and fuel spills. Oil and gas related vessel traffic would add short-term and localized impacts to the recreation, tourism, and sport fishing industries due to an increase in vessel traffic, displacement of sport fishing vessels, and accidental fuel spills, all of which could temporarily affect access to recreation sites and fishing areas. Overall, each of these impacts would pose a short-term cumulative impact on the recreation, tourism, and sport fishing industries.

The types of impacts related to a large oil spill and associated spill response on recreation, tourism, and sport fishing are discussed in Section A-3.8 of Appendix A. Spills from state oil and gas activities may also occur. Although highly unlikely, Appendix A also considers the possibility of up to two additional large spills from sources other than those related to LS 258 post-lease activity. If those spills are also considered, the most likely effect would be a lengthier and prolonged recuperation period for recreation and tourism sites in the area affected, including sport fishing areas. A spill would result in space-use conflicts for sport fishers where limited access is afforded to sport fishing. These large spills may cause long-term and widespread impacts to the recreation, tourism, and sport fishing industry through loss of access to some areas due to contamination or cleanup activities.

The projected growth in industrial activities and vessel calls at ports, harbors, and terminals could contribute to an increase in space-use conflicts between vessels that support commercial operations and recreational vessels. However, most water-based recreational and tourist activities in the Cook Inlet region occur in nearshore areas, especially in or adjacent to national and state parks or other areas of special concern (State of Alaska, 2018). In contrast, on-lease exploratory activities and most commercial operations for the E&D Scenario would occur far enough from these water-based areas described above to avoid space-use conflicts. Consequently, the overall additive effects of post-lease activities that may result from LS 258 to existing impacts to recreation and tourism could range from little to no impacts, or up to short-term and localized when combined with increased vessel calls at ports, harbors, and terminals.

New weather conditions differing from the historical pattern caused by climate change would most likely pose a challenge for tourism, recreational boating, and sport fishing, which rely on highly predictable water and air temperatures and calm seas. Changes in wind patterns and wave heights in Cook Inlet have been observed and are projected to continue to change in the future (Chapin et al., 2014). This may create challenges in planning leisure and tourism activities and may change preferred locations for recreation and tourism as weather patterns change and air and sea surface temperatures rise. In addition, infrastructure in the Cook Inlet region such as marinas, marine supply stores, boardwalks, hotels, and restaurants that support leisure activities and tourism could be negatively affected by sea level rise. They may also be affected by increased storm intensity, changing wave heights, and elevated storm surges due to sea level rise and other expected effects of a changing climate.

Most impacts resulting from the E&D Scenario would overlap recreational, tourism and sport fishing activities. However, in the instances when they coincide, the duration would be short lived. Overall, the cumulative impacts resulting from past, present, and reasonably foreseeable future actions would be minor. The incremental contribution of post-lease activities that may result from LS 258 to cumulative effects on recreation, tourism, and sport fishing is not expected to contribute measurably.

4.11 Communities and Subsistence

4.11.1 Affected Environment

Communities on the Kenai Peninsula include small cities and towns that are connected by the road system, and several smaller, non-road-connected villages. Larger communities include the cities of Kenai (population 7,000), Soldotna (4,327), Nikiski (4,563), and Homer (5,443) (ADCCED, 2020). Coastal towns along the road system in the KPB range in size from just over 200 people in Clam Gulch to over 2,000 in Anchor Point (ADCCED, 2020). The majority of residents in the Kenai Peninsula Borough do not live within incorporated cities but in one of the established unincorporated communities along the road system (KPB, 2019); these communities are an important element of the southern Kenai Peninsula. The ethnic composition of the cities and towns in the KPB is predominately white, with smaller representation of Alaska Native and other ethnicities (ADCCED, 2020). The community character and identity of the region is intertwined with connections to the natural environment; an observation that is also expressed in the Kenai Peninsula Borough Comprehensive Plan: “Today, the borough has diverse communities and lifestyles that share deeply held values such as connection to the land and water, appreciation for rural land small-town life, and strong family and community connections” (KPB, 2019, p. 42). Tourism, oil and gas, government, and commercial fishing are important economic sectors in the southern Kenai Peninsula, as are the tourism and recreation services many individuals and businesses in the region provide (Sections 4.10, 4.12 and 4.13; KPEDD, 2015).

The sociocultural systems of the small, non-road-connected communities in the Cook Inlet region are supported by a limited economic base, with commercial fishing and seafood processing as primary income-producing occupations. These communities include the villages of Tyonek (population 168), Nanwalek (291), Port Graham (179), and Seldovia (181) (ADCCED, 2020). Alaska Native peoples make up most of the population in these communities, although Seldovia is more diverse than the other villages. Other areas off the road system include Halibut Cove (population 83) on the south shore of Kachemak Bay, and Beluga (population 19) on the west side of Cook Inlet (ADCCED, 2020). Additionally, several Russian Old Believer communities on the Kenai Peninsula, including Nikolaevsk, Voznesenka, Razdolna, and Kachemak Selo, maintain a traditional lifestyle supported by hunting and fishing.

Residents of communities throughout the region rely on subsistence resources for food and to support a customary and traditional way of life. Many residents participate in the harvest, use, and sharing of wild resources as part of the mixed subsistence-cash economy that is important in many Alaska subsistence communities (Keating et al., 2020). Subsistence resources include salmon and other fish, big game, small game and furbearers, marine mammals, birds and eggs, marine invertebrates, and plants and berries. Subsistence and personal use regulations under state laws apply to all Alaskans, and residents of some communities also qualify for subsistence priority under the Federal Subsistence Management Program. Additionally, subsistence activities are considered central to the cultural identity, social and economic well-being, and health of Alaska Native communities. The importance of subsistence is reflected in high levels of participation; high harvest levels which produce a large portion of the local food supply; extensive sharing of subsistence harvests through kinship and other networks; and large investments of time and money in subsistence equipment, supplies, and activities. Subsistence hunting, fishing, and trapping occur year-round throughout the entire region on land, in rivers, and in coastal waters. Subsistence in many communities in the region, and throughout Alaska, is part of a mixed subsistence-cash economy, in which participation in subsistence activities depends on cash income for equipment and fuel (Keating et al., 2020). Changes in the availability of subsistence resources within affordable travel distances to communities can result in economic impacts on subsistence harvesters.

ADF&G, Division of Subsistence compiles data from a range of research efforts and conducts studies to gather information on aspects of subsistence uses in Alaska, including in the Cook Inlet region. The Division of Subsistence makes the information available through the Community Subsistence Information System (CSIS). Community-level information is available for some Cook Inlet region communities, with frequency and currency of data collection varying throughout the region. Characteristics of community subsistence harvests, based on data provided in the CSIS, are presented in the FEIS for Lease Sale 244, as part of its description of the affected environment for subsistence (BOEM, 2016, Section 3.3.3). Specifically, information set forth in Table 3.3.3-2, identifies annual per-capita harvest amounts in pounds; per-capita percentage of resources harvested; and the percent of households that harvested, received, or gave away subsistence foods for studied communities. Table 3.3.3-3 shows the types of foods harvested and the percentage each type represents of consumable resources for each study community; and Figures 3.3.3-1 and 3.3.3-3 depict composite resource harvest areas for Tyonek, Nanwalek, and Port Graham. The information in these tables and figures, as summarized here and with more specificity below, is incorporated by reference in support of BOEM's subsistence analysis for LS 258. The information incorporated by reference remains current and thus informative for understanding subsistence uses in the region. To the extent new or additional data exists, BOEM has included it in its LS 258 analysis. Additional studies new to the LS 258 analysis include updated resource harvest amounts and locations for Tyonek (Jones et al., 2015) and for Nikiski, Seldovia, Nanwalek, and Port Graham (Jones and Kostick, 2016), and are included below in the discussion of subsistence harvests for communities on the western and eastern sides of Cook Inlet.

The data in Table 3.3.3-2 in BOEM (2016a) indicate large amounts of subsistence foods are harvested in each of the geographic areas surrounding Cook Inlet. Annual per-capita harvest in the Cook Inlet communities for which data was available, including the more recent ADF&G data (Jones et al., 2015; Jones and Kostick, 2016), ranged from 111 pounds in Hope (study year 1990) to 466 pounds in Port Graham (study year 2003) and was mostly in the 200- to 300-pound range. Annual per-capita harvest in the Cook Inlet Alaska Native communities of Tyonek, Nanwalek, and Port Graham was higher than in other Cook Inlet communities.

All five species of Pacific salmon are important resources for communities, accounting for well over 30 percent of subsistence resources used in most communities and over 60 percent in many communities throughout the region, as shown in Table 3.3.3-3 in BOEM (2016). Several personal use dipnet and setnet fisheries operate throughout the Kenai Peninsula, and a combination of commercial, subsistence, and rod-and-reel fisheries provide salmon for domestic use. Many subsistence users also fish commercially, taking a portion of their commercial harvest for subsistence uses; households that participate in commercial fishing are overall some of the most productive subsistence harvesters (Jones and Kostick, 2016; Keating et al., 2020). Non-salmon fish and large land mammals make up the other main subsistence harvests. Marine invertebrates are another important subsistence food in some communities.

Subsistence activities are assigned high cultural values by local Cook Inlet Dena'ina, Alutiiq, and Koniag peoples; Alaska Native peoples in the region rely on subsistence resources for food and health, and to support cultural connections. Tyonek, on the western side of Cook Inlet, has a subsistence harvest area that extends from the Susitna River south to Tuxedni Bay; subsistence harvests are concentrated west and south of Tyonek (Figure 3.3.3-1 in BOEM, 2016). Moose and salmon are the most important subsistence resources measured by harvested weight, although important components of the harvest include non-salmon fish such as smelt, along with waterfowl and clams (Jones et al., 2015). Some Tyonek residents harvest marine mammals (primarily harbor seals) in nearshore areas (Jones et al., 2015). Harvest activity in Tyonek occurs year-round with higher levels in the spring, summer, and fall (Jones et al., 2015; Stanek et al., 2007).

On the eastern side of Cook Inlet, residents of Seldovia, Port Graham, and Nanwalek harvest resources in onshore, nearshore, and offshore areas. Harvest areas for these communities are primarily on the southern tip of the Kenai Peninsula, especially at the mouth and along the southern shore of Kachemak Bay, as well as in Seldovia, Jakalof, Tutka, China Poot, Nanwalek, and Koyuktolik ("Dogfish") bays (Figure 3.3.3-3 in BOEM, 2016; Jones and Kostick, 2016). Subsistence set gillnet salmon fisheries are managed by ADF&G in nearshore locations along the southern shore of outer Kachemak Bay, near Port Graham and Nanwalek, and near Seldovia (Brown et al., 2021). The Kachemak Bay set gillnet personal use salmon fishery is also available to area residents at specified locations around Kachemak Bay. Setnet fisheries are limited to specified locations and are open for short time periods (Brown et al., 2021; ADF&G, 2019c). Seldovia harvesters also fish for salmon and other fish farther offshore within the lease sale area (Jones and Kostick, 2016). Harvest areas for the communities of Seldovia, Port Graham, and Nanwalek overlap to an extent, with more concentrated usage in areas nearest each community. Area residents harvest seals, sea lions, and sea otters in nearshore areas around the southern part of Kachemak Bay and the southernmost point of the Kenai Peninsula (Wolfe et al., 2008). Primary waterfowl harvest areas are in the vicinity of Seldovia, Tutka, and China Poot bays and the McKeon and Fox River flats. Moose and black bears are hunted along local shorelines. Other resources, including non-salmon fish and shellfish, are used fresh in season. ADF&G (Keating et al., 2020) has documented shifts in subsistence harvests for Nanwalek and Port Graham in which the diversity of resources (i.e., the number of different types of resources) used for subsistence has declined in recent decades. Additionally, concentration of harvest production in Port Graham and Nanwalek has increased, such that a small number of households harvest most of the resources used within the community and distribute subsistence foods through sharing networks. This is especially notable for key resources such as sockeye salmon and Pacific cod (Keating et al., 2020).

Farther north up the Kenai Peninsula, residents of Ninilchik harvest fish on the eastern side of Cook Inlet, primarily salmon, along with halibut and other fish, butter clams, and razor clams. Large land mammals are also an important resource for Ninilchik. Residents of the communities harvest wild resources throughout the year. Certain species are targeted in different seasons, with harvest patterns defined by seasonal resource availability, laws and regulations, other economic activities, and land access (Jones and Kostick, 2016).

4.11.2 Environmental Consequences of the Proposed Action

Post-lease activities conducted as a result of LS 258, as described in the E&D Scenario, would have impacts on communities in the Cook Inlet region through effects on subsistence activities and harvest patterns. Impacts to subsistence relate to more than biological impacts and harvest amounts because they could affect communities' social organization, cultural identity, subsistence way of life, health, and well-being.

Potential impacts to subsistence activities and harvest patterns associated with activities considered in the E&D Scenario would primarily occur through changes in the availability of subsistence resources to harvesters and from space-use conflicts. Impacts on communities would also occur from changes in the economy of the region (Section 4.12) as well as through impacts to commercial fishing (Section 4.13), and tourism, recreation, and sport fishing (Section 4.10), because these activities are important aspects of the economic and social fabric of many Kenai Peninsula communities.

4.11.2.1 Resource Availability

Post-lease activities described in the E&D Scenario which could impact the availability of resources to subsistence harvesters include noise, seafloor disturbance, and operational discharges resulting in changes in the quantity, quality, or distribution of biological resources.

Noise, including active acoustic sound sources, drilling and equipment noise, and other operational noises, may impact subsistence harvest patterns by temporarily displacing or deflecting subsistence resources away from areas where harvesters can access them. As discussed in Section 4.6, underwater noise can produce localized and short-term impacts to fish that include dispersal of individuals from areas around sound-producing activities. Dispersal of fish away from waters near noisy activities could delay subsistence fishers in the immediate vicinity and result in potential short-term missed harvest. While subsistence fishing occurs throughout Cook Inlet, noise impacts in areas of high fishing activity, including near bays and river mouths, would have higher potential to impact subsistence fishing. In addition, because many commercial fishers remove a portion of their harvest for subsistence purposes, noise impacts on commercial fishing (Section 4.13) have implications for subsistence harvest amounts. However, subsistence users may be able to fish at other times and places during the season and impacts on subsistence fishing are expected to be short-term and localized.

Population-level noise impacts to marine mammals are not expected, but animals may be disturbed by or avoid noise-producing activities (Section 4.8). Activities that generate noise in nearshore areas have potential to overlap with marine mammal subsistence harvest areas (Jones and Kostick, 2016). These activities, such as nearshore pipeline construction or vessel traffic (discussed as part of space-use conflicts, below) could disturb marine mammals away from traditional harvest locations. However, most of the noise-producing activity considered in the E&D Scenario, including seismic activities and drilling, would occur offshore and is not expected to overlap substantially with marine mammal subsistence harvest locations. Overall, noise impacts to subsistence harvest patterns and activities are expected to be short-term and localized within individual harvest seasons, but the potential for impacts would persist throughout the lifespan of oil and gas activities that may result from LS 258, as described in the E&D Scenario.

Seafloor disturbance could result from drilling, anchoring, platform and pipeline installation, seafloor sampling, and placement of other equipment on the seafloor. Subsistence species that might be impacted by seafloor disturbance include crabs, shellfish, certain fish species, and subsistence species dependent on them as part of the food chain. However, impacts to individual resources would be localized to the footprint of disturbance (less than 1 acre per platform and up to 728 acres for pipelines) and would not result in changes to overall populations (Section 4.6). There would be minimal overlap of seafloor disturbances and harvest areas for marine invertebrates, which are mostly close to shore (Jones and Kostick, 2016). Localized disturbance in nearshore harvest areas could be associated with pipeline landfalls, depending on the landfall location. Temporary and localized impacts to subsistence harvest from seafloor disturbance may occur during pipeline construction.

Operational discharges, as described in Section 4.4, could occur over the life of the E&D Scenario. As described in Section 4.5, the quality of water in the Cook Inlet Planning Area meets criteria for the protection of marine life according to Section 403 of the Clean Water Act, and hydrocarbon concentrations in Cook Inlet sediments are comparable to values reported for background hydrocarbons in Alaska offshore coastal waters. However, harvesters in several Cook Inlet communities shared concern about the effects of discharges on resources in Cook Inlet, and some study participants from Tyonek reported observations of onshore odors following permitted discharges and concerns about effects on fish and marine mammals (Holen, 2019). Subsistence harvest patterns could be disrupted by harvesters' self-imposed restrictions on resources considered to be tainted. While discharges could occur at various times throughout the estimated lifespan of LS 258-related exploration and development, as considered in the E&D Scenario, NPDES permitting would regulate operational discharges to prevent, minimize, or mitigate the intentional discharge of effluents into Cook Inlet (Section 4.5).

Space-Use Conflicts

Post-lease activities that may result from LS 258 and considered in the E&D Scenario that could cause space-use conflicts include vessel, vehicle, and aircraft operations; and construction, operation, and maintenance of platforms and onshore pipelines. Space-use conflicts can result from activities that overlap in time and space with subsistence activities that would prevent or limit harvesters' access to subsistence use areas and resources.

Impacts to subsistence harvest patterns from vessel and air traffic during all exploration and development phases may result from the overlap of traffic activity with subsistence harvest activity. However, BOEM expects the overlap between vessel and aircraft traffic and subsistence activities to be minimal because the majority of oil- and gas-related aircraft and vessels would depart from existing on-shore bases in Homer or Nikiski and transit directly to offshore locations. This would reduce overlap with most nearshore subsistence activities by concentrating traffic in specific areas. In addition, minimum elevation requirements for aircraft and prescribed transit corridors for helicopters, intended to reduce impacts on marine mammals (Section 4.8), would reduce the likelihood of impacts on marine mammal subsistence activities from aircraft traffic. Short-term and localized conflicts could arise between subsistence fishing vessels and those supporting seismic and site clearance surveys, drilling, and construction activities (e.g., platform and pipeline installation), and harvesters would need to temporarily alter their harvest locations, timing, or levels of effort. Subsistence fishers may need to avoid localized fishing areas during seismic activities, and potentially other vessel operations, for safety. For example, longlines used by subsistence fishers could entangle with seismic survey equipment if fishing and survey vessels approach too closely.

The USCG would issue a Local Notice to Mariners, which would specify the activity dates and locations and the recommended avoidance requirements for other vessel traffic. Potential conflicts with vessels would likely be localized to specific, pre-identified areas. Over the course of the LS 258 lifespan, as considered in the E&D Scenario, individual occurrences of space-use conflicts between vessels or aircraft and subsistence activities would be short-term and localized.

Construction and ongoing presence of offshore platforms and onshore pipelines has the potential to result in space-use conflicts with some subsistence users. Construction of platforms may lead offshore subsistence fishers to avoid localized harvest areas during construction activities, and continued presence of platforms may result in highly localized, but long-term, avoidance of harvesting in the nearby area surrounding platforms. Space-use conflicts resulting from construction of an onshore oil pipeline would depend on the pipeline location and route. If the oil pipeline was sited in or near traditional hunting and fishing grounds, space-use conflicts and disruptions to local subsistence harvest patterns could occur and result in short-term and localized impacts to subsistence users' patterns of harvest of terrestrial mammals, fish, birds, and vegetation. Because the E&D Scenario assumes an offshore gas pipeline would tie into existing onshore pipeline infrastructure shortly after making landfall, little to no impacts from an onshore gas pipeline are expected.

Impacts on subsistence activities and harvest patterns could be reduced through coordination between lessees/operators and communities heavily dependent on subsistence harvest and use to identify potential conflicts between planned oil and gas activities and subsistence or other cultural activities. Documentation of consultation with participating communities would help lessees/operators and communities identify best practices to prevent unreasonable conflicts with subsistence or other cultural activities, and outline specific mitigation measures the operator should implement. The Alaska Conflict Management Plan lease stipulation (Stipulation 10) is intended to minimize potential impacts to subsistence and other cultural activities of Alaska Native communities by requiring lessees and operators to coordinate with Alaska Native communities prior to activities. As described in Stipulation 10 in the Proposed Notice of Sale, the Conflict Management Plan will detail how the Lessee/operator's oil and gas activities will be scheduled, located, and conducted, and include specific mitigation measures based on the consultations with participating communities to address identified potential conflicts.

4.11.2.2 Oil Spills Impact Summary

Effects of spills, spill drills, and spill response activities on sociocultural systems, subsistence, and community health are described in Sections A-3.10, A-3.11, and A-3.12 of Appendix A. Most small spills would be localized and have limited geographic and temporal effects; however, small spills of crude oil that impact key subsistence locations could have longer term impacts. Spill drills are not expected to impact subsistence because they would be infrequent, planned events that occur over short timeframes (usually one day). A large spill would have potential to disrupt subsistence activities, or to make subsistence resources unavailable or undesirable for use, or only available in greatly reduced numbers for a substantial portion of a subsistence season, or for more than one season. Therefore, a large oil spill has the potential to cause severe impacts to subsistence activities and harvest patterns in Cook Inlet. A large spill also has a very small probability of occurring and contacting subsistence use areas for Kodiak Island and Alaska Peninsula communities (Section A-3.11.2.1, Appendix A). Although it is very unlikely to occur, a large oil spill could result in severe impacts in affected communities in those regions. Impacts of spill response activities on communities would result from disruption of subsistence harvest and changes in employment of residents and non-residents who work on spill response. Levels of impacts would depend on where cleanup activities occur in relation to communities and harvest areas and how long cleanup efforts last, and could range from short-term and localized, to long-term and widespread. A large gas release over one day would be expected to have short-term and localized impacts to communities and subsistence.

4.11.2.3 Conclusion

Short-term and/or localized impacts to subsistence activities and harvest patterns could occur throughout the 40-year lifespan associated with post-lease activities resulting from LS 258 under the E&D Scenario through effects on the availability of subsistence resources and space-use conflicts. BOEM does not expect that impacts from those activities considered in the E&D Scenario, small spills, and spill drills would make subsistence resources unavailable or undesirable for use, or only available in greatly reduced numbers for a substantial portion of a subsistence season for any community. Overall, these impacts on communities and subsistence activities and harvest patterns are expected to be minor. A large oil spill and associated spill response could substantially disrupt subsistence harvests and commercial fishing for one or more seasons, resulting in major impacts to subsistence activities and harvest patterns. Impacts of a large oil spill could extend beyond Cook Inlet communities to Kodiak Island and Alaska Peninsula communities.

4.11.3 Environmental Consequences of the Alternatives

4.11.3.1 Alternatives 3A, 3B, and 3C – Beluga Whale Critical Habitat Exclusion, Critical Habitat Mitigation, and Nearshore Feeding Areas Mitigation

Potential impacts to communities and subsistence under Alternatives 3A, 3B, and 3C would not differ substantially from those described for the Proposed Action. Excluding the 10 OCS lease blocks that overlap Critical Habitat for the beluga whale under Alternative 3A would avoid activities within those OCS blocks but is not expected to change the total level of activity resulting from LS 258 as considered in the E&D Scenario. Alternative 3B, Critical Habitat Mitigation, could change the timing of seismic survey and exploration activities within the 10 OCS lease blocks overlapping beluga Critical Habitat but is not expected to change the activity levels or impacts. Limiting seismic surveys and decreasing noise disturbances from platforms near major anadromous fish streams (Alternative 3C) would decrease noise impacts for a large part of the year. This would benefit salmon species and subsistence and personal use salmon fisheries. However, none of these factors would be expected to change the likelihood or severity of impacts evaluated for the Proposed Action. For Alternatives 3A, 3B, and 3C, impacts to communities and subsistence would be minor for post-lease activities that may result from LS 258, accidental small spills and spill drills, and major with the addition of a large spill.

4.11.3.2 Alternatives 4A and 4B – Northern Sea Otter SW Alaska DPS Critical Habitat Exclusion or Mitigation

Potential impacts on communities and subsistence under Alternatives 4A and 4B would not differ substantially from those described for the Proposed Action. Neither excluding the OCS blocks under Alternative 4A nor the mitigation under Alternative 4B would be expected to change the likelihood or severity of impacts evaluated for the Proposed Action. Under Alternatives 4A and 4B, impacts to communities and subsistence would be minor for E&D Scenario activities, accidental small spills and spill drills, and major with the addition of a large spill.

4.11.3.3 Alternative 5 – Gillnet Fishery Mitigation

Potential impacts on communities and subsistence under Alternative 5 would be similar to those described for the Proposed Action, with a reduction in impacts in communities where commercial fishing is an important subsistence, economic, social, and cultural activity (Section 4.13). Alternative 5 would not be expected to change the likelihood or severity of overall impacts evaluated for the Proposed Action for subsistence activities and harvest patterns. Under Alternative 5, impacts to communities and subsistence would be minor for those activities described in the E&D Scenario, accidental small spills and spill drills, and major with the addition of a large spill.

4.11.4 Cumulative Effects

Communities in the Cook Inlet region are supported by subsistence and several other interconnected resources, including economy (Section 4.12), commercial fishing (Section 4.13), and recreation, tourism, and sport fishing (Section 4.10). Cumulative impacts on these resources are discussed in their respective sections and could translate to impacts in communities through changes in economic opportunities, population, health, and community character and identity. Subsistence activities and harvest patterns could be cumulatively impacted by oil and gas operations, large oil spills, mining projects, marine transportation and ports, national security activities, fishing, and residential and community development. Climate change is another source of cumulative impacts on subsistence in Cook Inlet. Potential cumulative impacts include changes in subsistence resource availability, changes in harvester access to subsistence resources or harvest areas, and harvester avoidance of resources or areas.

Types of impacts of past, present, and reasonably foreseeable oil and gas activities on subsistence would be similar to those described for those post-lease activities that may result from LS 258, but could occur on a larger scale. The activities attributed to leasing that result from LS 258, as described in the E&D Scenario, would combine with oil and gas activities onshore and in state and OCS waters to contribute to future impacts to fishing and hunting from noise, seafloor disturbance, discharges, traffic (vessels, vehicles, aircraft), and onshore activities and facilities. Impacts from post-lease activities that may result from LS 258, as described in the E&D Scenario, could be additive to those from other oil and gas activities if they occur in subsistence harvest areas within the same season(s). For example, cumulative noise impacts from oil and gas activities could extend the timeframe or area in which resource availability for subsistence fishers is affected, possibly limiting harvest amounts within a season. Additive space-use conflicts (such as from vessel and aircraft traffic) could result in short-term (less than one season) and potentially long-term (one or more season(s)) limitations on the use of harvest areas.

Although highly unlikely, Appendix A considers the possibility of up to two additional large spills from sources other than those related to LS 258 post-lease activity. Potential future large oil spills would impact subsistence use areas. Subsistence use areas that are contacted by a large oil spill would likely be unsuitable for subsistence activities until adequately restored. Large oil spills that are not contained to platforms, pads, or areas in the immediate vicinity of infrastructure could contaminate important hunting and fishing areas and subsistence foods and would likely impact subsistence uses of those areas. Spill cleanup operations could result in the closure of harvesting areas until cleanup is complete, but persistent contamination could keep areas closed for years. Avoidance of affected areas or resources by subsistence users could further extend the timeframe of impacts. Historical spills have resulted in avoidance of spill-impacted harvest sites and resources that lasted beyond closure periods (Fall et al., 2006; Impact Assessment, Inc., 2011). Oil and gas activities overall, when large spills are considered, could have long-lasting, widespread, and possibly severe cumulative impacts to subsistence activities and harvest patterns.

Other activities described in Section 3.2 with potential to impact subsistence are marine transportation and port maintenance and expansion, mining projects, fishing, residential and community development, and military and homeland security. These activities may contribute to impacts from noise, seafloor disturbances, discharges, traffic, and onshore and nearshore construction activities. Past activities have cumulatively affected subsistence through changes in species availability and harvester access to subsistence use areas, increased competition for resources by other users, and changes in laws and regulations regarding resource uses (Jones and Kostick, 2016; Jones et al., 2015). For example, competition for resources and use areas with sport fishers has been reported in some communities and has changed uses of traditional harvest areas (Holen, 2019). Such trends are expected to continue. Many of the impacts on resource availability or harvester access to resources would be spatially separated from each other and from the impacts expected to result from LS 258 post-lease activities, as captured in the E&D Scenario, but they may result in space-use conflicts or effects on resource availability when overlap occurs. Overall impacts of non-oil and gas activities on subsistence would be mostly short-term and localized but could extend to long-term and widespread if activities occur in or near subsistence harvest areas.

Communities in the region are likely to be impacted by effects on resources related to climate change. Communities and industries reliant on marine-based fisheries would most likely be affected to the greatest extent, as would individuals and communities dependent on subsistence harvest of marine fish, invertebrates, and wildlife as essential elements of their food security and cultural well-being. Impacts on subsistence resource availability from climate change are expected over the lifespan of LS 258 exploration, development, and decommissioning considered by the E&D Scenario. Climate change is likely to affect the habitat, behavior, abundance, diversity, and distribution of populations of subsistence species (Sections 4.6 through 4.9), thereby indirectly affecting subsistence harvest patterns. Warming oceans, increases in ocean acidity, changes in land cover type, and other factors associated with climate change may cause or contribute to regime shifts in communities of subsistence species in Cook Inlet. Range expansions may bring new subsistence species into Cook Inlet, while other species may become less prevalent. Subsistence harvest opportunities may be affected by potential shifts in hunting seasons and harvest opportunities due to changes in distribution or abundance of favored species (ADF&G, 2010). Cumulative impacts on subsistence activities and harvest patterns related to climate change could be short-term and localized or long-lasting and widespread and possibly severe depending on the extent to which availability of and access to subsistence resources are adversely affected.

The overall cumulative impacts on subsistence activities and harvest patterns from the activities described in Section 3.2 would be minor to moderate but could increase to major through impacts from cumulative oil spills and climate change. In the context of the potential long-term, widespread, and severe impacts on subsistence activities and harvest patterns related to climate change and cumulative oil spills, the impacts associated with the E&D Scenario would not represent a substantial incremental contribution to overall cumulative impacts.

4.12 Economy

4.12.1 Affected Environment

Employment income, royalty revenues, property taxes, and spending associated with the oil and gas industry are major contributors to the SOA and Southcentral Alaska's economy. Oil and gas production in Cook Inlet basin are used in the local market with infrastructure available for oil, LNG, and fertilizer exports. The oil and gas industry generates average earnings greater than two-and-a-half times all other Alaskan industries (Fried, 2017).

The Swanson River oil field founded in 1957, located within the KPB, has been credited with helping provide economic justification for statehood. In 1969, the Kenai LNG facility began to produce LNG for export to Japan, Agrium began production of ammonia and urea used for fertilizer, and the Kenai refinery began operations. Both the Kenai LNG facility (2017) and the fertilizer plant (2007) have ceased operations, while the Kenai refinery is still operating. Cook Inlet Gas Storage Alaska (CINGSA) is a gas storage facility built on a depleted gas reservoir used to balance seasonal swings in demand and supply. CINGSA entered service in 2012. Oil and gas production in Cook Inlet basin are used in the local market with infrastructure available for oil, LNG, and fertilizer exports.

All developed oil and gas fields discovered in the Cook Inlet Basin to date are onshore or in SOA waters (BOEM, 2015a). Cook Inlet oil production started in the 1960s, peaked in 1970 at 227,000 barrels per day, hit a low of 8,900 barrels per day in 2011, and had increased to 14,300 barrels per day in 2019. Natural gas production began in 1960 and peaked in 1994, with a gross production of 310 Bcf produced per year with 100 Bcf reinjected, netting 210 Bcf of annual production. Current natural gas production, as of 2019, is 70 Bcf per year, with gross production of 79 Bcf and 9 Bcf reinjected.

4.12.1.1 Employment and Wages

The oil industry has a large footprint in the SOA. Direct employment related to oil and gas accounted for 4 percent of the total Alaskan workforce (out-of-state workers excluded) and 11 percent of total wages in Alaska in 2015 (Fried, 2017); however, this does not include indirect jobs related to oil and gas pipelines, transportation companies, refineries, and many construction companies. Nonresidents represent 36 percent of the oil and gas workforce and earn 34 percent of its total wages (Fried, 2017). In 2019, the industry supported over 47,000 Alaska jobs, provided $4.6 billion in wages and contributed more than $19.4 billion to the state's economy (API, 2021). According to a Northern Economics 2018 Study, petroleum development in the Cook Inlet OCS could generate 1,750 annual jobs and $101.7 million in annual labor income (NorEcon, 2018).

The nearest communities that could be impacted by post-lease activities that may result from LS 258, as described in the E&D Scenario, include the KPB, the Municipality of Anchorage (a City and a Borough under state law), and the Matanuska-Susitna (Mat-Su) Borough. Identifiable economic effects are most likely to be associated with the KPB. Serving as a source of workers, KPB is likely to benefit from the related effects of income, spending, and taxes. Anchorage and the Mat-Su Borough could be sources of workers and recipients of spending. Oil and gas workers who commute from Anchorage and the Mat-Su are not considered permanent residents of the KPB; these workers would have minimal integration into the local economy.

Approximately 4,607 direct, indirect, and induced jobs in the KPB are attributed to the oil and gas industry, generating approximately $405 million in annual wages (Table 4-21; McDowell Group, 2020).

Table 4-21: Employment and Wages

Category	Employment	Wages ($ million)
Primary Companies (Alaska residents only)*	852	206.4
Oil and Gas Support Services (Alaska residents only)*	1,382	99.8
All other Indirect and Induced	2,373	98.7
Total Impacts (Direct, Indirect, and Induced):	4,607	404.9

Notes: * Includes workers who are employed statewide but reside in the KPB, as well as workers who live and work in the KPB.
Source: Alaska Department of Labor and Workforce Development, data from Primary Companies, and McDowell Group estimates.

The KPB had 58,367 permanent residents in 2019 (ADLWD, 2019). Ninety percent of KPB residents (ADLWD, 2016) are employed by state and local government, tourism, trade, utility, healthcare, retail, commercial fishing, and hospitality industries. Infrastructure, work sites, and housing are integrated within KPB communities.

Unemployment in the KPB ranged from 14.9 percent to 6.8 percent between 1990 and 2020. The KPB unemployment rate in 2019 was 6.8 percent, slightly higher than Alaska's unemployment rate of 6.1 percent the same year (ADLWD, 2019).

4.12.1.2 Revenues

The federal government collects revenues from the production of oil and natural gas on the OCS through bonus bids, royalties, and rents from lessees. The U.S. Department of the Treasury distributes about half of the revenues generated from all oil and gas development in various proportions to the states and various national funds such as the Historic Preservation Fund, Land and Water Conservation Fund, and Native American Tribes and Allottees. The other half remains at the U.S. Treasury to fund other U.S. programs.

State revenue comes from petroleum, non-petroleum revenue from taxes, charges for services, licenses, permits, and fines and forfeitures. Federal oil and gas rents and royalties from OCS leases located 4.8–9.6 km (3–6 mi) from shore are shared under Section 8(g) of OCSLA. In FY 2019, SOA revenues totaled $7.7 billion, and petroleum revenue accounted for $2.0 billion of the total. Traditionally, petroleum revenues made up 85 percent or more of SOA revenues. For over two decades, approximately 80 percent of Alaska's unrestricted (funds for any purpose) revenue has come from oil taxation and royalties (ADOR, 2018). Currently, the largest source of revenue for the SOA is the earnings reserve of the Permanent Fund (ADOR, 2020).

A minimum royalty rate of not less than 16.66 percent, but not more than 18.75 percent, during the 10-year period beginning on the date of enactment of the Inflation Reduction Act of 2022, and not less than 16.66 percent thereafter, applies to OCS leases. The SOA also is entitled to a 27.5 percent share of certain OCS revenues from leases subject to Section 8(g) of the OCSLA; such leases would be within 3 nmi of the state's territorial sea boundary.

The majority of property tax revenue KPB receives comes from the oil and gas industry. Property tax is KPB's largest revenue source. In 2019, total property taxes collected were $69.5 million of which oil and gas property taxes were $14.1 million (KPB, 2019). The KPB has an effective mill rate of 9.90 mills. Other local jurisdictions have a mill rate of 0 to 20 mills within the SOA (ADOR, 2019).

According to a Northern Economics 2018 Study, petroleum development in the Cook Inlet OCS could generate $2.7 billion in total in Alaska and local government property taxes, Alaska corporate income taxes, and royalty payments to the U.S. (NorEcon, 2018).

4.12.2 Environmental Consequences of the Proposed Action

4.12.2.1 Employment and Wages

Exploration, development, production, and decommissioning phases affect employment and wages to varying degrees. During the early stages of lease development, there are minimal impacts to the local economy due to the specific human labor skills required. Employment begins to increase during G&G data acquisition, analysis, and for numerous environmental studies needed for exploration. As development and production begin, the need for additional support services creates local employment opportunities. Employment continues to increase during exploration and development drilling. Employment reaches peak levels in the first several years when design, fabrication, installation, and initial production begin. Employment decreases as capital expenditure projects are completed, and spending transitions to an operational expenditures baseline. There is a slight increase in employment related to capital expenditures during decommissioning, while operational employment expenditures cease.

Out-of-state workers are estimated to compose 18 percent of the workforce. Because workers associated with E&D Scenario activities would be housed in the local community, there would be some impact to the local population. As development and production begin, the need for additional oil and gas support services could induce local employment opportunities in the KPB through the "multiplier effect." The multiplier effect stems from operational expenses requiring additional services or local goods. These additional jobs may include, but are not limited to transportation, retail, recreation, education, healthcare, and potential oil spill response services. Due to this multiplier effect, indirect and induced jobs can exceed the number of jobs directly created by E&D Scenario activities. Employment, income, and expenditures resulting from E&D Scenario activities would initiate subsequent rounds of income creation, spending, and investments. An increase in jobs and wages during peak employment periods could generate an increase of spending in local communities, thus benefiting local businesses. This can be perceived by some as an increase in quality of life. Therefore, employment and wage effects could be long-term and may have widespread impacts for the KPB and SOA.

4.12.2.2 Revenues

The KPB and SOA both receive a share of revenues from assessed oil and gas exploration production facilities, and pipeline property taxes. Oil and gas property tax revenues support some KPB residents working in local government jobs. The KPB primarily receives its revenues from these oil and gas property taxes and not production revenue. A marginal amount of new infrastructure would be located on state lands, which is likely to consist of pipelines connecting to existing infrastructure. New infrastructure would have little to no impact on additional oil and gas property tax revenues received annually but would effectively increase the lifespan of some infrastructure on which the KPB collects property tax. Effects on property tax revenue based on extending the lifespan of existing infrastructure could be negligible to moderate, depending upon the amount of oil and natural gas discovered. For example, if enough natural gas is discovered, the LNG terminal and/or the fertilizer plant could be restarted which would provide a moderate boost to property taxes collected by the KPB. It is more likely any oil and gas discoveries would extend the lifespan of existing infrastructure, as utilization of existing assets would be optimized. Therefore, communities in the KPB could have limited or moderate impacts associated with oil and gas property tax revenues, as they would occur on a scale sufficient to create local changes in population, employment, wages, and KPB revenues.

Primary impacts to the SOA revenues include property tax, corporate income tax, and revenues received under Section 8(g) of OCSLA which shares 27.5 percent of royalty rents and royalty revenues received on leases located 4.8–9.6 km (3–6 mi) from State lands. These revenues would be the primary sources of revenue for the SOA from post-lease activities conducted as a result of LS 258, as described in the E&D Scenario. The SOA receives fewer beneficial impacts than the KPB. The activities associated with the E&D Scenario could result in negligible to minor revenue impacts for the SOA.

4.12.2.3 Oil Spills Impact Summary

Effects of spills, spill drills, and spill response activities on economy are described in Section A-3.13 of Appendix A. Levels of employment, wages, and revenues would remain unaltered in the case of small spills resulting in the accrual of little to no economic benefits in local communities. For a small spill, most of the cleanup would occur from those already employed in the oil and gas sector. Additionally, oil spill drills would have a short-term and localized impact and would be of no consequence to the economy. However, if a large oil spill were to occur, cleanup workers may provide a considerable amount of wages earned for those living in the affected community. A gas release would not have a substantial impact to the economy.

4.12.2.4 Conclusion

Impacts related to employment, wages, and revenues for the SOA from the activities associated with the E&D Scenario range from short-term and localized to long-term and widespread. Size and duration of impacts are tied to the size of a resource discovered — the larger the resource the greater the impact on employment, wages, and KPB revenues. If the resource discovered is large enough, the potential for reopening of the LNG terminal and/or fertilizer plant exists. Reopening of one or both facilities would provide a step function to the size of the impact on the KPB's revenues, employment, and wages. Impacts on KPB employment and wages are likely to range from temporary and short-term, to long-term and widespread. Oil and gas property revenues KPB receives are expected to remain constant, with the possibility of increased infrastructure longevity and associated property tax. A long-term and widespread impact to KPB property tax would be expected if one or both LNG/fertilizer facilities reopened, resulting in a moderate impact to the KPB.

Population impacts are expected to be negligible to minor over the lifespan of the E&D Scenario and subsequent developments. Overall, the economic impacts to the SOA would range from negligible to minor, while the KPB would experience negligible to moderate effects. When a large oil spill is analyzed, impacts to the SOA remain minor due to the localized impact of a large oil spill, the small change in statewide jobs, and the small percent of revenues lost as discussed in Appendix A (Section A-3.13). The KPB would experience minor impacts due to temporary increased employment and wages associated with a large oil spill cleanup, and the long-term effects to the mixed economy as discussed in Appendix A (Section A-3.13).

4.12.3 Environmental Consequences of the Alternatives

Potential impacts on the economy under all the action alternatives would not differ substantially from those described for the Proposed Action. These alternatives would not change the total level of activity under the E&D Scenario, and thus economic impacts would be as described for the Proposed Action. None of the restrictions identified by these alternatives would be expected to change the likelihood or severity of impacts on the economy. Consequently, economic impacts of these alternatives would be negligible for small spills and spill drills for the SOA and the KPB. When considering a large spill, economic impacts for the SOA and KPB would be minor. Economic impacts of these alternatives would be minor for E&D activities in relation to potential revenues for the SOA and the KPB.

4.12.4 Cumulative Effects

There are numerous past, ongoing, and reasonably foreseeable oil and gas projects in the KPB, adjacent state waters, and other areas of Cook Inlet. Current and reasonably foreseeable projects would continue to sustain existing statewide employment and labor income opportunities into the future. Positive effects to the economy may result from new and modified infrastructure. Additional income opportunities include infrastructure construction/enhancement, support services for the oil and gas industry, community development, recreation, tourism, and local or tribal development. Employment and labor associated with improved infrastructure would maintain a longer-term tax base. The KPB government receives limited revenues from oil and gas property taxes and provides employment and income to KPB residents. Increased longevity of existing infrastructure would be significant to the KPB. Limited to significant property taxes would be recognized if the LNG terminal and/or fertilizer plants restarted in the manufacturing sector of the KPB. The amount of property tax would vary according to how much of the LNG terminal and/or fertilizer plant infrastructure is placed back in service. Consideration has also been given to a property tax break, which could occur before restarting this infrastructure. This creates a wide range of potential property tax revenues the KPB could receive. The SOA receives additional revenues from oil and gas beyond property taxes, unlike the KPB. Therefore, the State may comparatively experience larger economic impacts.

Employment patterns may be altered based on changes in seasonal drilling and exploration windows. Production patterns may be affected by these changes, as well. In addition to production from existing operations, ongoing exploration activities in Cook Inlet are occurring both onshore and offshore in both state and federal waters. Exploration activities include initial evaluation, geological survey, geophysical survey, and exploratory drilling. Limited development may occur, such as the Seaview natural gas project near Anchor Point. The activities associated with the E&D Scenario and these ongoing projects would contribute to the overall employment, revenues, and income for the KPB and SOA. The degree of incremental effect is dependent on industry interest/success, but it could be widespread and long-term.

The Past, Present, and Reasonably Foreseeable Future Actions section (Section 3.2) includes reasonably foreseeable potential income opportunities for the KPB and SOA. The primary contribution of the E&D Scenario to cumulative effects includes additional employment and income, extending infrastructure lifespans and property tax revenues further into the future, and negligible to limited impacts to the local communities.

Activities associated with the E&D Scenario could prolong the life of existing onshore infrastructure and encourage future industry activity as oil fields are discovered and developed, thus resulting in additive economic benefits greater than the sum of the parts. Positive long-term impacts to the local economy would primarily come from sustained revenues. Small impacts would come from other employment opportunities.

A large oil spill or gas release, as described in the Oil Spills and Gas Release Scenario (Section 3.1), may have some effects on the economy. These impacts may overlap with reasonably foreseeable future activities, thereby increasing the overall level of the effect expected. Short-term impacts from a large oil spill would contribute to employment and wages and minimally impact the KPB and SOA revenues. When impacts from the E&D Scenario are added to past, present, and reasonably foreseeable future actions, cumulative impacts to the economy would be minor to moderate.

4.13 Commercial Fishing

4.13.1 Affected Environment

The central Gulf of Alaska supports a large and diverse commercial fishery for shellfish, salmon, herring, and groundfish. Some species that are currently commercially harvested elsewhere in Alaska have been closed or greatly reduced in Cook Inlet over recent decades due to low stock levels (ADF&G, 2019a, b). It is possible that these fisheries could resume in Cook Inlet if population surveys showed harvestable abundances.

4.13.1.1 Crab and Shrimp

ADF&G manages crab fisheries of the Cook Inlet, Kodiak, and the Alaska Peninsula areas in cooperation with NMFS and the North Pacific Fishery Management Council. Seasons are established by ADF&G, and, for some species, harvest limits are set with coordination and in cooperation with the federal fisheries agencies. Due to low levels of abundance in the Cook Inlet area, fisheries for red king, Tanner and Dungeness crabs have been closed for some time (1983 for king crab, 1995 for Tanner crab, and 1997 for Dungeness crab) (Rumble et al., 2016, 2020). Cook Inlet commercial shrimp fisheries have included northern, sidestripe, coonstripe, spot, and humpy shrimp via pot or trawl gear. The shrimp fishery in Cook Inlet has been closed since 1997 due to low abundance (ADF&G, 2019b; Rumble et al., 2016).

4.13.1.2 Scallops and Clams

Weathervane scallops are harvested by dredges while hardshell clams are harvested by hand using shovels or rakes. Commercial weathervane scallop fishing in federal waters off Alaska is limited, but participation in state waters is open access. Scallops are harvested commercially during some years, but these efforts have been limited in recent years. Catches have been sporadic and centered on a single scallop bed near Augustine Island in the Kamishak District of lower Cook Inlet from August 15 through October 31. The Cook Inlet scallop fishery is periodically closed in some years based on population numbers and management decisions (ADF&G, 2019b; Rumble et al., 2016). This pattern of variable open and closed years is likely to continue through the life of the E&D Scenario. In the Cook Inlet area, Pacific littleneck and butter clams may be harvested by permit, but there are conservation concerns about their abundance. The last commercial harvest of these species in the Cook Inlet area occurred in 2006 in Kachemak Bay (Rumble et al., 2016). Commercial harvest of razor clams is managed by ADF&G. This fishery occurs throughout the year, historically occurring mostly in the western area of Cook Inlet near Polly Creek. In 2018, the commercial razor clam harvest had an ex-vessel value of approximately $131,500 (ADF&G, 2019b).

4.13.1.3 Other Commercially Harvested Invertebrates

Other shellfish commercially fished in Alaska include octopus, sea cucumbers, and sea urchins (ADF&G, 2019b). Octopus are captured as bycatch of the Pacific cod pot fishery. Sea cucumbers and green sea urchins are harvested by divers, but that commercial fishery has been closed in Cook Inlet since 1997 (Rumble et al., 2016).

4.13.1.4 Pacific Herring

Pacific herring are harvested annually in Cook Inlet as well as the waters adjacent to Kodiak, Chignik, and the South Alaskan Peninsula. Herring are targeted mainly for their roe and sac roe on kelp, but some carcasses are processed into fishmeal after the sac roe is removed. This gill net fishery occurs during April and May. In lower Cook Inlet, a commercial herring fishery has been on and off for much of the twentieth century (Hollowell et al., 2016). The most recent one was located in Kamishak Bay, but due to low stock abundance, it was closed in 1999 and has remained closed in order to allow the population further opportunity to rebuild from historically low abundance (ADF&G, 2019a; Hollowell et al., 2016).

4.13.1.5 Salmon

All five species of Pacific salmon are harvested commercially in Cook Inlet and the waters adjacent to Kodiak, Chignik, and the southern Alaska Peninsula. ADF&G and the Alaska Board of Fisheries manage the salmon stocks in the Cook Inlet, Kodiak, and Alaskan Peninsula areas (ADF&G, 2017). The seasons are set, and the salmon fisheries are managed intensively for conservation. Within a fishing season, there are closed periods to allow for adequate spawning escapements. Additionally, when spawning escapement numbers are low, ADF&G has the authority to impose emergency closures and other management actions to increase the number of salmon reaching the spawning grounds. Cook Inlet salmon fisheries use purse seines, drift gillnets, and set gillnets from June through August. Second only to Alaska's groundfish fishery, Alaska's salmon fishery is one of the largest fisheries in volume and value. The estimated total value of salmon fisheries in 2018 was approximately $7.2 million in lower Cook Inlet (Hollowell et al., 2019).

4.13.1.6 Groundfish and Halibut

ADF&G and NMFS share and coordinate management responsibilities for Alaska's groundfish fisheries, with the exception of halibut, which is managed by the International Pacific Halibut Commission. Commercially harvested groundfish in Cook Inlet have included, but are not limited to, rockfish (several species), flatfish (including halibut), Pacific cod, lingcod, sablefish, and pollock. Groundfish are harvested with trawls, pots, and longlines throughout the year. Pacific halibut is a major commercial fishery in Alaska, including Cook Inlet. Alaskan commercial harvest for halibut in 2019 was nearly 17.5 million lbs., with Cook Inlet harvests over the recent decade ranging from approximately 100,000 to 500,000 lbs. annually (IPHC, 2019). In 2018, an estimated 1.5 million lbs. of groundfish (other than halibut) were harvested in Cook Inlet, with a value of approximately $924,000. This is as low as values in the 1990s; catches in recent decades (2000–2010) were higher and were mostly due to catches of Pacific cod. Allowable groundfish harvest was reduced in 2018 due to a downturn in Pacific cod populations in the Gulf of Alaska, which led to a closure of the federal fishery in 2020. The fishery was reopened in 2021, when the population showed signs of recovery. Sablefish, rockfish, and pollock harvest in Cook Inlet in 2018 was also low. Lingcod have seen an increase in harvest value in recent years (NPFMC, 2019; Rumble et al., 2019).

4.13.2 Environmental Consequences of the Proposed Action

4.13.2.1 Noise

Post-lease activities conducted as a result of LS 258, as described in the E&D Scenario, which produce noise impacts to commercial fishing operations and targeted species include seismic surveys, drilling, and vessel traffic. Noise from these activities may temporarily displace targeted fish species (Section 4.6) and affect catch rates of commercial fishermen. Impacts from the use of airguns in deep penetrating marine seismic surveys may depend on the species involved (e.g., benthic versus pelagic). Seismic surveys might directly cause temporary disturbance and dispersal of fish, which may reduce purse seine and gillnet salmon harvests in a local area. Even in cases where dispersal does not occur, seismic surveys could affect the behavior of some targeted species temporarily, thereby affecting catch rates in the immediate area of the survey (Davis et al., 1998; Engås et al., 1996; Pearson et al., 1992). Generally, deep penetrating seismic surveys are short-term and localized operations and fish that are displaced are likely to backfill the surveyed area in a matter of hours; impacts on fishing operations would be brief. Additionally, post-lease activities as described in the E&D Scenario indicate that only one deep penetrating marine seismic survey would occur over the 40-year timeframe. However, if these short-term and localized impacts occur in areas where a time limited fishery operates, the adverse effects on commercial fishers could be magnified. For example, the drift gillnet salmon fishery, which operates only on Mondays and Thursdays from mid-June to mid-August, could see decreased catch of commercial fishers due to the displacement of targeted species from the fishery grounds.

In the short-term, direct effects from drilling sounds may frighten, annoy, or distract commercially harvested fish or shellfish, and lead to physiological and behavioral disturbances. These noises could cause species to leave a project site or adjacent area. Energetic consequences would depend on whether suitable food is readily available. However, over the long term, this impact could be naturally mitigated if a species becomes habituated to the noise produced by drilling activity, thereby potentially reducing the zone of displacement over time. Due to the relatively small size of a platform, height above the water, and existing underwater noise in Cook Inlet, noise impacts emitted from platform drilling would be short-term and localized.

As a result of the temporary change in background noise created by passing vessels, pelagic fish (e.g., herring, salmonids) in the immediate vicinity of vessels may exercise temporary and localized avoidance. It is likely that fish would return to an area once a vessel has passed or would migrate and move from the area. Therefore, the temporary noise impact would have a minor impact on fish and the commercial fishery targeting pelagic species. Due to a vessel's position on the water surface, typical distance between the noise source and seafloor, and existing underwater noise in Cook Inlet, temporary passing noises emitted from a vessel are unlikely to impact commercially important shellfish in the surrounding seafloor and are thus unlikely to affect commercial shell fishing activities.

4.13.2.2 Disturbance

Post-lease activities conducted as a result of LS 258, as described in the E&D Scenario, may disturb commercial fishing operations through space-use conflicts with oil and gas operations and presence of drilling structures. Potential effects of platform construction and operations would be highly localized but would occur throughout the life of the E&D Scenario, which spans 40 years. Pipeline and platform construction may temporarily impact commercial fishing if it occurs during the fishing season and targeted species are affected (Section 4.6). Equipment, vessels, and seismic surveys, can entangle commercial fishing gear (e.g., longlines) or impact the habitat of targeted species, and commercial fishers likely would be temporarily excluded from the local area during construction. During construction, pipelines can pose entanglement hazards for some types of fishing gear employed near the seafloor. Commercial fishers using the area near a production platform for transit or fishing may lose access to part of the fishing grounds to maintain a safe operating area around the platform. Following platform construction there could be some highly localized but long-lasting changes in fish densities and species diversity in the vicinity of platforms due to attraction of some invertebrate and fish species to new habitat (Section 4.6), which could be beneficial or adverse to both fish and commercial fisheries.

The disturbances on commercial fishing operations would be highly localized but would span multiple fishing seasons. Impacts to commercial fisheries and the success of residents who participate in these fisheries could affect multiple Cook Inlet region towns. New platform and pipeline locations would be identified on navigational charts, but because a relatively small area of Cook Inlet would be affected, interference with commercial fisheries is expected to be limited. Cooperation between the exploration industry and the commercial fishing industry regarding timing and location of operations could minimize these space-use conflicts.

4.13.2.3 Oil Spills Impact Summary

Effects of spills, spill drills, and spill response activities on commercial fishing are described in Section A-3.14 of Appendix A. Most accidental spills or spill drills would be small, localized, and have relatively limited impacts to commercial fishing activities. Small spills are not expected to persist long enough to result in fisheries closures or reduced market values of fisheries over the lifespan of the E&D Scenario and therefore are not expected to have an economic effect on the Cook Inlet commercial fishing industry. In contrast, a single large spill could depress numbers of fish in subpopulations of commercially important species. Even if fish stocks were not reduced as a consequence of a spill, specific fisheries could be closed due to actual or perceived contamination of fish or shellfish tissues. Such closures during peak salmon fishing could result in severe impacts to commercial fishing and major losses of income for commercial fishers. The occurrence of a large spill in Cook Inlet could result in an economic loss to the commercial fishing industry of approximately $9 to $43 million per year for 2 years (BOEM, 2016; Cohen, 1993). The impacts of a large spill could be widespread, long-lasting, and would require spill response and cleanup, which itself can affect target species and commercial fishing gear through use of dispersants and mechanical recovery methods (see Section A-3.14, Appendix A). As with most small spills, a gas release and the resulting explosion would not exist long enough to close a fishery. The economic cost of a large oil spill to the commercial fishing industry is primarily due to fishing closures, real or perceived catch tainting, and gear contamination.

4.13.2.4 Conclusion

Temporary displacement of fishery resources from localized areas could occur as a consequence of noise and activities associated with construction during development; however, these fishery resources would be expected to return once construction is completed. Some impacts could be beneficial or adverse for fishery resources. Disturbance or displacement of fishing activities is expected to be highly localized.

Generally, these impacts are minor, although in already time-limited fishing operations such as salmon gillnetting, impacts could be moderate due to the severity of the space-use conflict. Accidental small spills that may occur are unlikely to have an effect on commercial fishing. A large spill would affect only a small proportion of a given fish population within Cook Inlet but may damage fishing gear and could cause a fishery to be closed for an entire season or more, resulting in a 100 percent loss during the closure period. In general, most impacts are not anticipated to result in a clear, long-lasting change in the resource's function. Overall, activities associated with the E&D Scenario, accidental small spills, and spill drills are likely to have minor to moderate impacts, but the occurrence of a large oil spill would result in major effects on commercial fishing due to potential changes in target fish stocks and impacts expected from cleanup efforts.

4.13.3 Environmental Consequences of the Alternatives

4.13.3.1 Alternatives 3A, 3B, and 3C – Beluga Whale Critical Habitat Exclusion, Critical Habitat Mitigation, and Nearshore Feeding Areas Mitigation

Potential impacts on commercial fishing under these alternatives would be somewhat decreased from those described for the Proposed Action. Excluding some OCS blocks from LS 258, as with Alternative 3A, would preclude impacts from occurring in the mitigated area. Limiting seismic surveys and decreasing noise disturbances from platforms near major anadromous fish streams, as with Alternatives 3B and 3C, would eliminate or decrease impacts of proposed seismic sounds for a large part of the year. This would most likely benefit salmon species and commercial salmon fisheries. This could prevent some displacement of commercially targeted species and may mitigate the effects to commercial fishers. Portions of the drift gillnet fishery may still be affected by seismic surveys. Under these alternatives, impacts to commercial fishing from activities associated with the E&D Scenario, accidental small spills, and spill drills would decrease from a range of minor to moderate, to minor. The addition of a large spill would result in major effects on commercial fishing.

4.13.3.2 Alternatives 4A and 4B – Northern Sea Otter SW Alaska DPS Critical Habitat Exclusion or Mitigation

Potential impacts on commercial fishing under these alternatives would not differ substantially from those described for the Proposed Action. Excluding some OCS blocks from LS 258, as with Alternative 4A, would preclude impacts from occurring in the mitigated area. Prohibiting drilling discharges within 1,000 m (3,280 ft) of critical sea otter habitat, as with Alternative 4B, is unlikely to affect catch rates or access to commercial fishing grounds. Under this alternative, impacts to commercial fishing from activities associated with the E&D Scenario, accidental small spills, and spill drills would remain minor to moderate. The occurrence of a large spill would result in major effects on commercial fishing.

4.13.3.3 Alternative 5 – Gillnet Fishery Mitigation

Potential impacts on commercial fishing under this alternative would be somewhat decreased from those described for the Proposed Action. Under this alternative, seismic surveys north of Anchor Point during drift gillnetting season are prohibited. With the implementation of this alternative, impacts on the commercial drift gillnet fishery would become negligible, as no space-use conflicts or impacts to the targeted fishery would occur from seismic surveys. Seismic surveys would occur outside the drift gillnet fishing season, while changes in frequency of occurrence of exploration and development vessel traffic would be coordinated with local gillnet fishers. Other impacts may still occur as described in the analysis of the Proposed Action. Under this alternative, impacts to commercial fishing from activities associated with the E&D Scenario, accidental small spills and spill drills would decrease from a range of minor to moderate, to minor. The occurrence of a large spill would result in major effects on commercial fishing.

4.13.4 Cumulative Effects

Past, present, and reasonably foreseeable future actions that could impact commercial fishing include oil and gas operations, large oil spills, vessel traffic, and climate change (Section 3.2). Most effects of the activities associated with the E&D Scenario would be temporary and are unlikely to substantially overlap in time and space with the actions described in Past, Present, and Reasonably Foreseeable Future Actions (Section 3.2).

Offshore construction of platforms and pipelines resulting from the E&D Scenario are estimated to result in additive minor space-use conflicts such as competition for docking space and/or gear loss. Production facilities compete with commercial fishing interests for physical space in the ocean, and the facilities can pose hazards to fishing nets (e.g., drift gillnetting). Offshore construction could also have an additive or synergistic effect on commercial fishing. While platforms pose an obstacle to commercial fishing vessels, they also can provide structural habitat for fish. Platforms are known to attract fish for food and shelter from predators, The area occupied by the structures under the E&D Scenario is small compared to the area available in Cook Inlet for commercial fishing. Because the footprint area of oil- and gas-related structures is small and easily avoided by fishing vessels, the impact on commercial fisheries is anticipated to be highly localized. Additive impacts from the E&D Scenario are estimated to be relatively few in number and minor in scope.

Although highly unlikely, Appendix A considers the possibility of up to two additional large spills from sources other than those related to LS 258 post-lease activity. Large or chronic oil spills could have a cumulative impact on targeted fisheries in Cook Inlet through multi-season effects on commercial fishing. The effects of a large spill occurring would be additive to any other spill occurring from existing oil and gas activities. The most likely effect would be a lengthier and prolonged recuperation period for the natural resources in the affected area, including commercial fish species. Overall, the E&D Scenario would likely result in minor incremental increases in impacts to commercial fishing for small spills and a major incremental increase in impacts to commercial fishing for large spills.

Climate change is likely to affect the habitat, behavior, abundance, diversity, and distribution of populations of fish and invertebrate communities in Cook Inlet, thereby affecting the commercial fishing industry. Elevated ocean temperatures and rapidly melting snowpack will likely continue having an effect on lower Cook Inlet commercial salmon fisheries (Shafte et al., 2017). As described in Section 4.6, regime shifts in fish and invertebrate communities of Cook Inlet may occur as a result of climate change. Some commercially important species may benefit from such changes to the prey base and increase in numbers, while other species may find the altered habitats less suitable and decrease in numbers.

Overall, commercially important species may be affected by the activities described in the Past, Present, and Reasonably Foreseeable Future Actions section (Section 3.2). The incremental contribution of the activities associated with the E&D Scenario is unlikely to change the cumulative effects on commercial fisheries. However, the additive impacts associated with climate change and/or a large spill could have far-reaching effects on commercial fishing activities and fish populations and habitats in the area. Where impacts described in the Past, Present, and Reasonably Foreseeable Actions may overlap over the life of the E&D Scenario, such as climate change or seismic surveys, the activities of the E&D Scenario would have no discernable additive or synergistic effect that was not already considered in the effects analysis. Although the cumulative impacts to commercial fisheries may be moderate, primarily due to climate change, the incrementally additive impact of the activities associated with the E&D Scenario in the context of these Cumulative Assumptions would be negligible.

4.14 Archeological and Historic Resources

4.14.1 Affected Environment

Archaeological resources are any material remains of human life or activities that are at least 50 years of age and that are of archaeological interest (30 CFR 550.105). Archaeological resources can be either pre-contact or historic. In North America, pre-contact resources pertain to the period before European contact with Native American and Alaska Native cultures; historic resources are from the period after European contact with these cultures. The Cook Inlet area has the potential to contain both onshore and offshore historic and pre-contact resources, including shipwrecks, plane wrecks, and archaeological sites potentially dating to approximately 8,000 before present (B.P.), and may date to 17,000 to 14,000 B.P. (Dixon, 2013; Klein and Zollars, 2008). However, archaeologists have not systematically surveyed most of the Cook Inlet area, particularly areas of the OCS. 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). Assessment of archeological resources at the lease sale level includes describing the types of resources that may be present and the potential of their presence or absence.

Potential for occurrence of archaeological resources and a summary of documented resources is presented in the FEIS for Lease Sale 244, which covers the same area as the lease sale area for LS 258 (BOEM, 2016, Section 3.3.8). Specifically, the information set forth in Section 3.3.8-1 and Figure 3.3.8-1 summarizes the methodology for identifying areas with potential for occurrence of pre-contact resources and the lease blocks with potential paleo-landforms. Additionally, Table 3.3.8-2 lists known historical shipwrecks located in the vicinity of the lease sale area. The information in the specified section, figure, and table, as summarized here and with more specificity below, is incorporated by reference in support of BOEM's archaeological analysis for LS 258.

Submerged pre-contact sites may exist in areas of the Cook Inlet OCS that were once exposed above sea level and available to human occupation. The assessment of pre-contact resources considers the potential for such resources to have occurred, survived, and be recoverable within the lease sale area. Discussion of potential for submerged pre-contact resources is provided in Section 3.3.8.1, pp. 3-195 to 3-198, of BOEM (2016a), which builds on the previous Prehistoric Resource Analysis completed for Cook Inlet Lease Sales 191 and 199 (MMS, 2003). BOEM identifies areas up to the 200-foot isobaths as those where submerged pre-contact sites could exist. Relic paleo-landforms in these areas may potentially retain evidence of early hunters and gatherers who once occupied the area. Figure 3.3.8-1 identifies a total of 100 whole or partial OCS blocks in the lease sale area (which is the same as the lease sale area for LS 258) as having potential for pre-contact archaeological resources. The identified OCS blocks are located mostly toward the western side of the lease sale area, with some in central and eastern portions in the lower part of the lease sale area.

Potential offshore historic resources include sites of ship and plane wrecks. Table 3.3.8-2 in BOEM (2016a) identifies 68 known wrecks, obstructions, archaeological sites, occurrences, or sites marked as “unknown” within or in the vicinity of the lease sale area. Recorded ship losses include late nineteenth and early to mid-twentieth century vessels including numerous oil-, gas-, or diesel-powered screws, schooners, steamers, some barges and tugs, and other types of vessels. The number of recorded ship losses likely underrepresents total losses given the likelihood that sinkings occurred without survivors or witnesses to report the event. Even though many obstructions identified as “unknown” are eventually identified through investigation as modern trash or debris, those that have not been investigated cannot be ruled out as potentially submerged cultural or historic resources. Since publication of the LS 244 Final EIS, an additional potential shipwreck was identified in the lease sale area (OHA, 2020).

Historic and pre-contact archaeological resources are documented onshore and along the coast. Sites are documented from systematic investigations along both the eastern shore and in areas of the western shore, including in Lake Clark National Park. Sites representative of several pre-contact cultures are documented throughout the Cook Inlet and Kodiak Island regions, as described in BOEM (2016a) Section 3.3.8.2, pp. 3-201 to 3-203. Historic resources include structures, artifacts, and other resources from early Russian exploration and establishment to European and American settlement and activity. The Alaska Heritage Resources Survey keeps a database of all known archaeological sites, including those on the National Register of Historic Places.

4.14.2 Environmental Consequences of the Proposed Action

Post-lease activities conducted as a result of LS 258, as described in the E&D Scenario, which could impact archeological and historic resources include ground or seafloor disturbance during platform installation, pipeline installation (both offshore and onshore), drilling, placement of equipment on the seafloor (e.g., nodes and cables for 3D surveys, anchors), and seafloor sampling.

Impacts to archaeological and historic resources from platform or pipeline installation and drilling would be localized and occur where an activity directly disturbs the ground or seafloor. Should an offshore activity come into direct contact with a shipwreck, it could physically damage the hull structure, resulting in permanent loss of archaeological data (e.g., information about how the ship was built). Direct contact with a shipwreck site could also damage or disturb artifacts, resulting in the loss of cultural information about the crew and cargo. In some instances, shipwrecks serve as gravesites of sailors lost at sea and disturbance of the site may result in disturbance to human remains. Impacts to historic aircraft would be analogous to shipwreck disturbances. Impacts to buried pre-contact sites may include destruction of artifacts and site features and disturbance of the stratigraphic context of the site. The placement of wells, platforms, or pipelines near archaeological resources can cause the surrounding seafloor to slump or may change the direction and intensity of local currents, scouring or exposing archaeological resources. This could cause deterioration or eventual loss of the resource and the information it contains. Ground disturbance within the onshore pipeline corridor has the potential for localized damage or disturbance to onshore archaeological resources.

The discharge of drilling muds and cuttings along with sediment displacement during pipeline trenching could bury an exposed resource. The impact would depend on the proximity of the discharge locations to an archaeological resource and how quickly the discharges disperse before reaching the seafloor. In high-energy environments such as Cook Inlet, relatively small amounts of drilling fluids and cuttings accumulate near well sites because deposits are quickly transported away by strong currents (Section 4.4).

The placement of equipment on the seafloor and seafloor sampling activities has the potential to damage any archaeological resources present. BOEM assumes one deep penetrating marine seismic survey during the 40-year E&D Scenario. The survey is anticipated to occur prior to geo- and shallow-hazard site surveys in which archeological sites can be identified. Therefore, if the survey is conducted using bottom founded equipment, it could directly impact an unrecorded shipwreck or pre-contact site. Vessel anchoring could occur at any time during the E&D Scenario and could damage archaeological resources where anchors or anchor chains directly contact or drag/sweep across the seafloor. Geotechnical surveys could both affect and identify buried archaeological sites in all phases of the E&D Scenario. Seafloor sampling during geotechnical and shallow hazard surveys may include gravity/piston corers, shallow coring with a rotary drill, or grab or dredge sampling. Conducting an archaeological survey and allowing time for the data to be reviewed by a marine archaeologist and BOEM in advance of seafloor sampling activities would avoid impacts from sampling.

For all potential impacts discussed above, the intensity of impact may vary depending on the level of damage to a resource(s), the extent of impacts would be localized to the area of disturbance, and the duration would be long-term because archaeological resources are nonrenewable. However, because laws and regulations are in place to protect archaeological resources and other historic properties, BOEM expects to avoid most of the potential impacts described above, so their likelihood of occurrence is low.

In accordance with 30 CFR 550.194(a), where BOEM has reason to believe that an archaeological resource may exist in the lease area, it requires the lessee to provide an archaeological report with its EP or DPP. If that report suggests that an archaeological resource may be present, the lessee must either relocate its operations or conduct additional investigations to BOEM's satisfaction that archaeological resources do not exist there or otherwise would not be affected. Such investigations may include high-resolution surveys, use of magnetometers to detect ferrous materials, and other investigative techniques to identify potential archeological resources prior to potentially disturbing activities. All post-lease sale activities would be subject to review under the National Historic Preservation Act (NHPA). Section 106 of the NHPA (Title 54, USC 306108) and regulations at 36 CFR Part 800 require federal agencies take into consideration the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation an opportunity to comment. Historic properties are those that are on or eligible for the National Register of Historic Places as described in 36 CFR 60. BOEM would review site-specific information prior to approving any lease-related activities with the potential to affect archaeological resources.

BOEM will consult with the State Historic Preservation Officer, Tribes, or other consulting parties, and the public to determine appropriate mitigation measures to protect said resources. BOEM's regulations continue to protect archaeological resources even after BOEM issues an approval and the lessee or operator commences post-lease activities. In accordance with 30 CFR 550.194(b), BOEM will notify the lessee or operator whenever it learns that an archaeological resource is likely to be present in a lease area and could be affected by proposed or ongoing activities. In such circumstances, the lessee or operator may not take any action that may adversely affect the archaeological resource until BOEM has prescribed how to protect the resource. Further, in accordance with 30 CFR 550.194(c), lessees and operators must immediately halt their operations and notify BOEM whenever they discover an archaeological resource on their lease or right-of-way. BOEM may then prescribe additional measures to protect pre-contact and historic resources.

4.14.2.1 Oil Spills Impact Summary

Effects of spills, spill drills, and spill response activities on archaeological resources are described in Section A-3.15 of Appendix A. Most spills would be small, localized, and have relatively limited impacts to archaeological resources. BOEM expects little to no impacts from small spills, because spilled oil or fuel is unlikely to come in contact with submerged or onshore archaeological resources. Oil spill drills are not expected to disturb the seafloor and would have little to no impacts. A large oil spill could result in long-lasting and widespread impacts to archaeological sites if resources are oiled or the biota colonizing sites were substantially altered. Impacts from a large spill and cleanup would depend on several factors including the location and size of the spill, decisions made during cleanup and response, and the uniqueness of the site. The greatest impacts from a large spill may be due to spill response and cleanup activities, which create opportunities for disturbances to resources through vandalism (e.g., unauthorized removal of materials or artifacts by spill response personnel), or inadvertent damage from activities such as anchoring, or onshore activity. Impacts of spill cleanup and response would be long-term and localized or widespread, if resources are oiled, or sites are damaged during cleanup and important archaeological or historic information is lost. A large gas release over one day could have long-term and localized or widespread impacts in the unlikely event of ignition occurring and damaging nearby resource(s).

4.14.2.2 Conclusion

Impacts to pre-contact and historic resources would range from none to localized, and therefore minor. BOEM would review site-specific information regarding potential archaeological resources prior to approving any lease-related activities with the potential to affect such resources, including placement of bottom-founded equipment or structures. Lessees would be required to survey for pre-contact and historic resources prior to disturbing areas where they may occur and avoid or mitigate impacts to identified sites. Overall, the impacts to archeological and historic resources from the E&D Scenario activities, accidental small spills, and spill drills would be negligible to minor. When potential impacts of a large spill including response and cleanup activities are considered, the expected impacts could become moderate.

4.14.3 Environmental Consequences of the Alternatives

Potential impacts on archaeological and historic resources under all action alternatives would not differ substantially from those described for the Proposed Action. It is expected that most impacts of routine activities on archaeological and historic resources would be avoided under any action alternative through compliance with Section 106 of the NHPA and its implementing regulations at 36 CFR 800, and BOEM's requirements at 30 CFR 550.194. These alternatives are not expected to change the likelihood or severity of impacts on archaeological resources evaluated for the Proposed Action. Overall, the impacts on archaeological resources would be negligible to minor for E&D Scenario activities, accidental small spills, and spill drills, and could become moderate when considering the addition of a large spill and spill response.

4.14.4 Cumulative Effects

Sources of cumulative impacts on archaeological resources include oil and gas activities, large oil spills, marine transportation, maintenance and expansion of ports and terminals, mining projects, fishing, scientific research, community development, and climate change. Potential cumulative impacts to archaeological resources range from destabilization and degradation of resources to physical damage or destruction, resulting in the loss of archaeological data. Impacts could occur from direct contact to resources, ground- or seafloor-disturbing activities, and burial or contamination.

Types of cumulative impacts from oil and gas activities would be similar to those described for the activities associated with the E&D Scenario. Offshore impacts in federal and state waters could result from activities including placement of exploration survey equipment, drilling and discharges, and platform and pipeline installation. Impacts from onshore oil and gas activities could occur through ground disturbances from gravel mining, construction of gravel roads and pads, and pipeline installation. Because oil and gas exploration and development in federal or state lands and waters would be subject to permitting requirements that include agencies' reasonable and good faith efforts (36 CFR 800.4(b)(1)) to identify and protect historic and archeological resources, most of the impacts would be mitigated to little or none. However, if a resource that is not identified prior to activities, and therefore is not protected, is damaged, that impact would be localized but permanent.

Large oil spills could occur in Cook Inlet from a variety of activities. Although highly unlikely, Appendix A also considers the possibility of up to two additional large spills from sources other than those related to LS 258 post-lease activity. The types of impacts from oil spills and spill response on historic and archeological resources would be similar to those described for the activities associated with the E&D Scenario (Section 3.15, Appendix A). Large oil spills have potential to impact resources over a widespread area via direct contact, through persistent contamination of sediments, or during cleanup operations. Large spills could have severe impacts if resources are oiled, or sites are damaged during cleanup and important archaeological or historic information is lost.

Other activities that could contribute to cumulative impacts on archaeological resources include current and future seafloor and ground disturbances from residential and community development; marine traffic and port maintenance and expansion; fishing; scientific research; and infrastructure in support of mining projects. Residential and community development has potential to expose previously buried or otherwise inaccessible archaeological resources to potential looting or vandalism. Seafloor disturbance from vessel traffic could occur from anchoring or dredging of shipping channels and ports. Anchoring could occur throughout Cook Inlet, while dredging of shipping channels and around ports would be confined to specific areas. Some fishing techniques that use gear deployed on or near the seafloor such as dredging, bottom trawling, or placement and removal of pots, have potential to contact and possibly damage archaeological resources. Seafloor sampling activities related to scientific research also have potential to contact resources. These activities would not necessarily require federal approval; therefore, measures to identify and avoid archaeological resources may not be employed. Within the scope of the entire Cook Inlet area, localized bottom disturbances from anchoring, fishing, or scientific research activities are unlikely to contact a resource, but if impacts did occur, they would be localized and long-term.

Installation of pipelines and shoreline infrastructure for the mining projects described in Section 3.2 would result in seafloor and ground disturbance, but these activities would be subject to permitting requirements that include identification and protection of archaeological resources. Onshore, ground disturbance for community development or road construction projects would have potential to impact historic and archaeological resources, but site clearance surveys and avoidance of identified resources would minimize impacts. Overall, activities subject to permitting requirements would result in impacts that range from little to none to localized but long-term.

Changing environmental conditions have potential to affect both on- and offshore historic and archaeological resources. Storm surge, shoreline erosion, sea level rise, altered hydrology, snow melt, and glacier retreat or advances all have the present and reasonably foreseeable future effect of destroying, flooding, or altering the context and integrity of historic and archaeological resources (Hollesen et al., 2018; Rockman, 2015). Impacts on archaeological and historic resources include site modification that could occur as a result of shoreline erosion, and sea level rise that could destroy, flood, bury, or expose a historic site or artifact. Newly exposed sites can be vulnerable to vandalism or unauthorized collection of artifacts (Hollesen et al., 2018). In addition, changes in biological communities and water chemistry resulting from ocean acidification could disrupt the equilibrium in which archaeological resources currently exist, which could lead to deterioration. These impacts are expected to continue into the foreseeable future and many previously unidentified and undocumented resources, and their associated historic and archaeological information, could be lost. The overall effect of impacts from climate change to archaeological resources would be long-term and widespread and could be severe if important archaeological information is lost through destruction of resources and sites.

Many potential cumulative impacts would be mitigated or avoided by safeguards already in place through the NHPA and state and federal permitting processes. Cumulative impacts would be negligible to minor for most activities. Activities in the E&D Scenario are not expected to contribute measurably to cumulative impacts on archaeological resources because most impacts would be avoided or mitigated or would be localized. Large oil spills have potential for unavoidable or unmitigated impacts to resources over a widespread area. Impacts resulting from climate change can be expected to occur over the next several decades. Cumulative impacts to historic and archaeological resources would be potentially major if numerous sites face damage from large oil spills and/or climate change.

4.15 Environmental Justice

4.15.1 Affected Environment

Environmental justice (EJ) is defined as "The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (EPA, 2014). Executive Order (EO) 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, directs federal agencies to consider EJ as part of their mission. EO 12898 requires an evaluation in the EIS as to whether an action would have disproportionately high and adverse human health and environmental effects on a minority population, a low-income population, or Indian tribe (CEQ, 1997).

According to CEQ guidance on implementing EO 12898, minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent, or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or some other appropriate reference population (CEQ, 1997). Federal agencies are also directed to consider minority populations and Indian tribes with differential patterns of subsistence consumption of fish and wildlife (CEQ, 1997).

The Alaska statewide population is approximately 14 percent American Indian and Alaska Native. For the KPB, the population of American Indian and Alaska Native peoples is approximately 7 percent (ADLWD, 2020b). Table 4-22 identifies the racial composition of communities in the Cook Inlet region that have a high percentage of minority population compared to the borough and state. These communities have a meaningfully higher percentage of Alaska Native peoples living there than the KPB as a whole, and all but one, Ninilchik, have a meaningfully higher percentage of Alaska Native peoples living there than the SOA as a whole. Moreover, for all but two of these communities, the minority population exceeds 50 percent of the total community population.

Table 4-22: Population and Minority Composition of Cook Inlet Environmental Justice Communities

Community	Population	American Indian or AK Native (%)	White (%)	Two or More Races (%)	Asian (%)	Black or African American (%)	Native Hawaiian, Pacific Islander (%)
Nanwalek	280	78.24	5.56	13.43	0.46	0	2.31
Ninilchik	821	11.49	78.46	8.75	1.31	0	0
Port Graham	180	82.23	8.63	8.63	0	0.51	0
Seldovia Village	185	25.71	58.29	8.57	6.29	0	1.14
Tyonek	143	80.55	2.39	16.38	0	0	0.68

Source: ADCCED, 2020.

The Cook Inlet communities listed in Table 4-22 qualify as EJ communities based on their racial/ethnic minority composition. The identified EJ communities also display disproportionately high consumption patterns of fish and wildlife and other subsistence resources (Section 4.11). This analysis also considers the Kenaitze Indian Tribe and Salamatof Tribe in the Kenai-Soldotna-Nikiski area because they are Federally recognized tribes living near the lease sale area. Several Russian Old Believer communities in the Fox River Census Designated Area and in Nikolaevsk exhibit high rates of poverty and reliance on wild harvest foods (USFWS and Headwaters Economics, 2022). In addition, communities farther from the lease sale area that could be impacted by a large oil spill and that BOEM considers EJ communities based on high percentages of Alaska Native peoples (ADCCED, 2020; USCB, 2010) and subsistence consumption patterns, include Chignik Bay, Chignik Lagoon, Chignik Lake, Perryville, Ivanof Bay, Akhiok, Karluk, Larsen Bay, Old Harbor, Ouzinkie, and Port Lions.

EO 14008, Tackling the Climate Crisis at Home and Abroad, issued on January 27, 2021, calls for the Federal government to “secure environmental justice and spur economic opportunity for disadvantaged communities that have been historically marginalized and overburdened by pollution and underinvestment in housing, transportation, water and wastewater infrastructure, and health care.” Sections of EO 12898 were amended by EO 14008 to create the White House Environmental Justice Interagency Council. The Biden administration issued interim guidance for implementation pursuant to Section 223 of EO 14008 in July 2021 (OMB, CEQ, and National Climate Advisor, 2021). The interim guidance is focused on implementation of the Justice40 Initiative, an initiative included in EO 14008 to support a goal that 40 percent of the benefits from certain Federal investments flow to disadvantaged communities. The interim implementation guidance provided a list of variables to consider when assessing whether a specific community is disadvantaged. While an oil and gas lease sale is not covered under the Justice40 initiative, the considerations recommended in the interim guidance help provide additional context to potential challenges and vulnerabilities that EJ communities may face, which may make communities more vulnerable to impacts. The considerations recommended in the interim guidance that are most applicable to the lease sale area are:

- Low income, high and/or persistent poverty
- High unemployment and underemployment
- High housing cost burden and substandard housing
- High transportation cost burden and/or low transportation access
- Limited water and sanitation access, and affordability
- Disproportionate impacts from climate change
- High energy cost burden and low energy security
- Access to healthcare

Vulnerabilities of environmental justice communities may be compounded by a combination of the variables listed above. Rural communities throughout Alaska, including many of the EJ communities in the lease sale area, face high costs of living, especially costs of energy (fuel for vehicles/boats and for heating) (KPB, 2019; LPB, 2012; ADCCED, 2021). Remote communities, especially those that are not road accessible, also face unique transportation challenges and costs. Some of the EJ communities identified as minority populations also face challenges of unemployment/ underemployment, poverty, and low income. In the KPB, Alaska Native villages generally experienced higher rates of unemployment, low-income, and poverty than other KPB communities between 2008 and 2020 (Cuyno et al., 2022). Most of the EJ communities identified in the region have percentages of families below the poverty level that are well above that of Alaska as a whole (7 percent) (USFWS and Headwaters Economics, 2022). For example, the percentages of families below poverty in Port Graham (35 percent), Nanwalek (27 percent), and Tyonek (25 percent) are more than three times that of the state as a whole. Poverty percentages are also higher than the state in most Kodiak and Alaska Peninsula EJ communities (USFWS and Headwaters Economics, 2022).[21] Challenges with high energy and transportation costs along with low income and poverty intersect with potential environmental justice impacts of the Proposed Action because the subsistence economy is intertwined with broader economic considerations for subsistence communities and households (Keating et al., 2020).

[21] BOEM notes that income and poverty data for small populations are often less reliable than for larger populations due to data limitations; information on poverty is intended to provide additional context to consider vulnerabilities in EJ communities.

4.15.2 Environmental Consequences of the Proposed Action

The Alaska Native communities identified above as EJ communities have the potential to be affected by post-lease activities, that may result from LS 258 as described in the E&D Scenario, due primarily to their reliance on local natural resources for health, nutrition, social organization, cultural identity, economic stability, and well-being. BOEM initiated opportunities for Government-to-Government tribal consultations to include EJ concerns through letters and follow-on contacts to Tribes in the Cook Inlet and Kodiak Island region whose members could be affected by activities related to LS 258. Details of the consultation efforts and contacted communities are provided in Section 5.3.1. Seldovia Village Tribe provided written comments that expressed concerns for Cook Inlet beluga whale and northern sea otter populations and identified areas in state and OCS waters that are important for commercial, recreational, and subsistence fishing. Kenaitze Indian Tribe issued a resolution opposing the Proposed Action (Resolution No. 2021-74). The resolution expresses concern regarding impacts of oil spills, climate change, industrialization of offshore areas, and other factors, on resources and activities important to the Tribe's cultural, social, health, and economic well-being.

For the purposes of EJ analysis, in alignment with BOEM's approach to EJ assessments in other recent Alaska NEPA documents (e.g., BOEM, 2016, 2018) any major adverse impacts to a resource on which an EJ community depends would be considered disproportionately high and adverse; impacts lower than major would not. Analysis of the post-lease activities described in the E&D Scenario found no major (i.e., high and adverse) impacts for E&D activities or small spills for subsistence activities and harvest patterns, economy, air quality, water quality, or the biological resources harvested for subsistence. Therefore, no disproportionately high and adverse impacts to EJ communities are expected to result from the E&D Scenario activities, small spills, and spill drills.

A large oil spill could have disproportionately high and adverse effects to EJ communities because it could have major adverse impacts to subsistence activities and harvest patterns (Sections A-3.10 and A-3.11, Appendix A). These impacts would disproportionately affect EJ communities due to their distinct cultural practices and subsistence ways of life. In addition, moderate to major impacts on some marine and coastal resources (Sections A-3.4 through A-3.7, Appendix A) would also impact EJ communities that rely on a healthy marine system to support their way of life. BOEM anticipates these impacts would disproportionally affect EJ communities in the impact zone of a large oil spill, because these communities are more dependent on wild food production and distribution than the non-EJ communities in the lease sale area.

4.15.3 Environmental Consequences of the Alternatives

Potential impacts on EJ communities under all the action alternatives would not differ substantially from those described for the Proposed Action. Analysis of the action alternatives for subsistence, air quality, water quality, and biological resources found no major (i.e., high and adverse) impacts related to activities described in the E&D Scenario or small spills. Additionally, impact conclusions for a large spill did not change for the above-listed resources for the action alternatives. Therefore, no disproportionately high and adverse impacts to EJ communities are expected to result from the E&D Scenario activities, small spills, and spill drills, but a large oil spill could have disproportionately high and adverse effects.

4.15.4 Cumulative Effects

EJ communities in the Cook Inlet Region rely on local resources to maintain community resiliency, health, and social, cultural, and economic well-being, and could be affected by cumulative impacts on air and water quality, biological resources, subsistence activities and harvest patterns, and economy. Cumulative impacts on these resources are discussed in their respective sections (Sections 4.3 through

4.9, 4.11, and 4.12), and range from negligible to moderate from past, present, and reasonably foreseeable future actions, but could increase to major, primarily through impacts from climate change. Moderate to major cumulative impacts on populations of fish and wildlife are anticipated through effects of climate change (Sections 4.6 through 4.9). Those resources with major impacts would disproportionately affect EJ communities in the region that rely on fish and wildlife resources.

Climate change is raising environmental justice issues in Alaska and around the globe (Levy and Patz, 2015; Trainor et al., 2007). Communities that are especially reliant on natural resources, and communities who are already vulnerable due to a range of social, economic, historical, and political factors, may have a lower capacity to prepare for, cope with, and recover from climate change impacts (EPA, 2021b). The environmental justice communities in the region may be disproportionately impacted by effects of climate change, such as changes in drought and fire frequency and intensity, flooding and coastal erosion, shifts in biological species composition, and impacts to community infrastructure. To the extent that the status of various species of subsistence resources in Cook Inlet may change over the course of the 40-year lifespan of the E&D Scenario, the Proposed Action's direct and indirect effects on those subsistence resources and environmental justice communities might also change. However, a more precise accounting of such changes would be unduly speculative at this time given the complexity of these issues and difficulty in predicting effects. Any changes in the distribution of subsistence resources harvested by environmental justice communities will be accounted for based on the latest data in each of BOEM's EP- and DPP-specific review processes.

4.16 No Action Alternative

Under the No Action Alternative, Cook Inlet LS 258 would not be held, and no exploration, development, or production activities associated with this sale would occur. If the estimated 0-162.7 MMbbls of oil and 229.5–290.7 Bcf of natural gas were not produced, there would be no chance of oil spills or gas releases occurring from wells, platforms, or pipelines. Potential impacts from LS 258, including OCS oil and gas activities described in the E&D Scenario (Section 4.1), would be delayed or eliminated. Potential economic benefits including direct and indirect wage earnings, taxes, and royalties collected by the SOA and the federal government would not occur; however, Cook Inlet physical, biological, and socioeconomic resources would continue to be exposed to potential impacts from any ongoing activities in SOA and federal waters.

4.17 Unavoidable Adverse Environmental Effects

Section 102(2)(c)(ii) of NEPA requires an EIS to disclose any adverse environmental effects that cannot be avoided should the Proposed Action be implemented. Below is a list of resource areas that could experience unavoidable adverse effects under all the action alternatives.

- <u>Air Quality</u>: Impacts from surveys, exploration, and production operations. Impacts resulting from platforms would dissipate as the emissions mix with the surrounding air masses.
- <u>Water Quality</u>: Increase in TSS from construction activities; discharge of exploration and delineation well rock cuttings and fluids, and other operational discharges.
- <u>Coastal and Estuarine Habitats</u>: Impacts from seafloor disturbance activities, discharges, pipeline landfalls, and onshore construction.
- <u>Fish and Invertebrates</u>: Impacts from the addition of drilling platforms or presence of vessels in the region, would be limited to the immediate vicinity of the structure or activity.

- Birds: Vessel operations and marine habitat alterations would occasionally displace some birds and interfere with foraging. Bright artificial lighting and gas flaring from platforms and vessels would annually cause some collisions of migrating birds from widespread populations.
- Marine Mammals: Impacts of noise on marine mammals could lead to individual animals avoiding the most heavily ensonified areas, particularly around seismic surveys and pile-driving. Disturbances to marine mammal habitat could occur with the installation of production platforms and pipelines; platforms could have a positive impact by increasing food availability.
- Terrestrial Mammals: Most impacts associated with the lease sale would be geographically distant from terrestrial habitats, occurring largely offshore. Onshore pipeline construction and disturbance would have short-term and localized impacts.
- Recreation, Tourism, and Sport Fishing: Impacts will primarily arise from disturbance in the form of space-use conflicts. Access to some sport fishing areas may be temporarily limited and some short-term displacement of populations of sport species such as salmon and halibut may result.
- Communities and Subsistence: Short-term and localized impacts from effects on the availability of subsistence resources and space-use conflicts.
- Economy: Size and duration of impacts are tied to the size of a resource discovered. Exploration, development, production, and decommissioning phases affect employment and wages to varying degrees. Size and duration of impacts are tied to the size of a resource discovered.
- Commercial Fishing: Temporary displacement of fishery resources and fishing activities from localized areas as a consequence of noise and activities associated with construction during development.
- Archaeological and Historic Resources: Permanent loss of pre-contact and historic resources should they be disturbed by surveys or construction activities.

4.18 Relationship between Short-Term Uses and Long-Term Productivity

Section 102(2)(c)(iv) of NEPA requires that an EIS include information on the relationship between local short-term uses of the human environment and the maintenance and enhancement of long-term productivity, should the Proposed Action be implemented.

The impact analysis found that oil and gas exploration, development and production, and decommissioning activities would entail some impacts to nearly all resource categories analyzed. Most impacts are the result of short-term uses and are greatest during the exploration, development, and early production phases. These effects may be reduced by the assumptions and mitigation measures described in Chapter 3 (Section 3.4) and are not expected to adversely affect long-term productivity.

Oil and natural gas production would yield short-term economic benefits, but the resulting GHG emissions may contribute to global changes in climate, including long-term impacts to global productivity. In Alaska, ecosystems are at risk from loss of ice-cover and permafrost as well as the resultant slow rise in sea level in coastal areas. It is reasonable to expect that a changing climate could affect long-term productivity of marine and coastal environments.

4.19 Irreversible and Irretrievable Commitments of Resources

Section 102(2)(c)(v) of NEPA requires that an EIS include information on any irreversible and irretrievable commitments of resources that would be involved in the Proposed Action, should it be implemented. Irreversible and irretrievable commitment of resources refers to impacts or losses to resources that cannot be reversed or recovered. Holding an OCS lease sale and issuing OCS leases do not constitute an irreversible and irretrievable commitment of resources. OCSLA prescribes a four-stage process for the OCS program. This four-stage review process gives the Secretary of the Interior a "continuing opportunity for making informed adjustments" to ensure that all OCS oil and gas activities are conducted in an environmentally sound manner. In the first stage, BOEM prepares a 5-year leasing program to identify the size, timing, and location of proposed lease sales and an EIS under NEPA. In the second stage, BOEM conducts pre-lease processes and sale-specific NEPA review. The third stage involves exploration of the leased tracts. Prior to any exploration drilling, a lessee must submit an EP to BOEM for review and approval. The EP must comply with OCSLA, implementing regulations, lease provisions, and other federal laws, and is subject to environmental review under NEPA. If exploration drilling is successful, a lessee may then submit a DPP to BOEM for the fourth stage of review and approval.

Irreversible and irretrievable effects could occur only as a result of exploration, development, production, and decommissioning activities. Each of these activities occurs at a future stage of the OCSLA process and would require additional NEPA review before being authorized.

CHAPTER 5: CONSULTATION, COORDINATION, AND PREPARERS

5.1 Cooperating Agencies

BOEM is the lead agency for the preparation of this EIS. Following the guidelines at 40 CFR 1501.6 and 1508.5 from the CEQ, BOEM invited agencies which have jurisdiction by law or special expertise with respect to OCS-related environmental impacts to become cooperating agencies for the preparation of this EIS. BSEE participated as a formal cooperating agency.

5.2 Record of Decision

A ROD will be issued no less than 30 days after the Final EIS is made available, and the notice of its availability will be published in the Federal Register. The ROD will contain a concise summary of the decision made based on the analysis of the alternatives presented in the Final EIS. The ROD will state the decision and rationale for the decision. The ROD will also describe mitigation measures intended to avoid effects from the chosen alternative. Once the ROD is published, the EIS process is considered complete.

5.3 Consultation

5.3.1 Tribal Consultation & Government to ANCSA Corporation Consultation

EO 13175 established regular and meaningful consultation and collaboration with tribal officials in the development of federal policies that have Tribal implications, to strengthen United States government-to-government relationships with Indian Tribes (including Alaska Native Tribes and communities) and reduce the imposition of unfunded mandates when developing federal policies with Tribal implications. The order requires the head of each agency to designate an official "with principal responsibility for implementation" of the order.

Since implementation of E.O. 13175, the USDOI has established a Tribal Consultation Policy. Secretarial Order (SO) 3317 updated the USDOI's policy on consultation with Indian Tribes in compliance with EO 13175. In summary, SO 3317 states that USDOI officials must demonstrate a meaningful commitment to consultation "by identifying and involving Tribal representatives in a meaningful way early in the planning process," and that consultation aims to create effective collaboration emphasizing "trust, respect, and shared responsibility."

On August 10, 2012, the USDOI issued the Policy on Consultation with ANCSA Corporations. In this policy, USDOI restated a provision of ANCSA requiring "[t]he Director of the Office of Management and Budget [and all federal agencies] shall hereafter consult with Alaska Native corporations on the same basis as Indian tribes under EO 13175." The policy "distinguishes the federal relationship to ANCSA corporations from the government-to-government relationship between the federal government and federally recognized Indian Tribes... and [states that] this Policy will not diminish in any way that relationship."

BOEM initiated opportunities for Government-to-Government tribal consultations to include EJ concerns through letters and follow-on contacts to Tribes, ANCSA Corporations, Tribal entities and local governments in the Cook Inlet and Kodiak Island region whose members could be affected by activities related to LS 258. Additionally, as part of maintaining an active relationship and open communications, each Tribe, ANCSA Corporation and Tribal Entity was contacted multiple times with various notices and updates regarding the pending Cook Inlet LS 258. Additional outreach efforts included Federal Register Notices, BOEM website updates, press releases to local and statewide media, paid display ads in several newspapers, and several broadcast interviews.

Specifically, BOEM reached out to the following Tribes, ANCSA Corporations, and Tribal entities:

Cook Inlet Tribes

- Cook Inlet Tribal Council
- Chickaloon Traditional Village Council
- Eklutna Tribe
- Kenaitze Indian Tribe (IRA)
- Knik Tribal Council
- Native Village of Nanwalek
- Native Village of Port Graham
- Native Village of Tyonek (IRA)
- Ninilchik Traditional Council
- Salamatof Tribal Council
- Seldovia Village Tribe

Kodiak Tribes

- Alutiiq Tribe of Old Harbor
- Native Village of Afognak
- Native Village of Akhiok
- Native Village of Karluk
- Native Village of Larsen Bay
- Native Village of Ouzinkie
- Native Village of Port Lions
- Sun’aq Tribe (Kodiak)
- Tangirnaq Native Village

ANCSA Corporations

- Chickaloon-Moose Creek Native Association, Inc.
- Cook Inlet Region, Inc.
- Eklutna, Inc.
- English Bay Corporation
- Kenai Native Association
- Ninilchik Natives Association
- Port Graham Corporation
- Salamatof Native Association, Inc.
- Seldovia Native Association, Inc.
- Tyonek Native Corporation

Tribal Entities

- ANCSA Regional Association
- Inuit Circumpolar Council (Alaska)
- Tanana Chiefs Conference

BOEM engaged in formal Government-to-Government consultation with Kenaitze Indian Tribe who had expressed an interest in formal consultation. The Kenaitze Indian Tribe expressed their opposition to the Proposed Action by issuing a resolution (Resolution No. 2021-74) expressing their concern regarding impacts, of oil spills, climate change, industrialization of offshore areas, and other factors, on resources and activities important to the Tribe’s cultural, social, health, and economic well-being. The Seldovia Village Tribe, while not engaging in formal Government-to-Government consultation, chose to engage with BOEM informally. As such, they provided written comments expressing concerns for the Cook Inlet beluga whale and northern sea otter populations. They also identified areas in State and OCS waters that were important to them for commercial, recreational, and subsistence fishing. BOEM also reached out to the nine federally recognized Tribes associated with Kodiak Island to survey their level of interest in the lease sale and to develop a collaborative plan for engagement. Six of the nine Tribes expressed interest in being kept informed of future activities in the Cook Inlet Planning Area.

5.3.2 Section 7, Endangered Species Act Consultation

The ESA (16 USC §§ 1531 et seq.) provides a program for the conservation of threatened and endangered plants and animals and the ecosystems on which they depend. Section 7(a)(2) of the ESA requires each federal agency to ensure that any action that it authorizes, funds, or carries out is not likely to jeopardize the continued existence of a listed species or result in the adverse modification of designated critical habitat. With respect to this lease sale, BOEM is consulting with USFWS and NMFS (the "Services") concerning potential impacts to listed species and their designated critical habitat. For ESA consultation on lease sales in Alaska, BOEM specifically requests Section 7 consultation for each incremental step of lease activity. Regulations at 50 CFR 402.14(k) allow consultation on part of the entire action as long as: that step does not violate Section 7(a)(2); there is a reasonable likelihood that the entire action will not violate Section 7(a)(2); and the agency continues consultation with respect to the entire action, obtaining a Biological Opinion for each step. Accordingly, at the lease-sale stage of LS 258, BOEM is evaluating the early lease activities (e.g., seismic surveying, ancillary activities, and exploration drilling) to ensure that activities under any leases issued in Cook Inlet will not result in jeopardy to a listed species or cause adverse modification of designated critical habitat. BOEM will complete Section 7 consultation with the Services prior to authorizing any early lease activities and will then reinitiate consultation on future incremental steps, including development and production activities.

5.3.3 Essential Fish Habitat Consultation

The Magnuson-Stevens Fishery Conservation and Management Act (as amended) requires federal agencies to consult with NMFS regarding actions that may adversely affect designated Essential Fish Habitat (EFH). BOEM prepared an EFH assessment that identified adverse effects to designated EFH from potential oil and gas exploration activities in the LS 258 sale area. This assessment was provided to NMFS on January 20, 2022. NMFS responded on February 24, 2022. While they agreed with BOEM's determination that the lease sale will not result in adverse effects to EFH, they also stated concerns about: 1) long-term impacts to EFH associated with increased GHG emissions, and 2) the need for facilities to reduce methane and other emissions during operations. Their EFH Conservation Recommendations provided specific recommendations to address these concerns. Around the time of BOEM's receipt of the NMFS' EFH Conservation Recommendations, preparations for LS 258 were interrupted due to a court injunction and subsequently canceled due to lack of industry interest. As a result, BOEM did not further pursue EFH consultation until recently, when BOEM resumed preparations for LS 258 as directed by Congress in the Inflation Reduction Act of 2022 (Pub. L. 117-169, Aug. 16, 2022). Consequently, BOEM responded to NMFS in mid-October 2022. While BOEM shares NMFS' concerns about the potential long-term impacts of climate change on fish species and habitats in Alaska, due to limitations of technology, data, modeling, and methods, it is not presently possible to predict the precise geographical changes to species distributions and habitats that may occur over long time scales as the result of climate change. Consequently, it is not possible to analyze, with any degree of confidence, the potential effects of the increased GHG emissions from a single lease sale on local Alaskan fisheries. However, BOEM and NMFS have agreed to collaborate on studies to address impacts to fish in Cook Inlet. Regarding NMFS' concern about methods for facilities to reduce methane emissions, lessees are already subject to regulations that require adherence to best management practices at their facilities. Specific restrictions on facility operations to reduce methane emissions would be most appropriately addressed at the exploration or development stage, and not at the lease sale stage. However, BOEM has also developed a lease stipulation for Lease Sale 258 (No. 10, Royalties on All Produced Gas) that will serve as an incentive to reduce emissions of methane or other gases that contribute to climate change. BOEM anticipates that the requirements of Stipulation No. 10 will at least partially address the concerns reflected in the second EFH Conservation Recommendation.

5.3.4 Section 106, National Historic Preservation Act Consultation

Section 106 of the NHPA (Title 54, USC 306108) and regulations at 30 CFR 800 et seq. require federal agencies take into consideration the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation an opportunity to comment. Consultation under Section 106 would include the Alaska State Historic Preservation Office (SHPO), as well as Tribes and other interested parties. In a letter to SHPO dated September 23, 2020, BOEM explained it recognizes that a lease sale constitutes an undertaking under Section 106 of the NHPA but is not the type of activity that has the potential to cause effects on historic properties, and thus would not require formal SHPO consultation. SHPO agreed with BOEM in an email dated November 16, 2021. Subsequent project- and site-specific consultations will occur if any proposed exploration, development, and production activities are determined to be a type of activity that has the potential to cause effects on historic properties.

5.4 List of Preparers

Table 5-1: List of Preparers

Name	Position Title	Contribution
Michael Bradway	Regional Supervisor, Resource Evaluation	E&D Scenario Development
Sarah Coffman	Chief, Economics Division	Lifecycle GHG Emissions and Social Cost of GHG Emissions
Meghan Cornelison	Social Scientist	Communities and Subsistence; Archaeological and Historic Resources; Environmental Justice; NHPA Section 106 Consultation
Christopher Crews	Wildlife Biologist	Marine Mammals
Kelsey Crocker	Petroleum Engineer	E&D Scenario Development Support
Maureen De Zeeuw	Wildlife Biologist	Birds
Lorena Edenfield	Fish Biologist	Fish and Invertebrates; Commercial Fishing; Essential Fish Habitat Consultation
Lisa Fox	Environmental Protection Specialist	NEPA Coordinator; Document Development and Review
Shane Gray	Wildlife Biologist	Terrestrial Mammals; Recreation, Tourism, and Sport Fishing
Pamela Grefsrud	Wildlife Biologist	Water Quality; Coastal and Estuarine Habitat
Michael Haller	Tribal and Community Liaison	Government-to-Government and Government-to-ANCSA Corporation Consultation
Timothy Harper	Economist	Economy
Katsumi Keeler	Environmental Protection Specialist	Air Quality
Kimberly Klein	Wildlife Biologist	ESA Consultation; BA Preparation
Michael Lu	Petroleum Engineer	E&D Scenario Development
Frances Mann	Program and Legal Analyst	Document Review; Project Manager
Aditi Mirani	Chief, Forecasting and Analysis Branch	Lifecycle GHG Emissions and Social Cost of GHG Emissions
Gail Morrison	Geographer	GIS Map Production
Charles Paris	Economist	Air Quality Modeling; Lifecycle GHG Emissions and Social Cost of GHG Emissions
Casey Rowe	Chief, Environmental Analysis Section	Project Management
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David Weekley	Geographer	GIS Map Production and Area Calculations
Eric Wolvovsky	Meteorologist	Air Quality Modeling; Lifecycle GHG Emissions and Social Cost of GHG Emissions

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APPENDIX A

Oil Spills and Gas Release Analysis

for Oil and Gas Lease Sale 258

Cook Inlet, Alaska

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Acronyms and Abbreviations

AAC	Alaska Administrative Code
API	American Petroleum Institute
bbl	barrel(s)
Bcf	billion cubic feet
Bbbl	billion barrels
BOEM	Bureau of Ocean Energy Management
BS	boundary segment
BSEE	Bureau of Safety and Environmental Enforcement
C_2H_6	ethane
CH	critical habitat
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
DOT	Department of Transportation
DPS	Distinct Population Segment
E&D	exploration and development
EIS	Environmental Impact Statement
EJ	Environmental Justice
EPA	U.S. Environmental Protection Agency
ERA	environmental resource area
ESA	Endangered Species Act
ESI	environmental sensitivity index
EVOS	*Exxon Valdez* Oil Spill
FEIS	Final Environmental Impact Statement
G&G	geological and geophysical
GIUE	Government Initiated Unannounced Exercise
GLS	grouped land segment
IBA	important bird area
km	kilometer(s)
LA	launch area
LOWC	loss of well control
LS	land segment
mi	miles
mm	millimeter(s)
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NOAA	National Oceanic and Atmospheric Administration
NWR	National Wildlife Refuge
O_3	ozone
OCS	Outer Continental Shelf
OSRA	oil spill risk analysis
OWM	oil weathering model
PAH	polycyclic aromatic hydrocarbon
PL	pipeline
PM_{10} and $PM_{2.5}$	particulate matter (equal to or less than 10, and equal to or less than 2.5 micrometers diameter)
SINTEF	The Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology
SO_2	sulfur dioxide
SUA	subsistence use area
TAH	total aromatic hydrocarbon
TAqH	total aqueous hydrocarbon
USDOI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service

VLOS	very large oil spill
VOC	volatile organic compound

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Accidental Oil Spills and Gas Release Information and Analyses

The U.S. Department of the Interior (USDOI), Bureau of Ocean Energy Management (BOEM) analyzes hypothetical oil spills, a gas release, spill drills, and response activities and their potential impact to physical, biological, sociocultural, and economic resources in relation to lease sales it holds on the Outer Continental Shelf (OCS). These analyses inform the overall assessments of environmental consequences of offshore oil and gas exploration, development, and production that may occur in the future as a result of Lease Sale 258 (LS 258) in Cook Inlet, Alaska. Section A-1 provides the background and framework information for the analyses. Section A-2 provides supporting information used to derive the Oil Spills and Gas Release Scenario (Spill Scenario) in Section 3.1 of this Environmental Impact Statement (EIS). Section A-3 provides analysis of impacts on resources, and Chapter 4 of this EIS summarizes these impacts by resource.

A-1 Background and Framework for Analysis

Oil spills or gas releases have varying potential to occur from activities associated with offshore oil and gas exploration, production, or transportation in or adjacent to the Lease Sale Area. BOEM has conducted a formal oil spill and gas release analysis, which starts by using the Exploration and Development Scenario (E&D Scenario) (this EIS, Section 4.1) to develop oil spill and gas release assumptions. The E&D Scenario provides one hypothetical view of how post-lease oil and gas exploration, development, production, and ultimately decommissioning could proceed as a result of LS 258. The E&D Scenario provides a framework from which BOEM can analyze the impacts of the Proposed Action, which does not by itself authorize any particular activity. The E&D Scenario considers a range of production that could occur long-term as a result of LS 258. The E&D Scenario estimates, at the high end, production of up to 192.3 million barrels of oil and 301.9 billion cubic feet (Bcf) of gas. BOEM then uses technical information and historical data about oil spills and gas releases, modeling results, statistical analysis, and professional judgment to estimate information about oil spills and gas releases (detailed in Section A-2). The impact analyses are based on a set of assumptions about the number, volume, and types of spill or release, and their weathering—collectively referred to as the Spill Scenario (this EIS, Section 3.1). Additionally, the *Oil Spill Risk Analysis* (OSRA) report (Ji and Smith, 2021) informs the analysis of a large oil spill.

Oil spills are considered accidental events, and the Clean Water Act and the Oil Pollution Act include both regulatory and liability provisions that are designed to reduce damage to natural resources from oil spills. Because large spills and gas releases are an important concern to stakeholders, and no one can perfectly estimate future events, BOEM assumes a large spill or gas release will occur and conducts a large oil spill and gas release analysis for development and production activities. This conservative analysis addresses whether such spills could cause serious environmental harm and informs the decision maker of potential impacts should an unlikely large spill or gas release occur. Assuming more large spills or gas releases than the estimated mean number helps to ensure that this EIS does not underestimate potential environmental effects.

The Spill Scenario assumes:

- Approximately 410 small spills (spills less than (<) 1,000 barrels (bbl)) of crude, condensate, or refined oil occur over the life of post-lease activities that may result from LS 258, which the E&D Scenario has estimated to last 40 years.
- One large crude, condensate, or refined oil spill (greater than or equal to (≥) 1,000 bbl) over the 32 years of oil and gas development and production activities described in the E&D Scenario. This analysis assumes a large spill volume of 3,800 bbl.

- One large natural gas release (offshore or onshore), over the 32 years of gas production described in the E&D Scenario. This analysis assumes a gas release of 20–30 million cubic feet over one day.
- To ensure impacts of a spill are not underestimated, the impact analysis does not incorporate a potential volume reduction from cleanup and response; the entire spill or release volume(s) is analyzed. The impact analysis does incorporate BOEM estimates for impacts to resources from cleanup and response.

Very large oil spills and gas releases are very low probability, high impact events. Although very unlikely (frequency of spill exceeding 120,000 bbl is >0.00001–< 0.0001 per well) and not reasonably foreseeable, BOEM considered a hypothetical long duration loss of well control resulting in 120,000 bbl of oil and released gas. For an analysis of a very large oil spill (VLOS) (≥120,000 bbl) and gas release, which is not reasonably foreseeable as a result of Cook Inlet OCS oil and gas activities, refer to Section 4.12, Impacts of a Very Large Oil Spill and Appendix A, Section A-7, Very Large Oil Spill in *Cook Inlet Planning Area Oil and Gas Lease Sale 244 in the Cook Inlet, Alaska Final Environmental Impact Statement* (BOEM, 2016). The Lease Sale 244 Final Environmental Impact Statement (FEIS) includes a discharge analysis methodology, general effects of oil and gas on physical, biological, social, and economic resources, and impacts to resources from the initial loss of well control event to long-term recovery. BOEM analysts reviewed the analysis and determined it still provided decisionmakers with a robust analysis of the potential impacts associated with low probability very large oil spills for oil and gas activities on the OCS (CEQ, 2010).

Once oil or gas enters the environment, it begins to degrade through physical, chemical, and biological processes referred to as weathering. The report *Beaufort Sea: Hypothetical Very Large Oil Spill and Gas Release* (BOEM, 2020; Section 4.1) details the major oil weathering processes. These include spreading, evaporation, dispersion, dissolution, emulsification, microbial degradation, photochemical oxidation, and sedimentation to the seafloor or stranding on the shoreline (Afenyo et al., 2016; Allen, 1980; Boehm, 1987; Lee et al., 2015; Payne et al., 1987; Tarr et al., 2016; Wiens, 2013). These processes are complex and act simultaneously as well as independently. Weathering processes affect various oil or gas constituents at differing rates ranging from hours to decades (Farrington, 2014). Spreading, evaporation, dispersion, emulsification, and dissolution are most relevant during the early stages of a spill, while photo-oxidation, sedimentation, and biodegradation are longer-term processes. Evaporation removes the more volatile, highly soluble, and toxic lower molecular weight components and leaves behind the less soluble, higher molecular weight components with lower toxicity potential (Di Toro et al., 2007). Along with the weathering processes, the physical environment, depth of release, spill volume, and unique composition and physical properties of oil determine the oil's fate in the environment (NRC, 1985, 2003a, 2014). Specific oil weathering estimates for assumed oil types and volumes are presented in Sections A-2.1.3 and A-2.2.2.

Impacts to resources from oil spills or gas releases may be prevented or mitigated through oil spill prevention, preparedness, and response measures. The report, *Oil Spill Preparedness, Prevention, and Response on the Alaska OCS* (BOEM, 2019), provides information on oil spill prevention and preparedness requirements, including spill drills, and response strategies that could be employed on the OCS. From that report, Section 5.3.4, Bureau of Safety and Environmental Enforcement (BSEE) Oil Spill Response Plan Drills, and Section 7, Description of Potential Response Actions, are incorporated by reference and summarized here. The report is available on BOEM's website at https://www.boem.gov/BOEM-2019-006/. BSEE periodically performs both announced and unannounced exercises to test the operator's spill response preparedness. Government Initiated Unannounced Exercises (GIUEs) are typically less than 8 hours in duration but can last longer and include exercising a response plan, tracking and surveillance, and countermeasures in localized areas. Response and cleanup actions would be implemented in the event of an oil spill or gas release and could require multiple technologies. Technologies and response efforts include surveillance and monitoring, waste management, wildlife response, source containment, and both mechanical and non-mechanical countermeasures. Mechanical recovery includes the physical removal of oil from the sea, ice, or shoreline surface typically accomplished using containment booms, skimmers, direct suction, heavy equipment, sorbents, temporary storage, separation, and disposal. Non-mechanical countermeasures to combat an oil spill include dispersants, surface collecting agents, and in-situ burning.

A-2 Oil Spills and Gas Release Information, Models, and Estimates

This section discusses the information and methods used to derive the Spill Scenario (this EIS Section 3.1). Oil spills are divided into two general phases of operations and two spill-size categories. These divisions reflect a difference in how the information about the spills or releases is derived and used. The two general activity categories considered in oil spill analysis are:

- Exploration and delineation
- Development, production, and decommissioning

The two spill-size categories considered in oil spill analysis are:

- Small spills: those <1,000 bbl, generally do not persist on the water long enough to follow their path in a trajectory analysis.
- Large spills: those ≥1,000 bbl, meaning that 1,000 bbl is the minimum size for a large spill. A large spill persists on the water long enough to follow its path in a trajectory analysis.

BOEM considers three oil types—refined, crude, and condensate—and natural gas, which is primarily made up of methane (CH_4) and ethane (C_2H_6).

A-2.1 Small Oil Spills

Small spills, although accidental, are relatively routine. Accidental small spills are likely to occur over the life of the exploration and development activities, and operators follow routine spill prevention and response measures. The majority of small spills could be contained on a vessel or facility. Generally, if a small spill does reach water, refined fuels would evaporate and disperse in a few days, but small crude oil spills take longer. Further, those spills reaching the water may be contained by booms or absorbent pads.

A-2.1.1 Exploration

Exploration includes both geological and geophysical (G&G) activities (marine seismic, geotechnical, and geohazard surveys) and exploration and delineation drilling activities. Small spills during exploration are likely to be refined oil products such as lube oil, hydraulic oil, gasoline, or diesel fuel.

A-2.1.1.1 Geological and Geophysical Activities

BOEM estimates small, refined spills occur from vessels during G&G activities, but large crude and diesel fuel spills do not. This is based on a review of potential fuel transfer discharge volumes and on the historical oil spill occurrence data for the Alaska OCS and adjacent state waters.

The estimated offshore vessel transfer spill size ranges from <1–13 bbl (BOEM, 2012b, 2013; BOEMRE, 2010a, b). The <1 bbl is the estimated volume of diesel fuel resulting from an offshore vessel fuel transfer accident assuming the dry quick disconnect and positive pressure hose (spill prevention devices) function properly. Where a transfer hose ruptures and spill prevention devices fail, assumed discovery and response times are 30 seconds for rupture discovery and 30 seconds to stop the pump. Approximately 13 bbl spills on the vessel or reaches the environment during the 60-second interval.

To estimate the number and volume of spills, BOEM assumes each G&G activity transfers fuel and every other activity has a spill. This estimate is very conservative based on the fact that no offshore fuel transfer spills have been reported from G&G activities in the Alaska OCS. BOEM assumes 11 G&G site clearances are typical per survey. Site clearances include shallow hazard surveys and point samples. A total of 5 surveys were assumed including the deep penetrating marine seismic survey (this EIS Table 4-1). BOEM estimates 3 small spills from G&G activities. Ninety-nine percent of the time, transfer spill prevention devices function properly during offshore fuel transfers. For two G&G activities, BOEM assumes spill prevention devices function properly and spills could range from 0–<1 bbl each for a total of <2 bbl. It is assumed that one G&G activity has a spill prevention device malfunction and a spill up to 13 bbl. Finally, BOEM assumes that spills do not occur in the same time and space.

A-2.1.1.2 Exploration and Delineation Drilling Activities

To estimate spills from exploration and delineation drilling activities, BOEM reviewed potential discharges, historical oil spill and modeling data, and the likelihood of oil spill occurrence. No large crude or diesel oil spills are estimated to occur based on the following considerations:

- The low rate (3.58×10^{-3} per well drilled (Bercha Group, 2014)) of OCS exploratory drilling well-control incidents spilling crude oil.
- Since 1971, more than 14,000 OCS exploratory wells have been drilled, and one OCS crude oil spill from the Deepwater Horizon event (large/very large) has occurred during temporary abandonment (converting an exploration well to a development well).
- The number (8) of exploration wells in the E&D Scenario (this EIS, Section 4.1).
- No crude oil would be commercially produced from the exploration wells, and the wells would be permanently plugged and abandoned.
- All exploration spills on the OCS have been small.
- No large spills occurred while drilling 86 exploration wells to depth in the Alaska OCS from 1975–2019.
- Pollution prevention and oil spill response regulations and methods implemented since the Deepwater Horizon spill have reduced the risk of spills and diminished their potential severity (BOEM, 2012a, 2019; Visser, 2011).

Small spills are likely to occur during exploration and delineation drilling activities. Historical OCS exploration spill data suggest that the most likely cause of an oil spill during exploration would be operational, and the spill is likely be relatively small. A 50-bbl ultra-low sulphur diesel fuel transfer spill was chosen as one spill volume in the small spill category and 5 bbl was selected as the typical volume. The spill volumes were based on historical exploration spill sizes in the Beaufort and Chukchi Sea OCS (BOEM, 2015, Appendix A, Table A.1-2), which were all small; OCS oil spill data, which indicated that 99.7 percent of all OCS spills are <50 bbl (Anderson et al., 2012); and estimates of U.S. Coast Guard worst-case discharge, average most probable discharge, and maximum most probable discharge for exploration plans (Shell, 2011, 2012). To estimate the number and volume of spills, BOEM assumes that every exploration drilling activity (3) has an offshore transfer fuel spill. One drilling activity has a worst-case discharge of 50 bbl, and the rest have a maximum most probable discharge of 5 bbl for a total of 60 bbl. These spills are not assumed to occur in the same space and time.

A-2.1.2 Development and Production

To estimate the number of small crude and refined spills and volume, oil spill rates from *Update of Occurrence Rates for Offshore Oil Spills* (Anderson et al., 2012) and *2016 Update of Occurrence Rates for Offshore Oil Spills* (ABS 2016) were applied. Data for the years 1974–2015 was used for spills ≥1 bbl to <1,000 bbl (ABS, 2016) and 1996 through 2010 was used for spills <1 bbl (Anderson et al., 2012). Using the E&D Scenario production volume and the spill rates, a total of 405 small crude and refined oil spills (<1,000 bbl) were estimated during the 32-year oil and gas production life. BOEM multiplied the total number of spills in each size by the median volume to estimate the total oil spill volume.

A-2.1.3 Modeling Simulations of Oil Weathering

Table A1 summarizes the fate and behavior results of a 1-, 5-, 13-, and 50-bbl diesel fuel spill and a 125-bbl crude oil spill. Based on the Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology (SINTEF) Oil Weathering Model (OWM) calculations, a 50-bbl diesel fuel oil spill lasts less than three days in open water during summer or winter.

Table A1: Weathering of Small Diesel Oil Spills in the Cook Inlet OCS

Scenario Element	Summer Spill[1]					Winter Spill[2]						
Time After Spill in Hours	**6**	**12**	**24**	**48**	**72**	**6**	**12**	**24**	**48**	**72**	**96**	**120**
1 bbl Diesel												
Oil Remaining (%)	26	2	0	na	na	0	na	na	na	na	na	na
Oil Dispersed (%)	55	75	77	na	na	85	na	na	na	na	na	na
Oil Evaporated (%)	19	22	23	na	na	15	na	na	na	na	na	na
5 bbl Diesel												
Oil Remaining (%)	30	4	0	na	na	0	na	na	na	na	na	na
Oil Dispersed (%)	52	73	76	na	na	85	na	na	na	na	na	na
Oil Evaporated (%)	18	23	24	na	na	15	na	na	na	na	na	na
13 bbl Diesel												
Oil Remaining (%)	26	2	0	Na	na	0	na	na	na	na	na	na
Oil Dispersed (%)	55	75	76	Na	na	85	na	na	na	na	na	na
Oil Evaporated (%)	19	23	24	Na	na	15	na	na	na	na	na	na
50 bbl Diesel												
Oil Remaining (%)	26	2	0	Na	na	36	5	0	na	na	na	na
Oil Dispersed (%)	55	75	76	Na	na	54	80	84	na	na	na	na
Oil Evaporated (%)	19	23	24	Na	na	10	15	16	na	na	na	na
125 bbl Diesel												
Time After Spill in Days	**1**	**3**	**10**	**30**		**1**	**3**	**10**	**30**			
Oil Remaining (%)	84	74	53	24		75	55	22	3			
Oil Dispersed (%)	5	13	31	56		14	32	62	80			
Oil Evaporated (%)	11	13	16	20		11	13	16	17			

Notes: Calculated with the SINTEF OWM Version 4.0 of Johansen et al. (2010) and assuming marine diesel and or Endicott crude of 23.1° API.
na = not applicable because no oil is estimated to remain.
[1] Summer (April 1–October 31), 12-knot wind speed, 9 degrees Celsius, 1-meter wave height. Average Marine Weather Area A (Brower et al., 1988).
[2] Winter Spill (November 1–March 31), 16-knot wind speed, 5 degrees Celsius, 1.8-meter wave. Average Marine Weather Area A (Brower et al., 1988).
Compiled by BOEM, Anchorage, Alaska Office (2020).

A-2.1.4 Small Spill Assumptions Summary

The analysis of small oil spill impacts assumes the following:

- Small spills are likely to occur during exploration, development, and production activities.
- Small spills are <1-, 5-, 13-, or 50-bbl for exploration and mostly 3-bbl, with two 125-bbl spills for development and production.
- Small spills from offshore refueling during G&G activities total <1 bbl annually with one individual spill of approximately 13 bbl over all G&G activities.
- Small spills during exploration and delineation drilling operations range from 5 up to 50 bbl.
- The oil types could be ultra-low sulphur diesel during exploration and delineation activities and crude, diesel, or condensate during development and production.
- The weathering for a 1-, 5-, 13-, or 50-bbl refined oil spill is as shown in Table A1, and the spill lasts <1–2 days on the water. A crude oil spill of 125 bbl lasts 30 days.
- All the oil reaches the vessel, facility, or the environment.
- There is no reduction in volume due to cleanup or containment (pollution prevention, containment, and cleanup are analyzed separately as mitigation and as disturbance).

- Small spills could occur any time of the year in open water or on landfast ice during exploration and delineation activities and at any time of the year during development and production.
- Chronic small spills are those occurring repeatedly for long periods in the same location (e.g., fueling or development facilities) or individual small spills of long duration (small undetected leaks).

A-2.2 Large Oil Spills

Large spills (≥1,000 bbl) are accidental and occur infrequently. The large spill analysis estimates their frequency and number and describes their source, the type of oil, and its weathering. The OSRA results refine the analysis by providing where a large spill may go and what it may contact, and the overall occurrence and contact from one or more large spills over the life of the proposed action.

BOEM estimates the mean number of large oil spills or gas releases is less than one. The chance of one or more large spills occurring is 19 percent and the chance of no large spills occurring is 81 percent over the E&D Scenario lifecycle considered for LS 258. BOEM assumes a large spill or gas release will occur and conducts a large oil spill and gas release analysis for development and production activities. This conservative analysis addresses whether such spills could cause serious environmental harm and informs the decision maker of potential impacts should an unlikely large spill or gas release occur. Assuming more large spills or gas releases than the estimated mean number helps to ensure that this EIS does not underestimate potential environmental effects.

A-2.2.1 Large Oil Spill Sizes, Source, and Oil Type

Because no large spills have occurred from Alaska OCS oil and gas activities, the large spill volume assumptions are based on the reported spills in the Gulf of Mexico and Pacific OCS (ABS, 2016). The Gulf of Mexico and Pacific OCS data show that a large spill most likely would occur from a pipeline or a platform. BOEM uses the median OCS spill volume as the likely large spill size because it is the most probable size for that spill-size category. The average is not a useful statistical measure because it can be skewed by outliers such as the Deepwater Horizon spill volume. The median size of a crude oil spill ≥1,000 bbl from a pipeline on the OCS from 1974–2015 was 3,750 bbl, and the average was 5,808 bbl (ABS, 2016, Table 24). The median spill size for a platform on the OCS from 1974–2017, was 3,283 bbl, and the average was 1,227,006 bbl (ABS, 2016, Table 13). BOEM calculated the median spill size for both platforms and pipelines from 1974–2015 to derive the median OCS spill volume of 3,750 bbl. For purposes of analysis, BOEM rounded to the nearest hundred, 3,800 bbl, and used this value as the likely large spill size.

The source is the place from which a large oil spill could originate. The sources are divided generically into production platforms or pipelines (ABS, 2016). The places where a large spill could occur are based on the E&D Scenario created for LS 258. Platform sources include spills from wells or diesel fuel tanks located on platforms. Large offshore pipeline spills include spills from the riser and from the offshore pipeline to the shore. Large onshore pipeline spills include spills from the shoreline to the refinery. The types of oil spilled from platforms are assumed to be crude oil, natural gas liquid condensate, or diesel oil. Large pipeline oil spills are assumed to be natural gas liquid condensate or crude oil.

A-2.2.2 Large Oil Spill Weathering

Estimates of the oil types that could spill, along with their weathering, inform analysis of the effect of a 3,800 bbl oil spill. Weathering includes how much oil evaporates, disperses, and remains after a certain time. BOEM uses the SINTEF OWM, Version 4.0 (Johansen et al., 2010) for diesel, condensate, and crude oil to derive weathering results for up to 30 days. The SINTEF OWM results are validated with data from three full-scale field trials of experimental oil spills (Brandvik et al., 2010; Daling and Strom, 1999).

A-2.2.2.1 Oil Weathering Scenario

The SINTEF OWM uses information about the general type of oil, laboratory weathering data, the volume of oil, the location of the spill, and the environmental parameters of temperature, wind speed, and ice concentration to simulate weathering. BOEM chose an ultra-low sulphur diesel oil and a condensate (Sliepner) with an American Petroleum Institute (API) gravity of 50°. The properties of crude oils are variable and when spilled result in different behavior. A medium crude oil, similar to crude oils representative of Trading Bay within the Cook Inlet Region, is used for this analysis. Crude oil samples recovered from wells within Cook Inlet state waters are characterized by a range of API gravity, which is a measure of how heavy or light the oil is compared to water. The crude oils in the Cook Inlet Region are estimated to range from API gravities of 20° to 40°. Given the existing information from crude oil samples recovered from Alaska state wells, BOEM chose the lower end of the range of API gravities which generally weather and degrade more slowly than higher API gravities. BOEM looked for data on crude oils with similar API gravity values that also had laboratory data on their weathering (evaporation, dispersion). Endicott 2001 crude oil has an API gravity of 23.1° and is representative for the oil weathering simulations because it is a medium crude oil that falls within the lower range of API gravity 20° to 40°.

Three general scenarios are simulated: one in which the oil spills into open water (April–November) and two in which the oil spills into open water or broken ice (December–March). BOEM assumes the spill starts at or quickly rises to the surface. Weathering of spills for open water and broken ice are modeled as if they are instantaneous spills. Although different amounts of oil could melt out of broken ice at different times, BOEM took the conservative approach and assumed all the oil was released at the same time.

A-2.2.2.2 Large Oil Spill Weathering and Persistence Results

Table A2 shows how much oil evaporates, disperses, and remains at the end of 1, 3, 10, and 30 days. In general, the low sulphur diesel fuel and condensate evaporate and disperse in a short period of time (1–10 days) during summer and remain longer in winter. The Endicott 2001 crude oil tends to evaporate and disperse more slowly.

The Endicott 2001 crude contains a relatively moderate amount of lower molecular-weight compounds that evaporate. Table A2 shows that approximately 17–20 percent of its original volume evaporates within 30 days at both summer and winter temperatures. Dispersion ranges from 1–56 percent (Table A2). However, at higher wind speeds (e.g., 15 meters per second wind speed), the oil spill will be almost removed from the sea surface within a day through evaporation and dispersion.

If an oil spill occurred and contacted shore, two important questions arise: (1) How much shoreline would be contaminated? and (2) How long would the contamination persist? Based on Equation 17 in Ford (1985), if a 3,800-bbl spill occurred and contacted land, about 26–35 kilometers (km) of coastline would be oiled (Table A2). The 35 km of coastline is approximately equal to the length of two land segments (LSs) in the OSRA model (see Section A-2.2.3). Table A.1-12 from Ji and Smith (2021) shows the environmental sensitivity index of Cook Inlet shorelines can range from low oil persistence to some shorelines where oil would persist for decades. In winter, ice along some portions of shorelines of the Cook Inlet could keep spills offshore away from the shoreline, and any oil that did reach shore may not penetrate into the frozen beach. For Cook Inlet shorelines, the relevance of persistence is much greater for spills during the summer than for spills during the winter.

Table A2: Weathering of a Large Oil Spill in the Cook Inlet OCS

3,800-Barrel Diesel Spill	Summer Spill[1]				Winter Spill[2]				Winter Spill (Broken Ice)[3]			
Time After Spill in Days	1	3	10	30	1	3	10	30	1	3	10	30
Oil Remaining (%)	40	1	na	na	10	0	na	na	65	19	0	na
Oil Dispersed (%)	36	66	na	na	69	77	na	na	11	40	54	na
Oil Evaporated (%)	23	33	na	na	21	23	na	na	14	41	45	na
3,800-Barrel Condensate Spill	**Summer Spill[1]**				**Winter Spill[2]**				**Winter Spill (Broken Ice)[3]**			
Time After Spill in Days	1	3	10	30	1	3	10	30	1	3	10	30
Oil Remaining (%)	0	na	na	na	0	na	na	na	0	na	na	na
Oil Dispersed (%)	29	na	na	na	29	na	na	na	29	na	na	na
Oil Evaporated (%)	71	na	na	na	71	na	na	na	71	na	na	na
3,800-Barrel Crude Spill	**Summer Spill[1]**				**Winter Spill[2]**				**Winter Spill (Broken Ice)[3]**			
Time After Spill in Days	1	3	10	30	1	3	10	30	1	3	10	30
Oil Remaining (%)	86	75	55	24	79	57	23	3	89	84	76	61
Oil Dispersed (%)	3	12	31	56	10	30	61	80	1	3	8	19
Oil Evaporated (%)	11	13	16	20	11	13	16	17	10	13	16	20
Discontinuous Area (km^2)[3, 4]	12	50	241	998	12	50	240	992	12	50	240	992
Estimated Coastline Oiled (km)[5]	35				26				26			

Notes: Calculated with the SINTEF OWM Version 4.0 of Johansen et al. (2010) and assuming an ultra-low sulphur diesel, Sliepner Condensate, or Endicott Crude of 23.1° API.
1 Summer (April 1–October 31), 12-knot wind speed, 9 degrees Celsius, 1-meter wave height. Average Marine Weather Area A (Brower et al., 1988).
2 Winter Spill (November 1–March 31), 16-knot wind speed, 5 degrees Celsius, 1.8- meter wave heights and for Broken Ice 50% ice. Average Marine Weather Area A (Brower et al., 1988).
3 This is the discontinuous area of oiled surface.
4 Calculated from Equation 6 of Table 2 in Ford (1985) and is the discontinuous area of a continuing spill or the area swept by an instantaneous spill of a given volume. Note that ice dispersion occurs for about 30 days before meltout.
5 Calculated from Equation 17 of Table 4 in Ford (1985) and is the result of stepwise multiple regressions for length of historical coastline affected.

Compiled by BOEM, Anchorage, Alaska Office (2020).

A-2.2.3 OSRA Model

The OSRA uses spill rates, statistical methods, and oil spill trajectory modeling to derive information about large oil spill patterns. The OSRA report (Ji and Smith, 2021), Sections 2, 3.1–3.3, and Appendices A and B, are incorporated by reference and summarized here. The OSRA report is available to the public at: https://www.boem.gov/environment/environmental-assessment/oil-spill-risk-analysis-reports. The Lease Sale 258 OSRA estimates the chance of: (1) one or more large spills occurring; (2) a spill contacting resource areas assuming a spill has occurred at a specific location (conditional probabilities); and (3) one or more spills occurring and contacting resource areas (combined probabilities) (Ji and Smith, 2021).

A-2.2.3.1 Mean Number and Chance of One or More Large Spills Occurring

The large spill rate (1.11 spills per billion barrels (Bbbl); ABS, 2016) is multiplied by the production volume (0.1923 Bbbl) to estimate the mean number of spills (0.21). The chance of one or more large spills occurring is 19 percent and the chance of no large spills occurring is 81 percent over the E&D Scenario lifecycle considered for LS 258.

A-2.2.3.2 Conditional and Combined Probabilities

BOEM studied how and where large OCS spills move by using an oil spill trajectory model with the capability of assessing the chance of large spill contact to specific resource areas (Smith et al., 1982; Ji et al., 2011). The study area is chosen to be large enough to allow most hypothetical oil spill trajectories to develop without contacting boundary segments through as long as 30 or 110 days. This model analyzes the likely paths of slightly less than 800,000 simulated oil spill trajectories in relation to physical, biological, and sociocultural resource areas. The trajectory is constructed using the wind, sea ice, and current data from a coupled ice-ocean model.

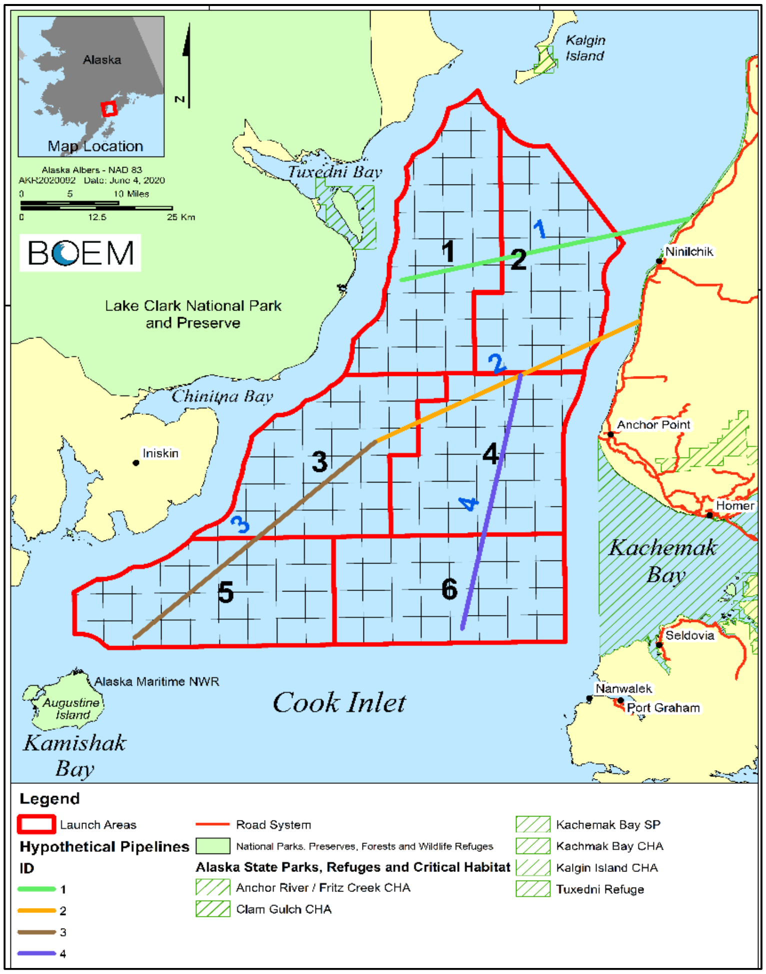

Figure A1: Areas Used in the Oil Spill Trajectory Analysis

The trajectory analysis in the OSRA used 6 hypothetical launch areas (LAs) and 4 pipelines (PLs) as locations where the hypothetical oil spill trajectory simulation starts. The LAs represent grouped locations of launch points that are spaced one per lease block throughout the Cook Inlet Proposed Action Area. The pipelines do not represent proposed pipelines or any real or planned pipeline locations. The LAs and PLs have no specific relation to the activities described in the LS 258 E&D Scenario. They are distributed throughout the Cook Inlet Area to evaluate differences in hypothetical oil spill trajectories from different locations. Figure A1 shows the 6 LA and 4 PL locations discussed in the OSRA report and how they were grouped geographically for this analysis.

Four types of onshore and offshore resource areas are used in the OSRA model: environmental resource areas (ERAs), land segments (LSs), grouped land segments (GLSs), and boundary segments (BSs). ERAs and BSs represent offshore areas while LSs and GLSs represent nearshore or onshore coastal areas of biological, social, or economic resource areas or resource habitats. BOEM analysts designated these resource areas by working with other federal and state agencies, academia, and various stakeholders who provided information, including local and traditional knowledge about these resources. Analysts also used information from BOEM's Environmental Studies Program research, literature reviews, and professional exchanges with other scientists to define these resource areas. The locations of resource areas, including islands and the coast within the model study area, were used by the OSRA model to tabulate the conditional and combined results for these areas (Ji and Smith, 2021).

The OSRA provides two datasets:

- Conditional Probabilities: Conditional probabilities are based on the assumption (condition) that a large oil spill has occurred at a given location. They reflect the hypothetical paths (trajectories) that oil would take based on modeled ocean surface currents, ice, and wind conditions in the study area. Tens of thousands of trajectories are simulated from each hypothetical spill point, and the percent chance of contact to resource areas within six different travel times (1, 3, 10, 30, and 110 days) are tabulated (Ji and Smith, 2021, Appendix A, Tables A.2-1–A.2-60). The conditional probabilities show statistically how, based on the surface current, sea ice, and wind patterns in the study area, spills originating in specific launch areas are more likely to contact particular resource areas than those originating in other locations.
- Combined Probabilities: Combined probabilities represent the estimated overall (combined) chance that one or more large spills will both occur and contact a specific resource area.

Combined probabilities incorporate conditional probabilities, spill rates, volume of oil, and the transportation scenario over the E&D lifecycle (Ji and Smith, 2021, Appendix A, Tables A.2-61–A.2-64). The combined probabilities are sensitive to oil resource volumes and transportation scenarios, which could vary in a frontier area.

The resource volumes for the combined probabilities were derived using the National Assessment and are shown in Table A3 (BOEM, 2021).

Table A3: BOEM, Alaska Regional Office, RE Estimation of Oil Resources in Million barrels (MMbbl) per Oil Spill Risk Analysis Launch Area for Cook Inlet Lease Sale 258

LA1[1]	LA2	LA3	LA4	LA5	LA6	Total
57.08902576	49.91522035	17.45426331	48.24318318	10.39713584	9.201171556	192.3

A-2.3 Large Natural Gas Release

BOEM assumes one gas release from either an offshore or an onshore pipeline. Although unlikely, there exists some potential for a gas pipeline to rupture. The estimated rate of offshore gas pipeline ruptures in the Gulf of Mexico is 2.4 x 10^{-5} per pipeline mile per year (MMS, 2009). For 120 miles of offshore gas transmission pipelines, over a 32-year gas production life, the estimated number of incidents is 0.08 offshore gas pipeline ruptures. For onshore gas pipelines, the estimated spill rate for generic Department of Transportation (DOT) onshore gas transmission lines from 2002–2013 is 3.1 x 10^{-5} spill or release per pipeline mile per year (Lam and Zhou, 2016). Using DOT's rate, for the 1-mile onshore pipeline described in the E&D Scenario, 0.003 significant incidents are estimated over the 32-year gas production life of the E&D Scenario for LS 258. Under DOT regulation, significant incidents involve property damage of more than $50,000, injury, death, release of gas, or are otherwise considered significant by the operator.

If a major release of dry natural gas occurs, a sudden decrease in gas pressure would automatically initiate procedures to close the valves on both ends of the ruptured segment of pipeline. Closure of the valves would effectively isolate the rupture and limit the amount of natural gas released into the environment. Given the estimated daily flow rate, BOEM estimates that approximately 20 million cubic feet could be released over one day. Onshore, any gas releases from an elevated pipeline would disperse into the atmosphere. There is some small potential for ignition and subsequent explosion, but ignition sources are not readily available.

It is possible, though unlikely, that a loss of well control (LOWC) during natural gas production could cause a release of natural gas into the environment. A LOWC can result in a blowout, but blowouts do not always follow a LOWC incident. Also, the frequency of LOWCs can vary with the type of well drilled. The International Association of Oil and Gas Producers estimates the frequency of LOWC events at 3.6 x 10^{-4} gas blowouts per exploration well, and at 7.0 x 10^{-4} gas blowouts per development well drilled (IAOGP, 2010). The production well control blowout incident rate for production of gas is an order of magnitude lower, estimated at 5.7 x 10^{-5} blowouts per well year (IAOGP, 2010). The estimated mean number of gas releases is less than one (0.04). The chance of no gas blowouts occurring is 96 percent and the chance of a gas release occurring is 4 percent over the life of the Proposed Action or its alternatives.

In year 7 of the timeline described in the E&D Scenario associated with LS 258, infrastructure will have been installed, and sale of natural gas from the Lease Sale Area would presumably begin. When this occurs, it is assumed that one well control incident of a single well on the facility could occur, releasing 30 million cubic feet of natural gas for one day. This is based on the average well production for one day from one well and the estimated rates of blowout duration for gas production wells.

A-2.4 Large Oil Spills: Historical, Current, and Future

Over the past 55 years (1966–2020) approximately sixteen large onshore and offshore oil spills were documented in the Cook Inlet area, including Joint Base Elmendorf-Richardson (JBER), Port of Anchorage, Nikiski, Drift River, and marine waters near Kenai, Nikiski, Drift River, Fire Island, and Anchorage (ADEC, 2007, 2020; BOEM, 2016; Robertson et al. 2020; Whitney, 2002). These include crude, diesel, jet and aviation fuel and other types of petroleum spills from various onshore and offshore sources, including pipelines, tanks, platforms, tankers, and other vessels. No large marine spills have been documented since the 1989 M/V Lorna B diesel spill, and no large onshore spills since the 1997 aviation fuel spill on JBER.

BOEM estimated cumulative large oil spills resulting from current and future oil production for the onshore and offshore region of Cook Inlet. BOEM estimates 0–2 large spills from onshore and offshore state lands and from potential production resulting from development of leases sold in LS 244 and a future OCS lease sale beyond LS 258 (Table A4). BOEM assumes Cook Inlet LS 258 would contribute 0–1 additional large spill. For the number of large spills, the incremental contribution could range from 0–33%.

Table A4: Potential Large Spills from Current and Future Production

Location	Reserves/ Resources (Bbbl)	Spill Rate (spills/Bbbl)	Size Category (bbl)	Size (bbl) Pipeline/Facility	Mean Number of Spills	Number of Large Spills
State Onshore and Offshore	0.599[1]	1.11[4]	≥1,000	3,800	0.67	0–1
Cook Inlet OCS Sale 244	0.215[2]	1.11	≥1,000	3,800	0.24	0–1
Cook Inlet OCS (Future)	0.260[3]	1.11	≥1,000	3,800	0.29	
Total					1.2	0-2

Notes: [1] State Onshore and Offshore (USGS 2011).
[2] BOEM (2016).
[3] Future OCS Resources (Bradway 2020, pers. comm.).
[4] OCS spill rate (ABS Consulting, Inc., 2016).
Compiled by BOEM, Anchorage, Alaska Office (2020).

A-3 Oil Spills and Gas Release Analysis

The following sections analyze the impacts of small spills, a large spill or gas release, spill drills, and response activities on each physical, biological, sociocultural, and economic resource. The resource sections begin with an overview of general oil and gas exposure effects. Each of these hypothetical spills or releases has varying potential to result from OCS oil and gas exploration, development, and production. A set of assumptions, which collectively form the Spill Scenario (EIS Section 3.1), provides EIS analysts with a consistent and logical estimate of the size of spills, where a spill may go, how long it may take to contact an area of concern, and how oil will weather to inform the impact analyses through a common assessment framework.

For the large spill analysis, BOEM focuses the OSRA conditional information into one timeframe in each of two seasons to identify the season in which a large spill begins. The season determines wind and wave conditions and how much ice is present, contributing to the behavior of spilled oil and how long it persists. A 3,800-bbl crude oil spill persists in summer (open water) and in winter (sea ice) for up to 30 days. The season also informs the environmental analysis, including biota presence and abundance, and subsistence harvest patterns. The OSRA combined information is focused into an annual timeframe.

The OSRA model includes resource areas with defined geographic locations and temporal timeframes: coastal and estuarine habitat; invertebrates and fish; birds; marine mammals; terrestrial mammals; recreation, tourism, and sport fishing; subsistence activities and harvest patterns; and archaeological resources. The commercial fishing analysis considers fish resource areas. Non-spatial resources—air quality, water quality, sociocultural systems, community health, economy, and environmental justice—are not examined in the OSRA model, but the analyses consider the spatial extent where a large oil spill could travel and its timeframe.

The tables and figures in the following sections show resource areas with the highest chance of contact (≥1%) from any spill area within 30 days from a large spill during summer or winter. In this analysis, a large oil spill with ≤5% chance of contacting resources would likely be widely dispersed and weathered, and not estimated to produce appreciable impacts on invertebrates and fish, marine mammals, or terrestrial mammals, based on the spill assumptions in Appendix A, Section A-2. The conditional analysis for each resource tiers to BOEM (2016) Chapter 4 and each resource subsection titled Oil Spill Risk Analysis therein is incorporated by reference and summarized in each resource section below. The conditional and combined probability results are reported in Ji and Smith (2021).

A-3.1 Oceanography of Cook Inlet

The information provided below describes the oceanographic conditions of Cook Inlet that could affect conditions during an oil spill.

The physical oceanography in Cook Inlet is presented in the FEIS for Lease Sale 244 as part of the affected environment (BOEM, 2016a, Section 3.1.3). The information in that section is broadly summarized here and incorporated by reference. The information remains current and thus informative for understanding the oceanography of the region.

Cook Inlet is an estuary defined as a semi-enclosed coastal waterbody with a free connection to the open sea and within which the seawater is measurably diluted with freshwater from terrestrial sources. It is connected to marine waters via Shelikof Strait and the Gulf of Alaska, and to fresh waters via the many terrestrial rivers – the most prominent of which are the Susitna, Matanuska, and Knik rivers. The circulation of Cook Inlet is complex and varies at tidal, seasonal, annual, and interannual timescales (Musgrave and Statscewich, 2006). The region has the fourth largest tidal range in the world. Figure 3.1.3-1 from the FEIS for Lease Sale 244 shows the predominant surface currents in Cook Inlet. The general circulation pattern of lower and middle Cook Inlet is characterized by denser, saltier water (the Alaska Coastal Current (ACC)) that flows northward from the Gulf of Alaska along the eastern shore of the inlet. The relatively fresh silty upper Cook Inlet outflow mixes with the incoming ACC in the middle inlet, and the outflowing water moves southward along the western shore (LGL Alaska Research Associates, Inc., 2000). The overall circulatory patterns are dominated by tidal flows, although surface circulation varies seasonally due to freshwater outflows with the ACC water traveling farther north during periods of less freshwater input.

Overall, Cook Inlet is shallow with an area-weighted mean depth of 44.7 m (148 ft), but is as deep as 212 m (695 ft) at the south end (Zimmerman and Prescott 2014). However, depths >50 m (164 ft) occupy the central core of the inlet and extend in narrow bands past Kalgin Island; water depths >100 m (328 ft) occur almost entirely at the inlet’s entrance.

Water temperature and salinity vary seasonally and geographically. Generally, however, the water in Cook Inlet begins to warm from March until July (Okkonen, Pegau, and Saupe, 2009). Water temperature is relatively constant between July and September, and water temperatures decrease from October to December and then remain low until March. Cook Inlet salinity changes seasonally and is driven by freshwater input. Freshwater riverine input is minimum in winter and increases by more than an order of magnitude during May. Input remains high through the summer and decreases from late September through November.

The amount of sea ice varies annually and is not prevalent across the Lease Sale Area. Sea ice is most widespread in the Lease Sale Area during winter. Sea ice generally forms in October or November, and increases through February. It recedes as it melts in March to April. There is seldom uniform ice cover due to tidal action and currents.

A-3.2 Air Quality

The airborne constituents associated with a release of refined or crude oil would release potentially harmful emissions into the atmosphere, particularly those pollutants regulated under the Clean Air Act: nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), and particulate matter (PM_{10} and $PM_{2.5}$). An oil spill or gas release would also include volatile organic compound (VOC) emissions, which are a precursor to ozone (O_3). Additional airborne constituents associated with oil or natural gas releases, which have environmentally harmful consequences, are methane and black carbon. Mechanisms that lead to impacts on air quality include:

- Aerosol formation by wind and wave action can transfer oil components into the atmosphere (Aeppli et al., 2013; Arey et al., 2007; de Gouw et al., 2011).
- Evaporation of volatile components degrades air quality in the immediate vicinity of the spilled oil (Hanna and Drivas, 1993; Harrill et al., 2014; Middlebrook et al., 2012).
- A fire or in-situ burning response operations increase emissions of nitrogen oxides (NO_x), SO_2, and CO, but decrease emissions of VOCs as compared to evaporation (Fingas, 2017).
- Response operations increase aircraft, surface vehicle, and ship emissions (Middlebrook et al., 2012).

Additional discussion of the general impacts of oil and gas spills on air quality is provided in the *Beaufort Sea: Hypothetical Very Large Oil Spill and Gas Release* report (BOEM, 2020, Section 4.2.1)

A-3.2.1 Small Oil Spills (<1,000 bbl)

The impacts of small spills at a given location would depend on the time of year; size, location, and duration of the spill; and meteorological conditions such as wind speed and direction. Evaporation of small accidental oil spills would cause brief localized increases in VOCs. However, the volume of VOC emissions resulting from such small spills is not expected to be sufficient to create conditions favorable for the formation of ozone.

The volatile components of diesel fuel would evaporate within the first 6–24 hours for a spill <1 bbl, 2 days for a spill of 50 bbl, and 30 days for a crude spill of 125 bbl (Table A1). This evaporation would potentially cause localized air quality degradation near the spill. Small crude oil spills would take longer to evaporate than refined product spills and result in air quality impacts over an extended timeframe in a localized area.

A-3.2.2 Large Oil Spill (≥1,000 bbl)/Gas Release

A natural gas release could adversely impact air quality, depending on the size and duration of the release and whether it is ignited. While methane, the principle component of natural gas, is a potent greenhouse gas, it is not a regulated criteria pollutant. But when methane is combusted, it generates emissions of NO_2, CO, SO_2, and PM. A condensate or diesel spill would evaporate and disperse within 1–13 days, and 17–20 percent of a crude oil spill would evaporate within 30 days (Table A2). An estimated 26 to 35 km of shoreline, and an area of 992 to 998 km^2 offshore, could be impacted (Table A2). A large, 3,800 bbl spill would increase VOC emissions over a larger area and for a longer period than a small spill. The emissions would continue until all the VOCs evaporated or the oil is removed from the water surface. The crude oil evaporates over 30 days (Table A2).

Offshore, assuming no oil would freeze into the sea ice, the distance, combined with the wind conditions over Cook Inlet, would likely disperse the VOCs. The emissions may be picked up by upper-level winds and transported away.

Emissions of VOCs from oil released near the shoreline could interact with existing NO_x emissions and lead to ozone formation near communities. The ability of VOCs to participate in the formation of ozone would depend on whether the large oil spill occurred in the summer or the winter. Along with a favorable mixing ratio of VOCs to NO_x, the formation of ozone requires sunlight. The intensity of sunshine over southcentral Alaska is moderate in the summer, and the opportunity for ozone formation exists. Ozone formation is unlikely to occur over Alaska in the winter when there is limited sunlight. A large crude oil spill would persist longer in the environment and is more widespread than a small spill.

A-3.2.3 Spill Drills and Response Activities

Emissions associated with spill drills, including GIUEs, would be caused by the combustion of diesel fuels from mobile sources (trucks and vessels). As a result, the dominant air pollutants produced during these exercises are those common to engine combustion: NO_x, $PM_{2.5}$, and PM_{10}. The amounts of emissions released as a part of spill drills are expected to be similar to the everyday emissions from ships regularly operating in that area. The resulting air quality impact would be localized to the immediate spill drill area and would last only for the duration of the drill. Within minutes to hours of the completion of the exercise, the air quality would recover and return to pre-exercise levels. It is likely the exercise would result in little to no air quality impacts.

Three response activities that could affect air quality are use of dispersants, in-situ burning, and mechanical recovery, all of which would include mobile sources of emissions from response vehicles. U.S. Environmental Protection Agency (EPA) suggests that using dispersants for oil spill cleanup would cause little or no impact on air quality (EPA, 2015). Most mobile emissions, including those of trucks or vessels participating in large spill response operations, have a limited impact to the air quality of any specific ground-based location. The dispersion of emissions from a moving source makes the accumulation of pollutants less of a concern at any specific downwind location. Pollutant concentrations decrease with increasing distance from the source. In-situ burning would result in short-term and widespread increases in emissions of NO_x, $PM_{2.5}$, and PM_{10}. Impacts of burning spilled oil are analogous to the emissions from engine combustion (described in EIS Section 4.3.2). In-situ burning also produces soot, or black carbon. This soot may be deposited on ice or snow and cause increased melting because the dark particles absorb heat (the albedo effect). Thus, the consequences of methods used to remove oil may actually outweigh the air quality impacts of the oil itself.

A-3.2.4 Conclusion

Impacts to air quality would be minor for small spills and minor to moderate for a large oil spill. A large gas release would have a minor to moderate impact to air quality, depending on the size of the release, its duration, and whether ignition occurs. Oil spill drills would have negligible impacts to air quality. Spill response and cleanup would have minor to moderate impacts to air quality.

A-3.3 Water Quality

The impacts of oil spills and gas releases on water quality are dependent on the type of oil; its chemical characteristics; how and where the oil is released into the water; the ambient temperature; sediment type and quality; and other environmental factors of the receiving environment at the time of the release. The fate and behavior of spilled oil, including weathering processes, also influence its impacts on water quality (Section A-2.1.2 and A-2.2.2, and BOEM, 2020, Section 4.4). Physical, chemical, and biological processes in the aquatic environment, coupled with the specific composition of the spilled oil, impact water quality.

- Impairment of water quality is regulated through the Clean Water Act administered by the EPA, and the State of Alaska’s Water Quality Standards, 18 Alaska Administrative Code (AAC) 70 (ADEC, 2018).

- Water quality impacts are influenced by the spills' initial release to either the surface water, subsurface, or seafloor, affecting the distribution, composition, and persistence of oil constituents (Boehm, Neff, and Page, 2013; Camilli et al., 2010).
- Toxicity and persistence of petroleum hydrocarbons varies with time, specific hydrocarbons, and location within the water column (Allen et al., 2012; Capuzzo, 1987; Neff, 2002; Neff and Durrell, 2011; Speight, 2007; Wiens, 2013).
- Fate, toxicity, bioaccumulation, and bioavailability of petroleum settling to the seafloor or shoreline varies due to sediment type and quality (Allen et al., , 2012; Capuzzo, 1987; Hannam et al., 2009; Neff, 1979, 2002; Neff and Durrell, 2011; Sharma and Schiewer, 2016; Wade et al., 2011; Wang et al., 2003).
- Natural gas displaces oxygen in the water column, and when released at depth, has been linked to an increase of methanotrophic activity (Joye et al., 2011; Valentine et al., 2010; Wimalaratne et al., 2015; Yvon-Lewis et al., 2011).

Additional discussion of the general impacts of oil and gas on water quality is provided in the *Beaufort Sea: Hypothetical Very Large Oil Spill and Gas Release* report (BOEM, 2020, Section 4.2.2).

A-3.3.1 Small Oil Spills (<1,000 bbl)

Refined oils, such as gasoline, diesel, and aviation fuel, are not persistent, do not form emulsions, and usually evaporate rapidly provided they are exposed to air. Refined oils contain only light fractions of hydrocarbons and weather primarily through evaporation. The rate of evaporation accelerates with rising temperature and increased wind speed. Modeled weathering calculations provided in Table A1 show that diesel spills from <1 bbl to 50 bbl evaporate and disperse within 6–24 hours in open water, respectively. Immediate, yet temporary exceedances of water quality standards for total aromatic hydrocarbons (TAHs) would result with water quality expected to return to ambient conditions within 2 days.

By contrast, small crude oil spills persist longer in the environment. These spills have the potential for a greater extent of horizontal and vertical contamination of the surface waters and water column. Hydrocarbons can volatilize into the air, dissolve into the water column or water surface, oxidize via ultraviolet radiation or microbial activity, or emulsify and float or sink to the subsurface (NRC, 2003a). A crude oil spill of 125 bbl would impact water quality longer in summer (>30 days) than in winter (~30 days) (see Table A1) when dispersion and evaporation rates are less due to lower wind speeds and wave heights. A small crude spill, or repetitive small oil spills, in open water would introduce hydrocarbon contaminants of various weights and toxicities into the marine environment, causing a temporary decrease in water quality. During ice season, small crude oil and condensate spills could affect the localized surface quality of ice, as well as surface water quality if the spill occurred in broken ice. TAH concentrations would be more likely to freeze into the ice than to dissolve or disperse. After the onset of melting, oil spilled under ice returns to the surface in an un-weathered state.

A-3.3.2 Large Oil Spill (≥1,000 bbl)/Gas Release

A large, 3,800 bbl oil spill would impact water quality by introducing hydrocarbons onto the sea surface, into the water column, and in seafloor sediments. Crude oil on the sea surface spreads initially under the influence of gravity and surface tension to form slicks with an average thickness of less than 1 millimeter (mm), and often as low as 0.1 millimeters (mm) (Lee et al., 2013). Subsequently, the slick-thickness will either decrease or increase depending on characteristics of the oil, the influence of surface factors (wind, waves, currents, temperature, salinity, etc.), and spill response actions (Beyer et al., 2016). In-situ cold water measurements (Payne et al., 1987) indicated that concentrations of individual components in an oil slick decrease significantly over a period of hours to tens of days. The highest dissolution rates of TAHs from a slick occur in the first few hours of a spill, and they accumulate in the underlying water. Surface oil slicks become patchy, and the total area of widely separated patches is greater than the actual amount of surface area covered by oil.

Oil and oil residues can interact with settling particles in the water column, providing a natural removal process (Tarr et al., 2016). Polycyclic aromatic hydrocarbons (PAHs), a component of total aqueous hydrocarbons (TAqH), from any discharge quickly attach onto particulate matter, and large amounts from the water are then deposited in bottom sediments where they are readily accumulated by aquatic biota (Neff, 1986). A small portion of the oil from a surface spill would be deposited in the sediments in the immediate vicinity of the spill or along the pathway of the slick. The observed range in deposition of oil in bottom sediments following offshore spills is 0.1–8 percent of the slick mass (Jarvela et al., 1984). Generally, the higher percentage of deposition occurs in spills nearshore where surf, tidal cycles, and other inshore processes can mix oil into the bottom. Farther offshore, where suspended sediment loads are generally lower, only about 0.1 percent of the crude would be incorporated into sediments within the first 10 days of a spill (Manen and Pelto, 1984).

An oil spill during the winter could occur in broken ice conditions. The oil would freeze into, move with, and melt out of the ice the following spring. Oil-contaminated ice could drift for tens of km prior to melting out. Due to the reduced wave-induced emulsification process, oil released from the ice would have the characteristics of fresh oil (Barber et al., 2014). Decomposition and weathering processes for oil are much slower in cold waters than in temperate regions due to lower evaporation rates. Refined oils, condensates, and diesel products, would weather much more quickly than crude oil, as described above, and would be generally dispersed within 2 days. After 30 days, approximately 3–24 percent of crude oil is estimated to remain in open water and 61 percent in ice (Table A2).

Severe, potentially widespread and long-lasting impacts to water quality and exceedances of Alaska's water quality standards for both TAH and TAqH would occur immediately after a large oil spill. The acutely toxic and highly volatile TAHs are likely to have a pronounced, short-term fluctuation and would likely rapidly dissipate from the spilled oil within a day. However, elevated levels of the less volatile and soluble PAH compounds would be expected in the water column for up to a month. These compounds are unlikely to persist in the water column for an extended period, but rather, are more likely to accumulate in sediments where they can remain for decades under some conditions (ADEC, 2015).

Little to no water quality impacts are expected during the short, 1-day duration of the gas release, but water quality could temporarily be impacted during the release. When natural gas (primarily methane) is released into the water, it rises through the water column as a function of pressure and temperature, temporarily displacing oxygen. When released at depth, the quality of the water would be altered temporarily and in deeper, colder waters some of the natural gas enters the water as a water-soluble fraction. Upon reaching the surface, the gaseous methane would react with air forming water and carbon dioxide (CO_2), which would then disperse into the atmosphere. The higher concentration of CO_2 near the surface would affect chemical and biological processes and reactions at the water-air interface such as egg and larvae respiration (GESAMP, 1995).

A-3.3.3 Spill Drills and Response Activities

There is potential for small, refined vessel oil spills during spill drills, including GIUEs; however, these events are infrequent and of short duration (<8 hours) and would result in little to no impact on water quality. Additional impacts on water quality would occur from spill response and cleanup activities for large oil spills, including impacts from vessels, in-situ burning of oil, dispersant use, and activities on shorelines associated with cleanup, booming, beach cleaning, and monitoring (BOEM, 2019). Permitted and incidental discharges from spill response vessels would temporarily impact localized water quality by increasing levels of low molecular weight hydrocarbons (TAH). However, the volatility of TAHs results in very short-term exposure durations, particularly if the source is intermittent as from passing motorized watercraft. Exposure to elevated TAH concentrations is likely in instances when watercraft are numerous and in a particular area for sustained periods. In-situ burning has the potential to impact water quality by increasing surface water temperatures while the oil slick is burning. Temperatures of crude oil burns on water vary from 900°C to 1,200°C; however, the temperature at the oil slick/water interface is never more than the boiling point of water and is usually around ambient temperature (Mullin and Champ, 2003). Any increase of surface water temperature would be temporary and short-term, if at all, returning to ambient temperature when the burning stops. Additionally, in-situ burning produces viscous oil and soot residues that initially float but may sink as they cool. In-situ residues (i.e., "tar paddies") exhibit little water solubility and have no detectable acutely toxic compounds (Mullin and Champ, 2003). Toxicity of dispersants to aquatic life are species- and chemical-specific, but dispersant persistence and toxicity levels have been documented in the water column and marine sediments (Lewis and Pryor, 2013; White et al., 2014). Shoreline spill response activities disturbing contaminated shoreline sediments can reintroduce stranded oil from back into the water column and drive contaminates farther into shoreline sediments. Weathered, and more viscous higher molecular weight hydrocarbons would most likely be present, and although lower in toxicity, these PAHs can persist for decades in sediment.

A-3.3.4 Conclusion

Oil spills or a gas release could affect marine coastal, and tidal riverine waters with potentially toxic levels of hydrocarbons until the process of dispersion, dilution, degradation, and weathering reduce oil and oil residue concentrations. A small spill would cause minor impacts and would not result in any long-lasting change to water quality nor its function in the ecosystem, whereas a large spill would cause moderate impacts to water quality based on the volume of oil spilled. A large gas release or spill drills would cause negligible impacts to water quality, and spill response and cleanup actions would cause negligible to minor impacts.

A-3.4 Coastal and Estuarine Habitat

The magnitude and severity of oil spill impacts to coastal and estuarine habitats are contingent upon the type and amount of spilled oil, substrate and shoreline type, amount of vegetation coverage, plants' seasonality at the time of the release (spring vs. fall), depth of penetration of the oil into the sediments, and type and effectiveness of any cleanup or remedial actions (NRC, 2003a). Oil spill impacts to coastal and estuarine habitat include:

- Impacts of persistent crude oil to wetlands and shoreline with permeable, fine-grained sediments include habitat smothering and oiling of beaches (Atlas and Bragg, 2013; Harper and Morris 2014; Mendelssohn et al., 2012; Michel et al., 2017; Michel and Rutherford, 2013).
- Crude oil exhibits less toxicity to plants than refined products such as diesel, however repetitive oiling to the root zone can cause plant death (Achuba, 2006; Hester and Mendelssohn, 2000; Jorgenson, 1997; Lin and Mendelssohn, 1996, 2012; McKendrick, 2000; Walker et al., 1978).
- Rehabilitation and restoration of vegetation from oil and diesel spills can be long-term with oil byproducts remaining in the soil for many years (Conn et al., 2001; Jorgenson et al., 2003; McKendrick and Mitchell, 1978).

Additional discussion of the general impacts of oil and gas on wetlands and vegetation is provided in the *Beaufort Sea: Hypothetical Very Large Oil Spill and Gas Release* report (BOEM, 2020, Section 4.2.3), and that analysis is incorporated by reference.

A-3.4.1 Small Oil Spills (<1,000 bbl)

Small offshore spills of light refined oil products can directly damage or kill vegetation by penetrating and destroying plant tissues (Behr-Andres et al., 2001). Diesel or refined product spills (<1–50 bbl) are estimated to evaporate in 24 hours in summer, and 6 hours in winter (Table A1). However, despite their evaporation rates, direct contact by diesel or refined product spills of any size could impact and cause lethality to emergent wetland vegetation. In contrast, crude oil shows little direct toxic effects to most plants unless the plant is heavily oiled, is a sensitive species, or oil has penetrated the soil/sediment and the roots are continuously exposed to oil. For a 125-bbl crude oil spill in summer, 24 percent remains after 30 days; in winter, 3 percent remains after 30 days (Table A1). Because of the rapid dispersion and evaporation during summer, it is very unlikely that impacts or injury to coastal and estuarine habitats, including wetlands and vegetation, would result from an offshore summer crude oil spill. Moreover, the majority of offshore small spills are contained on a vessel or platform, and spills making contact with water are expected to be contained by appropriate spill response activities. During winter, ice or snow could act as a barrier preventing oil and refined product from contacting estuaries, saltwater wetlands, and shorelines.

Most onshore small diesel spills are expected to occur during refueling on established roads or pads and are unlikely to contact wetland vegetation. Should a diesel spill occur during summer, direct contact with vegetation would result in immediate injury and potential lethality to vegetation. A 125-bbl crude oil spill has the potential to impact terrestrial vegetation and wetlands, particularly if the spill occurred during the summer. The spatial extent of impacted terrestrial wetland habitat depends upon wind and weather conditions at the time of the release, and the type of pipeline failure (pinpoint vs. rupture). Under windy conditions, a pressurized aerial mist could spray crude oil and impact many acres, but long-term injury resulting from heavy oiling or root penetration would not be expected. Winter spills with adequate snow cover are more readily cleaned up because contaminants can be removed as frozen material and soil penetration of oil contaminants is minimal (McKendrick, 2000).

A-3.4.2 Large Oil Spill (≥1,000 bbl)/Gas Release

An offshore large crude or refined oil spill during summer or broken-ice conditions could impact coastal and estuarine habitats, including shorelines, supratidal, intertidal, and subtidal communities. A large spill of crude oil would persist longer in the environment and result in greater, long-term impacts than spills of refined products which weather more rapidly. A 3,800-bbl crude oil spill in Cook Inlet is estimated to oil 35 km (21 miles (mi)) of coastline in summer and 26 km (16 mi) in winter (Table A2).

Alaska’s coastal and estuarine habitats are rich in biological resources that are sensitive to spilled oil. During summer, these habitats are ideal environments for migratory birds, fish, invertebrates, and foraging mammals. Coastal and estuarine habitats of Cook Inlet are varied and have different vulnerabilities to oil exposure; persistence of oil also varies between supratidal, intertidal and subtidal habitats once exposed. Porosity of the shoreline substrate is an important determinant of the extent to which a shoreline may be impacted by an oil spill. Shorelines in upper Cook Inlet are primarily sheltered tidal flats and salt marshes, which are highly sensitive to oil spill impacts and would be expected to retain spilled oil longer with longer-lasting impacts on biota (Culbertson et al., 2008). In contrast, shorelines in middle Cook Inlet are characterized by exposed tidal flats that are less sensitive to oiling (NOAA, 2002). Exposed rocky cliffs, headlands, and sheltered rocky coasts are characteristic shoreline types in lower Cook Inlet.

BOEM analyzed the vulnerability of Cook Inlet’s coastal and estuarine habitats to an oil spill (BOEM, 2016-069, Section 4.3.9.5, pp 4-179 through 4-184) and that analysis is incorporated by reference. BOEM’s full analysis includes a thorough explanation of the vulnerability of Cook Inlet’s diverse shorelines, supratidal, intertidal, and subtidal communities to oil impacts, and the relevant assumptions for these explanations. Specifically, this analysis includes a description of the impacts of the Exxon Valdez Oil Spill (EVOS) to different shore types in Prince William Sound, on the Kenai and Alaska Peninsulas, and in the Kodiak Archipelago. The environmental sensitivity index (ESI) used both in the EVOS and this OSRA, ranks shoreline types on a scale from 1 to 10 (10 being the most sensitive) based on predicted sensitivity to disturbance from oil spills and cleanup operations. Although the EVOS was a VLOS event spilling a much greater volume of crude oil than a large oil spill, the vulnerability and persistence of oil pollution to the various shore types and coastal habitats of Prince William Sound impacted by the EVOS, is pertinent to the shore types and coastal habitats found in Cook Inlet.

The concentration of low-molecular-weight alkanes and aromatics in crude oil is a primary determinant of toxicity. Heavy and medium crude oils exhibit a low level of direct toxicity upon contact to plants, whereas light crudes and refined products, such as diesel, can cause necrosis and plant mortality on contact (Mendelssohn et al., 2012). Oil and oil residues stranded in emergent wetland vegetation would be expected to persist for decades due to lower rates of dispersion and degradation. Destruction of emergent vegetation could occur if oil penetrates the root system (Mendelssohn et al., 2012). Oil contamination could persist for many years as oil in the sediments could be released back into the environment as a result of erosion or exposure of oiled sediments and soils. Oil persistence in marsh sediments could impact microbial communities in the soil and sediment resulting in long-term wetland effects and potential slow recovery (Delaune et al., 1990; Teal and Howarth, 1984; Teal et al., 1992).

An offshore gas release is expected to travel through the water column and dissipate quickly; coastal and estuarine habitats near the gas release could be exposed to lower oxygenated waters, however little to no impacts to coastal and estuarine habitats would be expected.

A large onshore spill of crude, condensate, or diesel would impact terrestrial vegetation and wetlands. The areal extent of the spill would depend on the season, wetland and soil type, wind conditions, and type of pipeline spill (rupture versus pinhole) at the time of the release. Should a pressurize pipeline fail and oil spray into the air, under windy conditions oil may be carried downwind and deposited over a widespread area (NRC, 2003b). During summer, a large spill could saturate wetland soils, penetrate the active layer of the soil and by coating plants' roots and rhizomes cause severe and detrimental impacts to wetland vegetation. In the case of a refined petroleum spill where direct toxicity is substantial, mosses and aboveground vascular plants would be killed on contact. During winter, snow and ice buffers vegetation from oil impacts and limits the extent of oil spreading. Cold temperatures would further retard oil from spreading, reducing the areal extent of impact.

An onshore gas release could result in thermal impacts to terrestrial vegetation and wetlands should ignition occur. The areal extent of thermal impacts and burning of vegetation would depend on the season, weather conditions, moisture content of vegetation, and suppression efforts. Little to no impacts to vegetation and wetlands is expected under most situations, unless an explosion, ignition, or fire ensues resulting in severe impacts.

A-3.4.2.1 Oil Spill Risk Analysis

The OSRA acronyms are LS Land Segment, LA Launch Area; and PL Pipeline. BOEM identified 112 LSs and their environmental sensitivity index (ESI) for this analysis (Ji and Smith, 2021; Tables A.1-11 and A.1-12; Figures B-3a–3d). The ESI is a numerical index ranking the vulnerability of a coastline's natural characteristics to impacts from oil spills. The higher the ESI number, the more vulnerable the coastline is to oil spills.

Conditional Probabilities. Table A5 and Figure A2 display 39 LSs with a ≥1 percent chance of contact in summer or winter. Although every LS in Table A5 has a chance of contact, most of these contacts range from 1–5 percent. For this analysis, only the 11 LSs with a ≥6 percent chance of contact during summer or winter are discussed further (Table A5). Overall, the pattern of contact from north to south, on western and eastern shorelines is similar between summer and winter seasons. The western LSs have a greater chance of contact than the eastern LSs, and the more northern LSs have a greater chance of contact than the southern LSs. As identified by the ESI (Ji and Smith, 2021, Table A.1-12), most of the shorelines within the LSs, are characteristically mixed sand/gravel beaches, exposed and sheltered tidal flats, wave-cut bedrock, and salt/brackish water marshes.

Summer. For a summer spill, 8 western LSs from Redoubt Point (36) to Amakdedulia Cove, Bruin Bay, Chenik Head (28), and Augustine Island (29) have a chance of contact. The highest chance of contact is the most northern of the contacted western LSs at Redoubt Point (36) from a LA1 spill (Ji and Smith, 2021, Table A.2-29). Chinitna Bay (33) has the greatest chance of contact from all LAs and PLs, and the chance of contact decreases steadily to Amakdedulia Cove, Bruin Bay, Chenik Head (28) in the south. Three eastern LSs have a similar chance of contact from a spill in LA6 or LA5: Cape Starichkof, Happy Valley (56), Barbara Point, Seldovia Bay (61) and Nanwalek, Port Graham (62) (Ji and Smith, 2021, Table A.2-29).

Winter. A winter spill has a chance of contacting the same western LSs as identified above for summer, with the addition of Iliamna Point (34). Chinitna Bay (33), as for a summer spill, has the greatest chance of contact from all LAs and PLs, and the chance of contact decreases steadily to the south at Amakdedulia Cove, Bruin Bay, Chenik Head (28). Only two eastern LSs, Cape Starichkof, Happy Valley (56) and Port Graham (62), have a chance of contact from LA6 and PL2, respectively (Ji and Smith, 2021, Table A.2-49).

Table A5: Highest Percent Chance of a Large Spill Contacting Coastal and Estuarine Resources (Assuming a Large Spill Occurs)[1]

OSRA Feature Type	Highest Chance of Contact	Summer: 30 days	Winter: 30 days
LS	≥0.5–<6	18, 19, 20, 21, 22, 23, 24, 25, 26, 34, 37, 38, 40, 54, 55, 57, 58, 60, 63, 79, 80, 81, 82, 83, 84, 85, 86, 87	21, 22, 23, 24, 25, 26, 27, 37, 38, 39, 40, 54, 55, 57, 58, 60, 61, 63, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88
LS	≥6–<25	28, 29, 30, 31, 32, 33, 35, 36, 56, 61, 62	28, 29, 30, 31, 32, 33, 34, 35, 36, 56, 62
Names of LSs Contacted: 18 Alinchak Bay, Cape Kekurnoi, Bear Bay; 19 Cape Kubugakli, Kashvik Bay, Katmai Bay; 20 Amalik, Dakavak and Kinak Bays, Cape Iiktugitak, Takli Island; 21 Kaflia Bay, Kukak Bay, Kuliak Bay, Missak Bay; 22 Devils Cove, Hallo Bay; 23 Cape Chiniak, Swikshak Bay; 24 Fourpeaked Glacier; 25 Cape Douglas, Sukoi Bay; 26 Douglas River; 27 Akumwarvik Bay, McNeil Cove, Nordyke Island; 28 Amakdedulia Cove, Bruin Bay, Chenik Head; 29 Augustine Island; 30 Rocky Cove, Tignagvik Point; 31 Iliamna Bay, Iniskin Bay, Ursus Cove; 32 Chinitna Point, Dry Bay; 33 Chinitna Bay; 34 Iliamna Point; 35 Chisik Island, Tuxedni Bay; 36 Redoubt Point; 37 Drift River, Drift River Terminal; 38 Kalgin Island; 39 Seal River, Big River; 40 Kustatan River,West Foreland; 54 Clam Gulch, Kasilof; 55 Deep Creek, Ninilchik, Ninilchik River; 56 Cape Starichkof, Happy Valley; 57 Anchor Point, Anchor River; 58 Homer, Homer Spit; 59 Fritz Creek, Halibut Cove; 60 China Poot Bay, Gull Island; 61 Barabara Point, Seldovia Bay; 62 Nanwalek, Port Graham; 63 Elizabeth Island, Port Chatham, Koyuktolik Bay; 79 Barren Islands, Ushagat Island; 80 Amatuli Cove, East & West Amatuli Island; 81 Shuyak Island; 82 Bluefox Bay, Shuyak Island, Shuyak Strait; 83 Foul Bay, Paramanof Bay; 84 Malina Bay, Raspberry Island, Raspberry Strait; 85 Kupreanof Strait, Viekoda Bay; 86 Uganik Bay, Uganik Strait, Cape Ugat; 87 Cape Kuliuk, Spiridon Bay, Uyak Bay; 88 Karluk Lagoon, Northeast Harbor, Karluk.			

Notes: [1] Highest percent chance from any launch area (LA) or pipeline area (PL) during summer or winter assuming a large spill occurs. Note that all LSs with <0.5 percent chance of contact are not shown.
Source: Ji and Smith (2021).

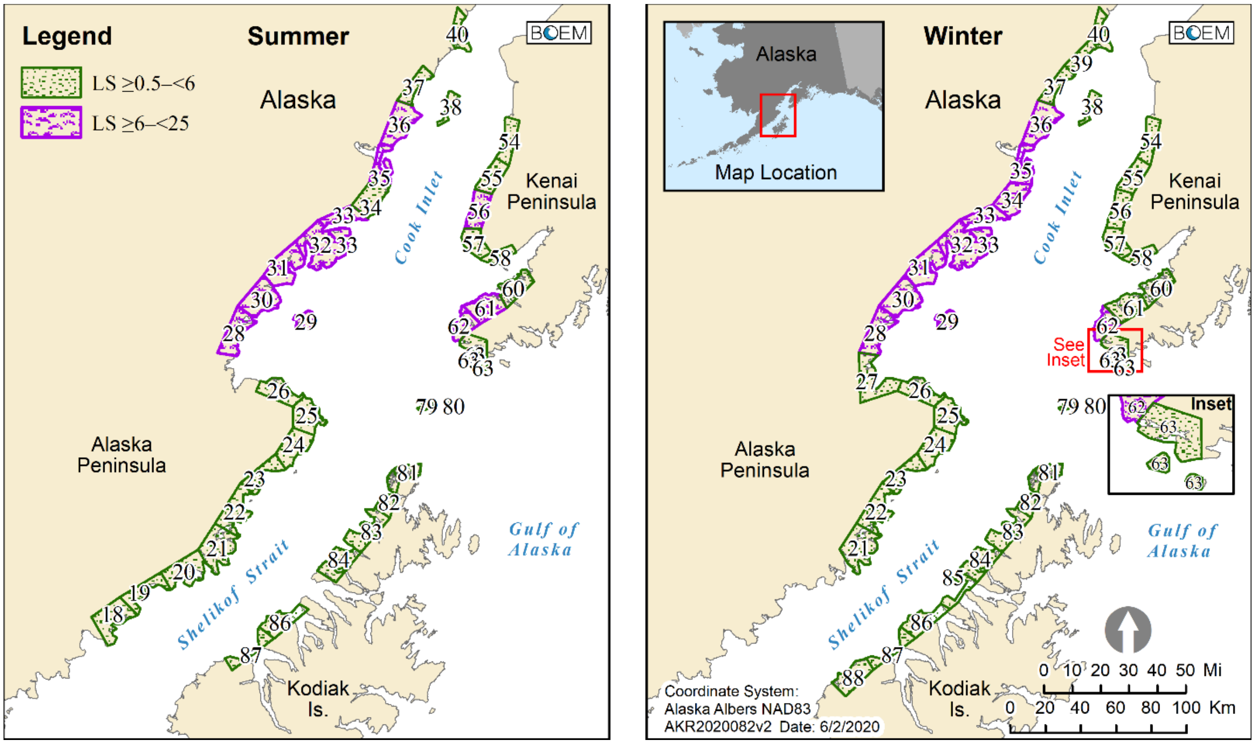

Figure A2: Location and ID number of Land Segments (Assuming a Large Spill Occurs ≥1% Chance of Contact within 30 Days): Summer and Winter

<u>Combined Probabilities</u>. The OSRA model estimates a <1–3 percent chance of one or more large spills occurring and contacting LSs 25, 28–36, 56, and 62 within 3 to 30 days (Ji and Smith, 2021, Table A.2-62). The greatest chances of occurrence and contact within 30 days are 3 percent for Chinitna Bay (33) and 2 percent for Chisik Island, Tuxedni Bay (35), both located on the western coastline of Cook Inlet; LSs 25, 28–32, 34, 36, 56 and 62 all have a 1 percent chance of occurrence and contact.

A-3.4.3 Spill Drills and Response Activities

Spill drills, including GIUEs, would be infrequent and localized and are expected to have little to no impacts to coastal and estuarine habitats.

Skimming, booming, in-situ burning, and other spill response and cleanup operations can be effective means of preventing offshore oil spills from reaching coastal and estuarine habitats, and shorelines (BOEM, 2019). Spill cleanup operations might impact coastal beaches if the removal of contaminated substrates affects beach stability and results in accelerated shoreline erosion. Vehicular and foot traffic during cleanup could mix surface oil into the subsurface, where it would likely persist for a longer time. Manual cleanup, rather than the use of heavy equipment, would minimize the amount of substrate removed due to effects of motorized vehicles on fragile soils.

Spill response for onshore contaminated wetland vegetation usually involves low pressure flushing to mobilize the oil and remove it, along with removal of the most highly contaminated soils. Scraping the surface is designed to leave plant parts (roots, rhizomes) intact so that sprouting will occur the following spring (Cater et al., 1999). Faster rehabilitation of vegetation and wetlands occurs if spill cleanup is aided by use of fertilizers and other bioremediation applications (McKendrick, 2000a

A-3.4.4 Conclusion

The environmental conditions at the time and location of an oil spill, the habitat type and substrate of the shoreline, oil type, and size of the spill are critical factors that influence the extent of impacts to coastal and estuarine habitats. Oil contamination on shorelines, supratidal, intertidal and subtidal habitats consisting of tidal flats, sand/gravel beaches, rocky shores, and saltwater marshes would have long-term and widespread impacts for many years. Impacts would be negligible to minor for small spills, and moderate to major for a large oil spill, contingent upon these defining factors. A negligible to minor impact would not result in any long-lasting detrimental effects on the overall ecological functions, species abundance, or composition of marine or freshwater wetlands or plant communities of Cook Inlet. A large gas release would have negligible impacts to coastal and estuarine habitats, unless there is an associated explosion or ignition, in which case impacts to wetlands and vegetation could be major. Spill response and cleanup activities, or spill drills, are expected to have negligible impacts to coastal and estuarine habitats, particularly if cleanup activities occur during the winter season.

A-3.5 Invertebrates and Fish

Exposure to oil or its toxic components causes lethal to sublethal toxicity to marine invertebrates. Impacts of oil on marine invertebrates vary depending on level of exposure, life history, feeding behavior, and ability of a species to metabolize toxins. Benthic and planktonic invertebrates are exposed to oil in different ways and vary in their ability to avoid exposure. Impacts from a spill can occur through exposure to toxins, changes in oxygen and light availability in the water, and physical damage to organisms by settled oils. Adverse impacts to fish and fish habitat from spills can occur in both freshwater and marine environments. Impacts can occur through exposure of various life stages of fish to toxins, impacts to prey and interference with access to important habitat areas. Although oil is toxic to fish at high concentrations, certain species are more sensitive than others, and oil can have toxic effects even in low concentrations. Potential impacts to marine invertebrates and fish related to accidental spills include the following:

- Direct toxic effects to marine invertebrates can include lethal or sublethal consequences such as impacts on biomass and community composition, as well as impacts on behavior, reproduction, growth and development, immune response, and respiration (Auffret et al., 2004; Bellas et al., 2013; Blackburn et al., 2014; Hannam et al., 2010).
- Spills that are not immediately lethal can have short- or long-term impacts on biomass and community composition, behavior, reproduction, feeding, growth and development, immune response, and respiration (Blackburn et al., 2014; Dupuis and Ucan-Marin, 2015). The level of toxicity is influenced by how marine invertebrates are exposed, their life history, feeding behavior, and ability of a species to metabolize toxins.
- Chronic exposure to oil and its byproducts can cause cellular damage and impair feeding, mobility, reproduction, growth, and development in marine invertebrates (Bellas et al., 2013; Blackburn et al., 2014).
- Indirect toxic effects can occur through the inhibition of air-sea gas exchanges and hypoxia from the degradation of oil (Abbriano et al., 2011; Blackburn et al., 2014; Ozhan et al., 2014).
- Other lethal or sublethal impacts include physical smothering of organisms by settled oil and reduced photosynthesis through changes in light penetration into the water column (Blackburn et al., 2014; González et al., 2013; Ozhan et al., 2014).
- Oil or its toxic components in plankton can biomagnify/bioaccumulate through food webs and affect higher trophic levels (Blackburn et al., 2014). This can reduce prey availability for fish and other marine animals.
- Immediate mortality or other sublethal impacts to fish can occur, such as abnormal development and growth, reproductive damage, and behavioral changes (Carls et al., 1999; Dupuis and Ucan-

Marin, 2015; Hjermann et al., 2007; Incardona, 2017; Nahrgang et al., 2016; Rice et al., 2000; Short, 2003).

- Toxic concentrations can build up in coastal areas where oil is trapped in shallow bays and inlets, and presence of oil can interfere with fish spawning or access to spawning grounds (Heintz et al., 2000; Wertheimer et al., 2000).

Additional discussion of the general impacts of oil and gas on invertebrates and fish is provided in the *Beaufort Sea: Hypothetical Very Large Oil Spill and Gas Release* report (BOEM, 2020, Sections 4.2.4 and 4.2.5).

A-3.5.1 Small Oil Spills (<1,000 bbl)

Small spills would have localized adverse impacts to planktonic and benthic invertebrates and fish. Toxic effects on organisms could occur in the immediate area of a spill. The majority of small spills are estimated to be less than 50 bbl (EIS, Table 3-1), and the impacts on invertebrates and fish would be short-term and localized to the spill area. Impacts to the overall marine invertebrate and fish populations of Cook Inlet would not likely be detectable for small, isolated accidental spills, especially if contained by platform or ice, or are cleaned up before they enter the water column. Most refined small spills that reach the water column will evaporate and disperse within days, which would limit the number of individuals exposed to the toxic effects. A crude oil spill of 125 bbl would likely affect a larger area, and therefore a greater number of fish and invertebrates, but population level impacts from that isolated event are not anticipated.

Chronic, repeated small oil spills could have an extended adverse effect on invertebrates and fish because residual oil can build up in sediments and affect living marine resources. However, these impacts would be limited to discrete areas around the development facilities. Planktonic invertebrate species would quickly repopulate the area via currents and no long-term population impacts are expected. Pelagic fish are expected to avoid the area, thus limiting the number of individuals exposed. Benthic invertebrate and fish communities that are exposed to chronic small spills may experience impacts for multiple generations. These impacts to benthic communities would be limited to the immediate area of the development facilities and would not result in population-level impacts when considering Cook Inlet as a whole. Over the life of the E&D Scenario, invertebrate and fish communities would not generally experience widespread, multi-year, multi-generational impacts.

A-3.5.2 Large Oil Spill (≥1,000 bbl)/Gas Release

Impacts of a large, 3,800 bbl spill on invertebrates and fish would be of greater magnitude and severity than from a small spill. In general, a greater area would be oiled, and more individuals would be impacted depending on the location, volume, trajectory of the spill, and the time of year it occurs. Oil spilled on landfast ice may not reach the water column in the winter, however, a spill occurring in winter may persist for a longer period than during ice-free conditions (Drozdowski et al., 2011), resulting in larger impacts on invertebrates and fish if it is trapped under the ice. The conditional analysis below shows resource areas that have the highest chances of contact for spill locations adjacent to them.

Spilled oil would dilute slowly when ice is present, and more swiftly in open water conditions. Most VOCs in spilled oil would evaporate within a couple of days, although some of the remaining oil could adhere to particles and sink to the seafloor and remain in the sediment. A large crude oil spill would persist longer in the environment and could result in greater impacts to benthic invertebrates and fish than small spills. Migratory and anadromous fish, including several species of forage fishes, could experience adverse effects from a large oil spill in spawning and rearing habitats. Impacts of a large spill in nearshore intertidal areas could persist for generations and might have additive impacts by affecting more than one life stage. Adverse impacts from a large spill, including mortality and community structure changes, could be widespread and persist for multiple generations.

A large gas release and potential ignition or explosion could cause death or physical damage to organisms in the immediate vicinity. Fish mortality associated with a gas release could range from only a few to hundreds of individuals. However, such an event would likely involve several species of fish and invertebrates, with no expected population-level impacts. Overall, mortality associated with a release is expected to have very short-term impacts on invertebrates and fish in the immediate area and little to no impacts on the overall invertebrate and fish communities.

A-3.5.2.1 Oil Spill Risk Analysis

BOEM identified 5 lower trophic (fish and invertebrates that are food for other animals) resource areas and 104 anadromous fish resource areas for the analysis (Ji and Smith, 2021; Tables A.1-2, and A.1-3; Figures B-2a; B-3a–d, and B-4a.1). The OSRA acronyms are: ERA Environmental Resource Area; LS Land Segment; and GLS Grouped Land Segment.

Conditional Probabilities. Conditional probabilities help illustrate the biologically important areas that may be contacted and assume that a spill occurs. Table A6 and Figure A3 and Figure A4 show resource areas with a ≥0.5 percent chance of contact in summer or winter. This analysis focuses on resource areas that have a ≥6 percent chance of contact. Depending upon the timing of seasonal ice and location of the spill, seasonal ice could affect the chance of a spill contacting nearshore resource areas.

Summer. All five of the ERAs identified for lower trophic organisms have ≥6 percent chance of being contacted by a spill occurring in the summer or winter (Table A6; ERAs 11, 153–155, GLS 138); two have ≥50 percent chance. In contrast, only 10 of 104 anadromous fish resources exceeded a 6 percent chance of contact (Table A6; LSs 28, 30–36, 56, 61, and 62). These LSs, which identify important spawning stream locations, are located adjacent to the middle of the Lease Sale Area, and with the exception of the area near Anchor Point, occur on the western edge of the Lease Sale Area. The chance of contact for lower trophic ERAs and GLSs ranged from ≥0.5–89 percent, while LSs that contained anadromous fish streams had comparatively low chances of contact that ranged from ≥0.5–20 percent.

In general, chances of contact are higher for an area when the spill originates close to the resource. For example, for invertebrates, the Barren Islands (155) have the lowest chance of contact and Polly Creek Beach (153) has the highest, except when the spill occurs in the lower portion of the Lease Sale Area. Oil spills originating from the upper and middle part of the Lease Sale Area are more likely to contact important resource areas than spills originating from the lower part of the Lease Sale Area. Regardless of where the spill occurs, Augustine (11), important for lower trophic organisms, shows consistent chances of contact, with higher chances of contact for spills occurring closest to the ERA. Of anadromous fish resources, Chinitna Bay has the most consistent risked contact, although Redoubt Point and Tuxedni Bay had the highest likelihoods to be contacted by a spill occurring in the summer and winter, respectively.

Winter. In general, the resource areas important for lower trophic organisms that are contacted by a large winter spill are the same as the summer, with relatively similar probabilities of contact. Some areas are higher, and some areas are lower, likely due to the expected influence of ice. The Clam Gulch (138) and the LS near Anchor Point (56) decrease to <6 percent in winter.

Table A6: Highest Percent Chance of a Large Oil Spill Contacting Lower Trophic Level or Anadromous Fish Resources (Assuming a Large Spill Occurs)[1]

OSRA Resource Type2	Highest Chance of Contact	Summer: 30 days	Winter: 30 days
ERA	≥0.5–<6	--	--
ERA	≥6–<25	154, 155	154 155
ERA	≥25–<50	--	--
ERA	≥50	11, 153	11, 153
GLS	≥0.5–<6	--	--

OSRA Resource Type2	Highest Chance of Contact	Summer: 30 days	Winter: 30 days
GLS	≥6–<25	138	138
LS	≥0.5–<6	18, 19, 20, 21, 22, 23, 24, 25, 26, 34, 37, 38, 40, 54, 55, 57, 58, 60, 63, 81, 82, 83, 84, 85, 86, 87	21, 22, 23, 24, 25, 26, 27, 37, 38, 39, 40, 54, 55, 57, 58, 60, 61, 63, 81, 82, 83, 84, 85, 86, 87, 88
LS	≥6–<25	28, 30, 31, 32, 33, 35, 36, 56, 61, 62	28, 30, 31, 32, 33, 34, 35, 36, 56, 62

Names of ERAs Contacted: 11 Augustine; 153 Polly Creek Beach; 154 Chinitna Bay; 155 Barren Islands.
Names of GLSs Contacted: 138 Clam Gulch Critical Habitat
Names of LSs Contacted: 18 Alinchak Bay, Cape Kekurnoi, Bear Bay; 19 Cape Kubugakli, Kashvik Bay, Katmai Bay; 20 Amalik, Dakavak and Kinak Bays, Cape Iiktugitak, Takli Island; 21 Kaflia Bay, Kukak Bay, Kuliak Bay, Missak Bay; 22 Devils Cove, Hallo Bay; 23 Cape Chiniak, Swikshak Bay; 24 Fourpeaked Glacier; 25 Cape Douglas, Sukoi Bay; 26 Douglas River; 27 Akumwarvik Bay, McNeil Cove, Nordyke Island; 28 Amakdedulia Cove, Bruin Bay, Chenik Head; 29 Augustine Island; 30 Rocky Cove, Tignagvik Point; 31 Iliamna Bay, Iniskin Bay, Ursus Cove; 32 Chinitna Point, Dry Bay; 33 Chinitna Bay; 34 Iliamna Point; 35 Chisik Island, Tuxedni Bay; 36 Redoubt Point; 37 Drift River, Drift River Terminal; 38 Kalgin Island; 39 Seal River, Big River; 40 Kustatan River,West Foreland; 54 Clam Gulch, Kasilof; 55 Deep Creek, Ninilchik, Ninilchik River; 56 Cape Starichkof, Happy Valley; 57 Anchor Point, Anchor River; 58 Homer, Homer Spit; 59 Fritz Creek, Halibut Cove; 60 China Poot Bay, Gull Island; 61 Barabara Point, Seldovia Bay; 62 Nanwalek, Port Graham; 63 Elizabeth Island, Port Chatham, Koyuktolik Bay; 81 Shuyak Island; 82 Bluefox Bay, Shuyak Island, Shuyak Strait; 83 Foul Bay, Paramanof Bay; 84 Malina Bay, Raspberry Island, Raspberry Strait; 85 Kupreanof Strait, Viekoda Bay; 86 Uganik Bay, Uganik Strait, Cape Ugat; 87 Cape Kuliuk, Spiridon Bay, Uyak Bay; 88 Karluk Lagoon, Northeast Harbor, Karluk.

Notes: -- No highest percent chance in this range.
[1] Highest percent chance from any launch area (LA) or pipeline area (PL) during summer or winter assuming a large spill occurs. Note that all resource areas with <0.5% chance of contact are not shown.
[2] Invertebrates and Fish are represented by ERAs and GLSs. Anadromous Fish resources areas are represented by LSs.
Source: Ji and Smith (2021).

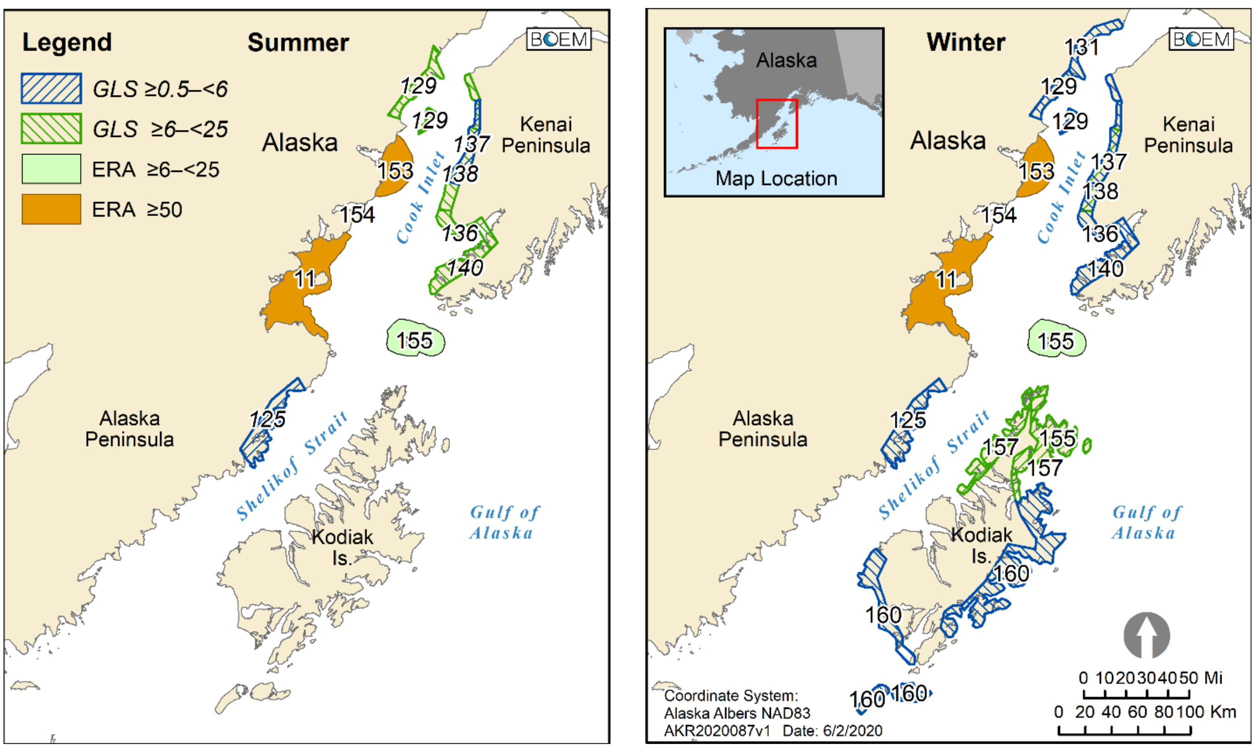

Figure A3: Location and ID number of Invertebrate Resource Areas (Assuming a Large Spill Occurs ≥1% Chance of Contact within 30 Days): Summer and Winter

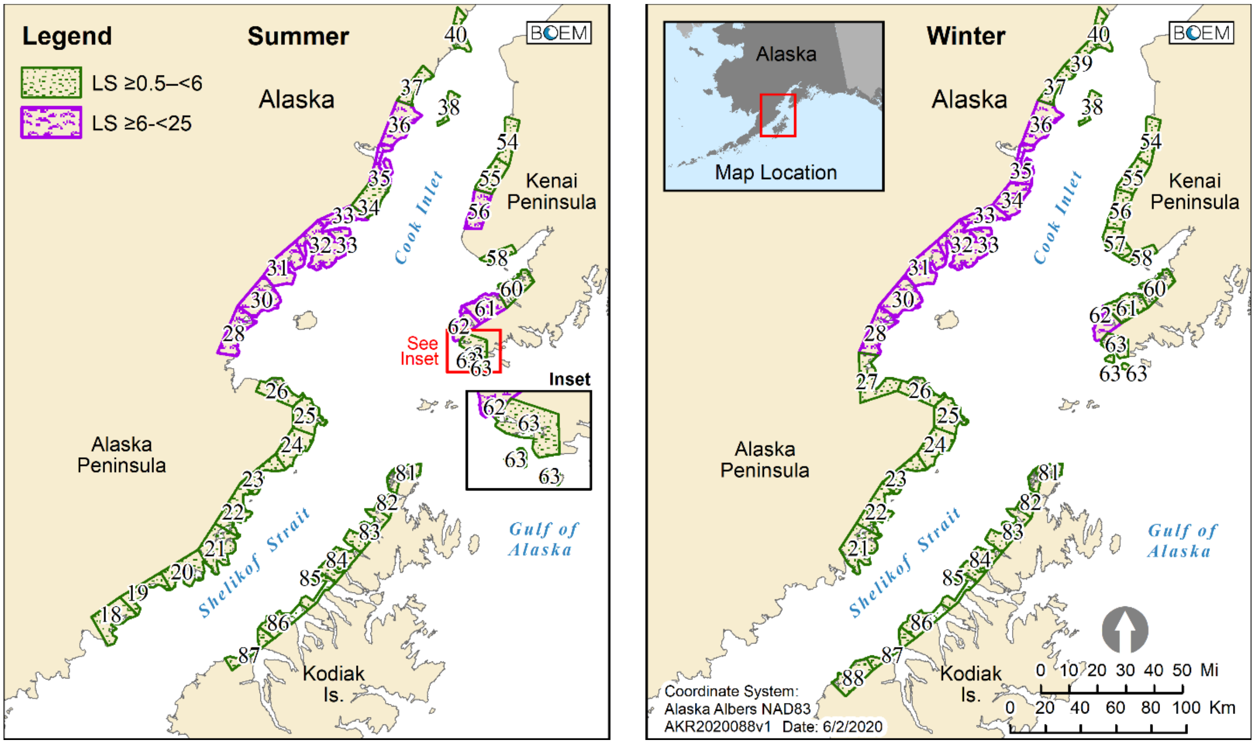

Figure A4: Location and ID number of Anadromous Fish Resource Areas (Assuming a Large Spill Occurs ≥1% Chance of Contact within 30 Days): Summer and Winter

Combined Probabilities. When analyzing the combined probabilities, the resource areas for lower trophic organisms that are impacted are generally the same ones described in the conditional analysis, but the magnitude of contact is reduced due to factoring in the probability of a large spill occurring. Most areas have a combined probability of occurrence and contact <1 percent within 30 days; the highest is Augustine (11), which has a 6 percent chance within 30 days.

A-3.5.3 Spill Drills and Response Activities

Spill drills, including GIUEs, would impact invertebrates and fish through vessel traffic, noise, and discharges, and possibly through testing of mechanical recovery methods. Spill response activities could include mechanical recovery methods and in-situ burning, as well as use of dispersants (BOEM, 2019). Increased vessel traffic, with corresponding increases in vessel discharges and noise, would also be associated with spill cleanup. If cleanup operations include sections of the beach or intertidal zones, access to spawning habitat for some species may be restricted.

Spill impacts and cleanup operations would be influenced by time of year. Response efforts would be both hindered and aided by the presence of ice. Ice would contain a spill, concentrate it, and may act as a barrier to shoreline oiling. However, ice may also make a spill difficult to detect, locate, and access. Volatile components of the spill would be more likely to freeze into the ice rather than evaporate.

Physical damage to invertebrates and fish from containment and collection procedures could occur. Lethal impacts may occur to planktonic organisms but are not expected to be detectable at the population level. Pelagic fishes may be affected by mechanical recovery of spilled material but are expected to avoid an oiled area and to move away from vessels and booms or skimmers. If spill response activities occur during spawning runs, some fish could experience difficulty reaching their spawning grounds. However, these avoidance impacts would be short-term and localized to the spill area. Benthic invertebrates and fish would not likely be affected by mechanical recovery activities occurring at the surface. In-situ burning could impact organisms in the immediate area due to residue from the burn sinking to the bottom. Death of planktonic invertebrates and pelagic fishes that did not move away from the spill is possible in the immediate burn area. At the seafloor, habitat can be altered by residue from a burn. Some benthic organisms may be smothered. Impacts from mechanical recovery or burning are expected to be short-term and localized to the area of the spill.

The use of dispersants has been shown to increase the exposure of fish eggs to toxic levels of hydrocarbons because the dispersants make the oil more easily cross the egg membrane (Ramachandran et al., 2004). Dispersants used in spill response activities can result in greater toxic impacts to invertebrates than crude oil alone (Almeda et al., 2013; Lee et al., 2012), and can also have negative impacts on the food web (Lee, 2013;Ortman et al., 2012; Trannum and Bakke, 2012).

Impacts from a large spill response could be long-lasting and widespread for fish and invertebrate communities if a large spill occurs near spawning grounds or dispersants are used. Impacts from small spill response and spill drill activities would be localized and short-term, especially if pelagic individuals are able to avoid areas of activity. Impacts to the benthic community from spill response and spill drills would be limited spatially by the settling of oil and dispersants, and no population-level impacts are expected to be observable for the Cook Inlet overall.

A-3.5.4 Conclusion

Impacts from small spills would be minor because invertebrate and fish communities in the Cook Inlet would not generally experience widespread, multi-year, multi-generational impacts and there would not be a clear, long-lasting change in this resource's function in the ecosystem. In contrast, a large oil spill could have widespread and long-lasting, and therefore moderate, impacts depending on the season and location of the spill. Spills originating in the upper and middle portion of the Lease Sale Area have the greatest potential to affect fish and invertebrates through contact with oil. A large gas release would have negligible impacts on the overall community structure of fish and invertebrates in Cook Inlet. Spill response and cleanup could have minor to moderate impacts on fish and invertebrates, depending on where the spill is located and if dispersants are used. Spill drills are short-term and localized and are expected to have negligible impacts on fish and invertebrates.

A-3.6 Birds

Spills can have lethal and sublethal physiological and behavioral effects on birds, and indirect impacts via contamination and disturbance of prey resources and habitats. The impacts of oil spills on birds are well documented and the evidence for these impacts is briefly discussed below. In particular, potential oil spill impacts to birds include the following:

- Mortality or reduced fitness resulting from direct contact (Balseiro et al., 2005; Haney, Geiger, and Short, 2014a, b; Maggini et al., 2017; O'Hara and Morandin, 2010).
- Toxic (lethal or sublethal) reactions from inhalation, direct ingestion, or ingestion of contaminated prey (Balseiro et al., 2005; Bursian et al., 2017).
- Effects to migration and reproduction via physiological damage to adults (Dorr et al., 2019; Golet et al., 2002).
- Other productivity effects, such as via oil contamination of eggs and nest material or adults delivering contaminated prey to chicks (Stout et al., 2018; Zuberogoitia et al., 2006).
- Modified prey abundance (Esler et al., 2002; Golet et al., 2002; Irons et al., 2000).
- Damage to and displacement from foraging or molting habitat (Day et al., 1997; Esler et al., 2002; Henkel et al., 2014; Wiens et al., 2004).

- Disturbance and displacement of breeding or migrating birds, and nest failure from cleanup activities in nesting habitat (Andres, 1997; Fraser and Racine, 2016; DWH Trustees, 2016).

Additional discussion of the general impacts of oil and gas on birds is provided in the *Beaufort Sea: Hypothetical Very Large Oil Spill and Gas Release* report (BOEM, 2020, Section 4.2.8).

A-3.6.1 Small Oil Spills (<1,000 bbl)

Most of the 410 small spills are not expected to impact migratory birds. This is because some spills may be associated with vessels, vehicles, and heavy equipment, but birds typically move away from operational disturbances (EIS Section 4.7.2).

Some small spills, however, could affect foraging or nesting birds, localized areas of open water and wetland nesting habitat, or marine prey (Sections A-3.3.1, A-3.4.1, and A-3.5.1). The greatest impact could occur if there was chronic annual oiling in an important forage area or if the 125-bbl crude oil spill occurred where hundreds or more birds are densely concentrated or rapidly moving through an area (Fraser and Racine, 2016). Various groups of birds that could be immediately vulnerable include spring migrants in an open ice lead; dense flocks of foraging birds in pelagic waters or in summer near a seabird colony; molting ducks concentrated in the post-breeding period in nearshore waters; or migrating shorebirds and waterfowl staging in spring or fall in coastal habitat. Healthy populations would withstand the short-term and localized impacts of a one-time event (Henkel, Sigel, and Taylor, 2012).

A-3.6.2 Large Oil Spill (≥1,000 bbl)/Gas Release

The same bird concentrations described above as vulnerable to small spill impacts would likely experience the highest numbers of direct mortality if they were contacted by a large, 3,800 bbl spill. The species most vulnerable to a large marine spill are mostly pelagic seabirds, not only because of their long exposure time at sea, but because their long-lived, delayed maturation, and limited offspring life history strategies mean that the loss of relatively few breeding age adults can have population-level effects (Fraser and Russell, 2016). Additionally, harm to habitats and prey that could result from a large spill (Sections A-3.4 and A-3.5) could produce impacts to more birds and more bird populations even if those birds are not initially present during spill contact. As an example, a large spill may initially only contact (i.e., affect) seabirds and phalaropes in offshore waters and reach coastal mudflats at a time before abundant coastal species are present, but large numbers of staging shorebirds and waterfowl could later arrive on the mudflats and be affected by lingering oil or reduced or contaminated prey. This would not only increase the number of affected individuals but also the number of species and populations affected.

Spill timing and location as well as characteristics of spill response efforts influence the magnitude and extent of spill impacts to birds. For example, a terrestrial pipeline spill would have localized impacts on a variety of landbirds, shorebirds, waterfowl, raptors, and cranes if it occurred in preferred wetland habitat during the breeding season or if impacts to habitat persisted into the breeding season. Impacts to most locally breeding birds would generally be short-term and confined to the local area because most of these species have large and widely dispersed breeding distributions. However, a marine spill that occurred, for example, when certain seabirds are experiencing, or struggling to recover from, one of the increasingly common widespread breeding failures or starvation-related die-offs could potentially keep the population depressed for several years. A spill that contacted or decreased food availability for some of the largest colonies or flocks (e.g., Barren Islands colonies or molting or wintering Kamishak Bay flocks) could potentially impact enough birds of a given population or populations to affect them for several years. The combined analysis below estimates that the highest chances of occurrence and contact may be considered relatively low (i.e., <10 percent), but does include high population areas (e.g., Barren Islands). Contact with a large proportion of a vulnerable population or long-term damage to its habitat, such as Pribilof Island rock sandpiper and its wintering habitat in places like Redoubt Bay, would have long-term, potentially severe impacts. The combined analysis does show Redoubt Bay as among the areas with the highest, albeit still <4 percent, chance of a spill occurrence and contact.

Impacts to birds would not only be long-term but potentially widespread if dense flocks of staging, molting, or wintering birds are affected. This is because flocks during these periods are typically made up of migratory individuals from multiple widespread breeding populations. Birds' trophic relationships with multiple habitats can complicate and widen a spill's impacts (Henkel, Sigel, and Taylor, 2012). The conditional analysis below shows chances of contact are highest to some high-use breeding, molting, wintering, and migratory stop-over areas and pelagic resources.

A natural gas release would have potential to harm birds, but only if large numbers happened to be in the immediate vicinity at the time of certain types of release. A gas release with an ignition and explosion could physically injure staging or diving flocks of birds. Also, if the gas release was ignited at night or during a period of low visibility in spring or fall, the bright light could attract, disorient, and cause the collisions of many migrating species, including gulls and Endangered Species Act (ESA) listed Steller's eiders. Collision of a large flock of a vulnerable population could potentially have widespread and long-lasting impacts, but the chance of all predictive factors occurring together (e.g., explosion, low visibility conditions during heavy migration, and presence of a vulnerable population) is unlikely. Any flocks that actually were to fly through the release of natural gas would be unlikely to experience long-term impacts because of the quickly dissipating nature of the gas in air, and very low level of hydrogen sulfide or other toxins (Shell Gulf of Mexico Inc., 2015).

A-3.6.2.1 Oil Spill Risk Analysis

BOEM identified 48 bird resource areas for analysis (Ji and Smith, 2021; Table A.1-8; and Figures B-2a–d, and f– h; B-3a–c; B-4b). The OSRA acronyms are: ERA Environmental Resource Area; LS Land Segment; LA Launch Area; and PL Pipeline.

Conditional Probabilities. Table A7 and Figure A5 show that if a large spill occurred from any location in the summer or winter it would contact up to 21 of the 48 resource areas with a ≥0.5 percent chance. Up to 9 of those areas, have a ≥10 percent chance of contact (Ji and Smith 2021, Tables A-2.24, and A-2.44). Outer Kachemak Bay Important Bird Area (IBA) (145) and Lower Cook Inlet 153W59N IBA (146) are the only areas with ≥50 percent chance of contact, and up to 97 percent, depending on spill location (Ji and Smith 2021, Table A-2.24 and A.2.44). Depending on the season and spill location 4 resources areas in or adjacent to the Lease Sale Area are contacted ≥25–<50 percent. Those areas with <0.5 percent chance of contact are mostly coastal areas south of Shelikof Strait, or on the eastern shores of the Kodiak Archipelago and Kenai Peninsula. In general, there is a lower chance of winter spills contacting bird resource areas than summer spills because there is a temporal aspect to most bird resource areas, and seabird breeding colony sites are not active during winter.

Summer. The areas with the greatest chance of contact (>25 percent) for a summer spill are Outer Kachemak Bay/IBA (145), Kamishak Bay IBA (136), and Tuxedni Island Colony IBA (138), which means pelagic seabirds, seaducks, and phalaropes foraging offshore of the mouth of Kachemak Bay, numerous seabird colonies in Tuxedni Bay and Kamishak Bay, and molting seaducks in Kamishak Bay will be some of the most vulnerable marine birds. With a 6–<25 percent chance of contact, among the next most vulnerable would be Redoubt Bay and Shaw Island seabird colonies (140 and 135), seabirds foraging in Lower Cook Inlet (146), Steller's eider in nonbreeding habitat in the Clam Gulch vicinity (144), and the quarter of a million seabirds, including over 100,000 fork-tailed storm petrels and 17 other species, that nest on the Barren Islands (147 and 148) (Kettle, 2017). The OSRA estimates a >0.5–<6 percent chance that a summer spill would contact the foraging areas of western Kodiak Island (ERAs 111 and 112, and LS 87), seabird colonies in Shelikof Strait (130, 132, 133, and 134) and Semidi Islands (122), and extend east of Kodiak into Gulf of Alaska foraging areas (119).

Winter. The winter chances of contact follow roughly the same patterns as discussed above for a summer spill, with the following notable differences. Fewer resource areas would be contacted because the spill would have <0.5 percent chance of extending as far to the south down Shelikof Strait as in summer. Figure A2 shows that a summer spill may have >0.5 percent chance of contact as far south as Alinchak

Bay, Cape Kekumoi, Bear Bay (18), while a winter spill may only have >0.5 percent chance of contact as far south as Kaflia, Kukak, Kuliak, and Missak Bays (21). Furthermore, many bird resource areas are seabird colonies with a temporal component, meaning that large numbers of birds are most vulnerable in those areas only during the summer breeding season. There is still a >0.5 percent chance that a winter spill from the southern LAs or PLs would extend to the Gulf of Alaska (151) where hundreds of thousands of seabirds forage year-round.

Table A7: Highest Percent Chance of a Large Oil Spill Contacting Bird Resources (Assuming a Large Spill Occurs)[1]

OSRA Feature Type	Highest Percent Chance Contact	Summer: 30 days	Winter: 30 days
ERA	≥0.5–<6	111, 112, 119, 122, 130, 132, 133, 134, 137, 149, 151	151
ERA	≥6–<25	135, 139, 140, 144, 146, 147, 148	140, 144
ERA	≥25–<50	136, 138	137, 139
ERA	≥50	145	145, 146
LS	≥0.5–<6	87	87
Names of ERAs Contacted: 111 NW Afognak Is IBA; 112 Uganik And Viekoda Bay IBAs; 119 Gulf Of Alaska Shelf IBA; 122 Semidi Islands Marine IBA; 130 South Alinchak Bay Colony; 132 Amalik Bay Colonies IBA; 133 Ninagiak Is Colonies; 134 Kiukpalik Is ; 135 Shaw Is Colony; 136 Kamishak Bay IBA; 137 Kamishak Bay STEI Habitat; 138 Tuxedni Is Colony IBA; 139 Tuxedni Bay IBA; 140 Redoubt Bay IBA; 144 Clam Gulch STEI Habitat.; 145 Outer Kachemak Bay/IBA; 146 Lower Cook Inlet 153W59N; 147 Barren Islands Marine IBA; 148 Barren Islands Colonies IBA; 149 SW Kenai Pen Marine IBA; 151 Gulf of AK Shelf 151W58N IBA Names of LSs Contacted: 87 Uyak Bay			

Notes: [1] Highest percent chance from any launch area (LA) or pipeline area (PL) during summer or winter assuming a large spill occurs. Note that all resource areas with <0.5 percent chance of contact are not shown.
Source: Ji and Smith (2021).

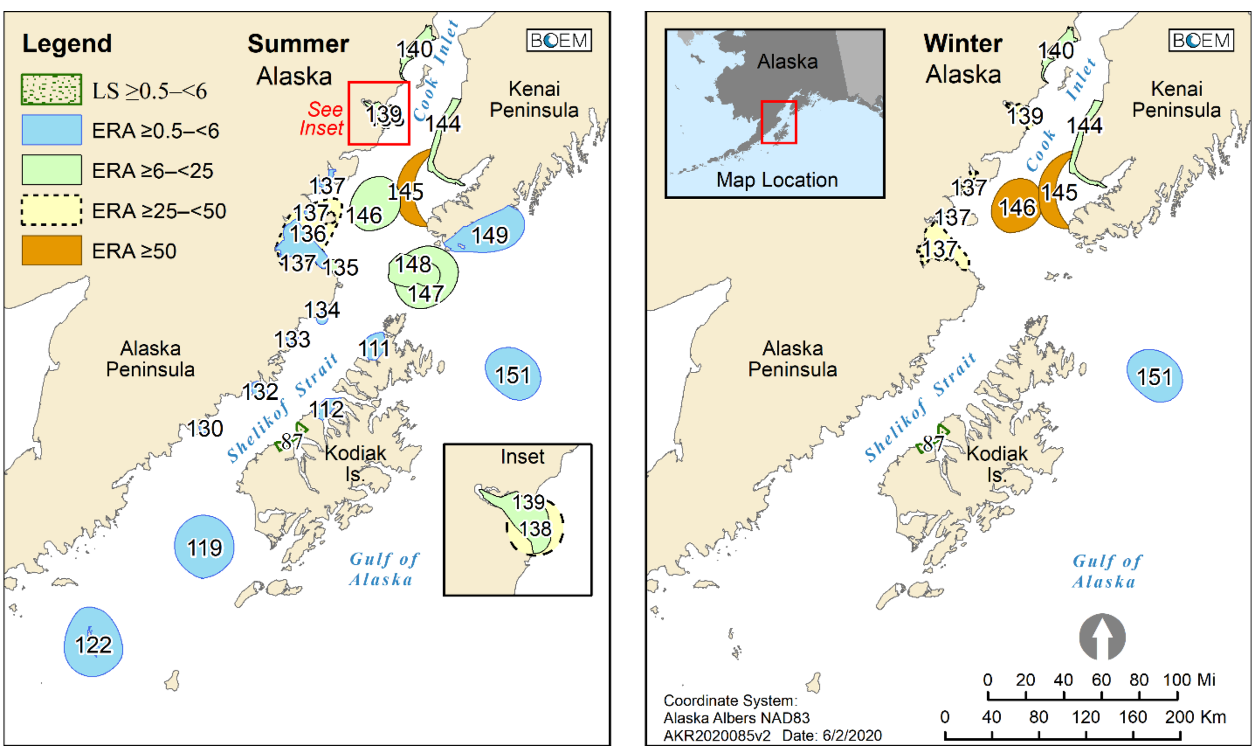

Figure A5: Location and ID number of Bird Resource Areas: (Assuming a Large Spill Occurs ≥1% Chance of Contact within 30 Days) Summer and Winter

Combined Probabilities. The OSRA estimates the highest chance of a large spill both occurring and contacting an important bird resource area is 9 percent within 10 days for Outer Kachemak Bay IBA (145) (Ji and Smith, 2021, Table A.2-61). There is a 1–5 percent chance of a large spill occurring and contacting 9 other resource areas within 30 days, including summer colony activity of Kamishak Bay IBA (136), Tuxedni Island Colony IBA (138), Barren Islands Marine IBA (147), and Barren Islands Colonies IBA (148); post-breeding and winter shorebird and waterfowl activity of Tuxedni Bay IBA (139); wintering seabird habitat of Lower Cook Inlet 153W59N IBA (146); and Steller's eider (and other seaduck) wintering habitat of Kamishak Bay (137) and Clam Gulch (144) (Ji and Smith, 2021, Table A.2-61). Redoubt Bay IBA (140) falls into this 1–5 percent category as well where seabird, waterfowl, and shorebird resources could be at risk year-round. Redoubt Bay IBA shorebirds include a large proportion of the world's population of Pribilof Island rock sandpiper which shelters in Redoubt and Tuxedni bays when the coldest winter days push them south from the Susitna Flats/Trading Bay areas (Ruthrauff, Gill, and Tibbitts, 2013).

A-3.6.3 Spill Drills and Response Activities

Spill drills, including GIUEs, would be infrequent, localized at areas of high human activity, and are expected to have little effect on birds. Spill response operations, however, can impact birds. The dense concentrations of birds most vulnerable to oil can also be fouled by burn residue from in-situ burning and the emulsions of oil created by dispersants and suspended in the water column (Chen and Denison, 2011; Fritt-Rasmussen, Wegeberg, and Gustavson, 2015). Depending on timing and location, large concentrations of nesting, molting, or staging birds may be disturbed or displaced during spill cleanup operations in or near oil-affected onshore and nearshore habitats. Nests, especially those of shorebirds, waterfowl, landbirds, and cranes, could be destroyed (Andres, 1997; Harwell and Gentile, 2006; Jenssen, 1994). Besides spill characteristics, the size and extent of spill response impacts on birds ultimately depends on techniques, siting in relation to bird seasonal timing and densities, efficacy of cleanup, and how many seasons response activities may last.

A-3.6.4 Conclusion

Most accidental small spills or spill drills would be localized and limited in area and have no more than minor impacts on birds. A large spill that contacts many marine birds or reaches coastal areas could have impacts that are more persistent, require remediation, and impact a greater number of birds and species. If it occurred during a period of high bird use in coastal waters, it would be expected to foul large numbers of staging and migrating birds from widespread populations. Foraging, resting, and sheltering habitat for staging, migrating, and nesting birds would be fouled, with mechanical damage to foraging habitat and possibly nests during the cleanup process. Some populations that experience spill-related effects to large numbers of birds would be expected to take several years to recover. Long-term damage to otherwise vulnerable seabird breeding populations (e.g., chronically failing murres and black-legged kittiwakes) would be possible. The long-term and widespread impacts from a large spill would be considered less than severe, and therefore moderate, for most species because the various populations affected would be expected to eventually recover. Depending on location and timing however, contact with wintering rock sandpipers or their habitat would have potentially major population-level impacts. Spill response would typically have short-term and localized displacement-related impacts, but impacts would range up to long-term and moderate if involving both marine and land-based activities when large concentrations of birds are present or nesting. In the unlikely event that migrating or staging birds were within the vicinity of a gas explosion, a few hundred individuals from disparate populations could be killed, which would have a localized and minor level of impact on bird resources as a whole.

A-3.7 Marine Mammals

Oil spills can affect marine mammals, their habitats, and their prey through a variety of direct and indirect pathways which can have both long-term individual impacts and population-level impacts depending on the spill size, location, and environmental factors present at the time of the spill (Helm et al., 2015). An oil spill affects each group of marine mammals differently. Marine mammals live in offshore and nearshore waters and could be exposed to spilled oil at sea. Seals, sea lions, and sea otters can also be exposed to spilled oil at terrestrial nearshore areas. The effects of oil spills on marine mammals have been observed in studies on spill effects and from controlled experiments on marine mammals. These effects include, but are not limited to, the following:

- Short- and long-term respiratory effects such as pulmonary emphysema and inflammation and infection of respiratory tissue through inhalation of VOCs from crude oil or natural gas (Geraci and St. Aubin, 1990; Godard-Codding and Collier, 2018; Hansen, 1985; Helm et al., 2015; Neff, 1990; Schwacke et al., 2014).
- Inflammation, ulcers, bleeding, and damage to organs from ingestion of oil (and dispersants) directly or via contaminated prey. However, some marine mammals may metabolize and eliminate hydrocarbons (Engelhardt, 1982, 1983; Geraci and St Aubin, 1990; Kooyman, Gentry, and McAlister, 1976).
- Irritation, inflammation, or necrosis of skin, as well as chemical burns of skin, eyes, and mucous membranes from dermal contact (Hansen, 1985; Engelhardt, 1982, 1983; Werth, Blakeney, and Cothren, 2019).Venues of dermal contact include oiling of whale baleen, fur on sea otters, oiling of skin, eyes, conjunctive membranes, and cetacean blowholes.
- Elevated cortisol and altered endocrine levels in some individual marine mammals from exposure to hydrocarbons (Geraci and St Aubin, 1990).
- Short- and/or long-term reductions in prey availability, habitats, and populations (USFWS, 2015a; Section A-3.4).
- Disruption of social groups leading to decreased survival and lowered reproductive success (Geraci and St Aubin, 1990; Matkin et al., 2008).
- Habitat degradation (Geraci and St Aubin, 1990; Hoover-Miller, Parker, and Burns, 2001; Helm et al. 2015).
- Delayed recovery of habitat from chronic exposure to residual oil components, which could produce lingering effects on marine mammals (Peterson et al., 2003).
- Disturbance or displacement from cleanup crews, vessels, or aircraft during spill response activities (USFWS, 2015a NMFS, 2019; Ziccardi et al., 2015).

Additional discussion of the general impacts of oil and gas on whales, seals and -other marine mammals is provided in the respective sections below and is detailed in the *Beaufort Sea: Hypothetical Very Large Oil Spill and Gas Release* report (BOEM, 2020, Section 4.2.6).

A-3.7.1 Cetaceans

Beluga, killer, and minke whales, Dall's and harbor porpoises, and Pacific white-sided dolphins are resident cetaceans that occur in Cook Inlet throughout the year. Fin, gray, and humpback are migrant cetaceans that occur in Cook Inlet from spring to fall and could only be directly affected by oil spills in that window of time. Fin, gray, and humpback whales migrate from and to their wintering areas in spring and fall respectively. Gray whales usually pass by the outlet of Cook Inlet on their way to and from their primary summer feeding areas in the Bering and Chukchi seas. Some fin and humpback whales return specifically to Cook Inlet for summer feeding, while others periodically show up near the Lease Sale Area to feed. Cook Inlet beluga whales spend most of the ice-free months feeding on aggregations of anadromous fish in upper Cook Inlet, north of Kalgin Island. When ice begins forming in the inlet, these whales relocate to lower Cook Inlet. Killer and minke whales, Dall's and harbor porpoises, and Pacific white-sided dolphins occasionally show up in different parts of Cook Inlet throughout the year, as sea ice permits.

A-3.7.1.1 Small Oil Spills (<1,000 bbl)

Small spills in winter would occur when most whales are absent. Beluga whales would be present in Lower Cook Inlet, as might a few killer whales, Dall's and harbor porpoises, and Pacific white-sided dolphins. Small, refined spills dissipate in less than 2 days while portions of a 125-bbl crude oil spill could persist up to a month (Table A1). These small spills would be localized in extent and could be cleaned up.

In the event of a small spill during summer, individual whales or their prey could come into contact with oil. Temporary exposures to small spills over highly localized areas would be infrequent with few consequences. Since oil poorly adheres to cetacean skin, chronic impacts from epidermal contact would be unlikely for them (Engelhardt, 1983; Geraci and St Aubin, 1986). Furthermore, small spills occurring over localized areas could only affect small quantity of prey resources. For these reasons the impacts of small spills would not affect cetacean populations and would have a very limited ability to affect individual cetaceans. Because small spills dissipate or are cleaned up rapidly, the likelihood of impacting cetaceans or their populations would be further reduced.

A-3.7.1.2 Large Oil Spill (≥1,000 bbl)/Gas Release

Large spill (3,800 bbl) impacts to whales would depend on the location, timing, duration, sea and climatic conditions, and response to the spill event. There is little potential to impact large numbers of cetaceans which are few in number inside lower Cook Inlet at any time; however the small population sizes for belugas, humpback, fin and North Pacific right whales in or near Cook Inlet means adverse impacts to a small number of individuals could lead to a cascade of impacts to their populations. The magnitude of such a cascade would vary based on the type of impact, the overall stock/population size, number of individuals affected, and the genetic diversity in the population. The conditional analysis below shows probability of contact is highest for cetacean resource areas near the outlet of Cook Inlet Shelikof Strait, and the southern Kenai coastline in summer. The probability of a large spill contacting summer Critical Habitat for Cook Inlet beluga whales, or areas in the upper inlet where they usually occur in summer, remains low so individuals from their population are less likely to be impacted by a large summer spill than individuals of other cetacean species who regularly occur in the Lease Sale Area and nearby areas. A large spill in winter could affect belugas and their winter Critical Habitat areas, and such an event could have major impacts on the stock due to the small population size and their restricted winter range in the inlet.

Although individuals may experience temporary and/or permanent injury and non-lethal impacts through inhalation, ingestion, or contact, mortality would be unlikely. Temporary displacement from high value feeding and resting areas might occur, depending on spill characteristics. Whale prey (schooling forage fish and zooplankton) could be reduced or contaminated leading to modified whale feeding distributions. However, reduction or contamination of food sources would be localized relative to the available prey in Cook Inlet and the Gulf of Alaska. This effect on discrete food sources could be short- or long-term but would not likely have population-level impacts on whales or their prey. The seasonal presence of migrant whale species such as fin, gray, and humpback whales, means the likelihood of them contacting a large spill must occur between late spring and early fall when they are present. Resident cetaceans such as beluga, killer, and minke whales, Dall's and harbor porpoises, and Pacific white-sided dolphins could be affected by a large spill at any time; however, they only occur in small numbers within the inlet, and belugas spend most of the year in the upper inlet areas of Knik and Turnagain Arms, away from the Lease Sale Area. For these reasons, population-level impacts to these species would be unlikely.

A gas release during winter would not affect migrant whales since they would be absent from the inlet. A gas release during spring, summer, or fall could expose some cetaceans to natural gas at high concentrations. However, natural gas VOCs would disperse rapidly upon release, and it is unlikely many individuals of any species would be close enough to the gas release site to be affected. A gas release could temporarily reduce the available food for whales in a small, localized area (Section A-3.5.2).

Oil Spill Risk Analysis

BOEM identified 51 cetacean resource areas for the analysis (Ji and Smith, 2021; Table A.1-4; and Figures B-1a, B-2a–g). The OSRA acronyms are ERA Environmental Resource Area and LA Launch area.

Conditional Probabilities. Cetacean species are collectively addressed for the conditional analysis. Table A8 and Figure A6 show 33 and 23 cetacean resource areas with a ≥0.5 percent chance of contact in summer and winter respectively. Some biologically important areas for whales are not estimated to be contacted (<0.5 percent) or have a <6 percent chance of contact. This analysis focuses on those areas having a ≥6 percent chance of contact in summer (20) or winter (11) shown in Figure A6. For all LAs, there is a lower chance of contacting cetacean resource areas in the winter than in the summer when more habitat is occupied, and migrant cetaceans are present. Figure A6 shows resource areas located in western Cook Inlet coastal areas have the greatest chances of contact and resource areas between Kachemak Bay and Shelikof Strait-Kodiak Island have the second highest chances of contact.

Summer. Within 30 days a large spill has the highest chance (≥50 percent) of contacting the Cook Inlet 4- Harbor Porpoise (104) and West Cook Inlet-Beluga Critical Habitat (CH) (72). To a lesser extent, the Middle Cook Inlet-Beluga CH (71), Kachemak-Humpback Whale (75), Shelikof MM 1 (80), Barren Islands-Fin Whale (90), Cook Inlet 2-Harbor Porpoise (102), Cook Inlet 3-Harbor Porpoise (103), and Cook Inlet 5-Harbor Porpoise (105) had chances of contact ranging from ≥25–<50 percent.

Winter. Within 30 days a large spill has the highest chance of contacting (≥50 percent) the Cook Inlet-Beluga CH (72). Other cetacean resource areas showing higher chances of contact are Middle Cook Inlet-Beluga CH (71), Shelikof MM 1 (80), and Barren Islands-Fin Whale (90).

Table A8: Highest Percent Chance of a Large Oil Spill Contacting Cetacean Resources (Assuming a Large Spill Occurs)[1]

OSRA Feature Type	Highest Chance of Contact	Summer: 30 days	Winter: 30 days
ERA	≥0.5–<6	70, 73, 78, 84, 85, 86, 87, 89, 91, 92, 97, 99, 109	16, 26, 27, 70, 76, 78, 89, 91, 94, 97, 99, 109
ERA	≥6–<25	16, 76, 77, 81, 82, 83, 94, 95, 98, 101, 108	24, 25, 75, 77, 95, 98, 108
ERA	≥25–<50	71, 75, 80, 90, 102, 103, 105	71, 80, 90
ERA	≥50	72, 104	72
Names of ERAs Contacted: 16 Inner Kachemak Bay; 24 Shelikof MM 2; 25 Shelikof MM 3; 26 Shelikof MM 4; 27 Shelikof MM 5; 70 Forelands-Beluga CH; 71 Middle Cook Inlet-Beluga CH; 72 West Cook Inlet-Beluga CH; 73 NPRW Feeding Area; 75 Kachemak-Humpback Whale; 76 Shelikof-Humpback Whale; 77 N Kodiak-Humpback Whale; 78 E Kodiak-Humpback Whale; 80 Shelikof MM 1; 81 Shelikof MM 1a; 82 Shelikof MM 2a; 83 Shelikof MM 3a; 84 Shelikof MM 4a; 85 Shelikof MM 5a; 86 Shelikof MM 6a; 87 Shelikof MM 9; 89 Shelikof MM 11; 90 Barren Islands-Fin Whale; 91 NE Kodiak-Fin Whale; 92 Kodiak-Gray Whale Feeding; 94 Lower E Kenai-Gray Whale; 95 NE Kodiak-Gray Whale; 97 SE Kodiak-Gray Whale; 98 Shelikof-Gray Whale; 99 N Shumagin-Gray Whale; 101 Cook Inlet 1-Harbor Porpoise; 102 Cook Inlet 2-Harbor Porpoise ; 103 Cook Inlet 3-Harbor Porpoise; 104 Cook Inlet 4-Harbor Porpoise; 105 Cook Inlet 5-Harbor Porpoise; 108 Shelikof-Killer Whale; 109 E Kodiak-Killer Whale.			

Notes: [1] Highest percent chance from any launch area (LA) or pipeline area (PL) during summer or winter assuming a large spill occurs. Note that all ERAs with <0.5 percent chance of contact are not shown.
Source: Ji and Smith (2021).

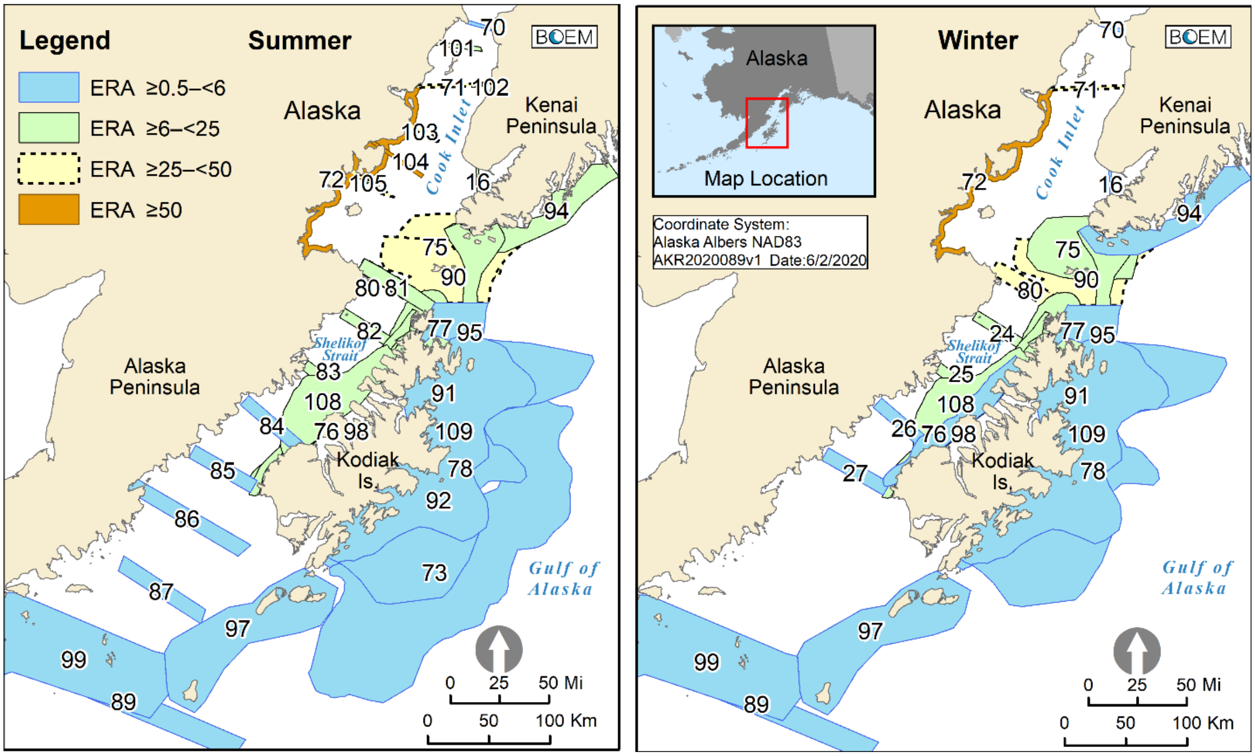

Figure A6: Location and ID number of Cetacean Resource Areas (Assuming a Large Spill Occurs ≥1% Chance of Contact within 30 Days): Summer and Winter

Combined Probabilities. Combined probabilities for 30 of 51 cetacean resource areas are <0.5 percent and 19 are ≥1–<6 percent (Ji and Smith, 2021, Table A.2-61). The OSRA estimated the highest chance of a large spill both occurring and contacting is 11 percent within 30 days to the West Cook Inlet-Beluga CH (72) (Ji and Smith, 2021, Table A.2-61).

A-3.7.1.3 Spill Drills and Response Activities

Spill drills, including GIUEs, would result in short-term and localized displacement of cetaceans due to increased vessel activity and disturbance. Whales would be expected to resume their normal activities after the drills are complete.

The National Oceanic and Atmospheric Administration (NOAA) developed oil spill response guidelines for whales and noted that most impacts to whales from spill response activities would likely be from vessel and aircraft presence (NMFS, 2019). Cleanup activities could involve multiple marine vessels operating in the spill area for extended periods of time. As noted in the discussion of impacts associated with vessel traffic (EIS Section 4.8.2), whales may react to the approach of vessels with avoidance behavior, and potential for whale-vessel collisions could increase. Whales would likely avoid the louder noises related to a spill response, reducing the potential for them contacting oil; however, porpoises and dolphins sometimes seek out vessels in order to play. After an oil spill, helicopter and fixed-wing aircraft overflights would typically be used to track the spill and to monitor distributions of marine wildlife. Impacts to cetaceans from aircraft encounters would be transient, and animals would typically resume normal activities after aircraft leave the area. Depending on the spill location, oil spill response could take some time to mobilize vessels and aircraft. Any delay in the cleanup activities could increase the number of individual cetaceans exposed to spilled oil.

Cleanup and response activities could result in localized, short- or long-term displacement of cetaceans and their prey from preferred habitats and disturbance through increased human interactions. Conversely, response activities would also decrease the likelihood of contact with oil by removing oil from the environment and displacing animals from oiled areas. The use of dispersants, while not immediately harmful to cetaceans, can create disruptions in food webs (Section A-3.5). While there would likely be impacts to individual animals, these activities and their potential impacts to whales, porpoises, or dolphins would not have population level effects.

A-3.7.1.4 Conclusion

Due to small size, localized and temporary impacts, and rapid weathering, it is expected that small spills would not impact cetacean populations. Depending on the spill location, timing, and duration, the sea and climatic conditions, and the spill response, a 3,800 bbl large spill would have inconsequential impacts on whale populations, with the possible exception of Cook Inlet belugas. Although unlikely, a large spill contacting aggregations of Cook Inlet belugas could have permanent and adverse population-level effects due to the small number of individuals in the population. A large gas release, cleanup and response activities, and spill drills would also have inconsequential impacts on cetacean populations.

A-3.7.2 Pinnipeds

Harbor seals and Steller sea lions occur in the Lease Sale Area and could be affected by oil spills at any time of year. They occur throughout lower Cook Inlet though both use coastal haulouts, and mostly remain in shallower coastal areas. Both species feed on fishes throughout the water column. Harbor seals in the inlet belong to the Cook Inlet-Shelikof Strait stock and Steller Sea Lions belong to the Western Distinct Population Segment (DPS).

A-3.7.2.1 Small Oil Spills (<1,000 bbl)

Few individual seals or sea lions would be expected to be contacted by small spills given the spills' limited size and extent. Furthermore, seals have demonstrated an ability to eliminate small amounts of ingested crude oil from their bodies (Geraci and St. Aubin, 1990). Seals and sea lions would not likely be harmed by small spills, because spills would be cleaned up, or disperse and weather quickly, limiting the duration and severity of any exposures.

A-3.7.2.2 Large Oil Spill (≥1,000 bbl)/Gas Release

Impacts to pinnipeds from a large, 3,800 bbl spill would depend on the location, timing, and duration of the spill, sea and climatic conditions, and spill response. The conditional analysis below shows the chance of contact in summer or winter is highest for areas of western Cook Inlet, particularly in and around Kamishak Bay (Figure A6), but less likely around Kalgin Island and Kachemak Bay.

A large spill in open water would only affect a few seals or sea lions before cleanup and weathering would occur, and impacts would be temporary and mildly injurious, with no lingering impacts to individuals.

A gas release could expose some seals and sea lions to natural gas at high concentrations through inhalation, ingestion, and physical contact. However, rapid atmospheric dispersion and a short residence time of gas in the ocean would reduce the window for potential contacts with pinnipeds, and the severity of those contacts. It is unlikely more than a few individuals present near a gas release would be affected, and the impacts on harbor seals and Steller sea lions would consist of temporary prey reduction over a localized area (Section A-3.5.2). For these reasons, the impacts of a gas release on pinnipeds would be short-term, localized, and non-injurious.

Oil Spill Risk Analysis

BOEM identified 34 pinniped resources for the analysis (Ji and Smith, 2021; Table A.1-5; Figures B-2a–e, h). The OSRA acronyms are ERA Environmental Resource Area.

Conditional Probabilities. Table A9 and Figure A7 show harbor seal and Steller sea lion resource areas with a ≥1 percent chance of contact in summer and winter. Many areas were not contacted (<0.5 percent) or have a <6 percent chance of contact. This analysis focuses on resource areas with a ≥6 percent chance of contact (Table A9). For conciseness, only areas with chances of contact within 30 days and are ≥25 percent are discussed.

Summer. Within 30 days Augustine (11), South Cook HS 1a (12), South Cook HS 1b (13), South Cook HS 1c (14), and Clam Gulch HS (17) have a ≥50 percent chance of contact. The pinniped resource areas having the next highest chances of contact were South Cook HS 1d (15) and Tuxedni HS (18), with a chance of contact ≥25–50 percent. The greatest chances of contact were to the western portions of lower Cook Inlet. Areas with lower chances of contact occurred outside of Cook Inlet, mostly around the Barren Islands and in Shelikof Strait. Spills contacting those areas could affect Steller sea lions which have rookeries there, but the chances of contacting any area outside of Cook Inlet are <25 percent, with most <6 percent.

Winter. A large oil spill occurring in winter has similar chances of contacting pinniped resource areas as described for summer except the Clam Gulch HS (17) increases to ≥50 percent chance and three resources, in northern Cook Inlet (16, 20) and central Shelikof Strait (26), are contacted slightly less.

Table A9: Highest Percent Chance of a Large Oil Spill Contacting Seal and Sea Lion Resources (Assuming a Large Spill Occurs)[1]

OSRA Feature Type	Highest Chance of Contact	Summer: 30 days	Winter: 30 days
ERA	≥0.5–<6	21, 27, 28, 29, 30, 31, 32, 37, 38, 43	16, 20, 26, 27, 28, 29, 30, 31, 37, 43
ERA	≥6–<25	16, 19, 20, 23, 24, 25, 26	19, 23, 24, 25
ERA	≥25–50	15, 18	15, 17, 18
ERA	≥50	11, 12, 13, 14, 17	11, 12, 13, 14
Names of ERAs Contacted: 11 Augustine; 12 South Cook HS 1a; 13 South Cook HS 1b; 14 South Cook HS 1c; 15 South Cook HS 1d; 16 Inner Kachemak Bay; 17 Clam Gulch HS; 18 Tuxedni HS; 19 Kalgin Island HS; 20 Redoubt Bay HS; 21 Trading Bay HS; 23 Barren Is. Pinniped; 24 Shelikof MM 2; 25 Shelikof MM 3; 26 Shelikof MM 4; 27 Shelikof MM 5; 28 Shelikof MM 6; 29 Shelikof MM 7; 30 Shelikof MM 8; 31 Kodiak Pinniped 1; 32 Kodiak Pinniped 2; 37 Port Chatham Pinniped; 38 Port Dick Pinniped; 39 Two-Arm Bay Pinniped; 43 AK Peninsula Pinniped 1			

Notes: [1] Highest percent chance from any launch area (LA) or pipeline area (PL) during summer or winter assuming a large spill occurs. Note that all resource areas with <0.5 percent chance of contact are not shown.
Source: Ji and Smith (2021).

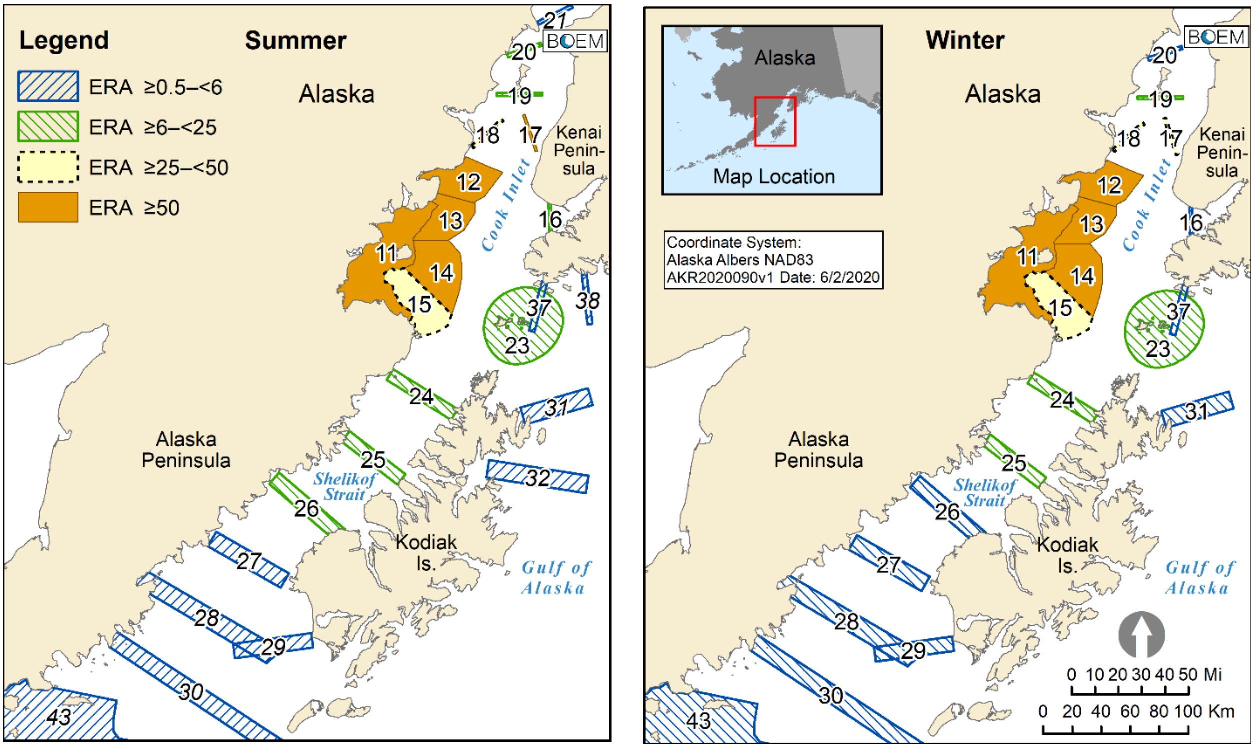

Figure A7: Location and ID number of Seal and Sea Lion Resource Areas (Assuming a Large Spill Occurs ≥1% Chance of Contact within 30 Days): Summer and Winter

Combined Probabilities. Harbor seal resource areas Augustine (11), South Cook HS 1a (12), South Cook HS 1b (13), South Cook HS 1c (14), and Inner Kachemak Bay (16) have 6–13 percent combined probabilities. However, the remaining resource areas for harbor seals and Steller Sea lions are <6 percent with most <3 percent (Ji and Smith, 2021, Tables A.2-61).

A-3.7.2.3 Spill Drills and Response Activities

Spill drills, GIUEs, and spill response activities could disturb and displace pinnipeds from affected marine and coastal areas. Vessel and aircraft traffic, and activities such as in-situ burning, animal rescue, and the use of skimmers and booms could displace or stress individuals. Typical responses of pinnipeds to any of these disturbances would consist of leaving the local area for the duration of the disturbance.

The use of dispersants is unlikely to have any immediate direct impacts on harbor seals or Steller sea lions; however, there may be some adverse consequences from using certain types of dispersants which may affect the food web (Section A-3.5), and the long-term impacts of dispersant use may extend beyond the contaminated area to varying degrees.

Because impacts would be limited to temporary avoidance of an area for the duration of the disturbance, no injuries to pinnipeds from spill drills, GIUEs, and spill response would be expected. For spill responses, any negative short-term impacts from disturbance would be outweighed by beneficial impacts from intentionally or unintentionally deterring individual animals away from oiled areas, resulting in little or no impacts to harbor seals or Steller sea lions.

A-3.7.2.4 Conclusion

Small and large oil spills, and a large gas release would not impact pinniped populations because of the limited spatial area contacted, weathering processes, short duration of potential contact incidents, and the mostly temporary duration of impacts on individual pinnipeds, though impacts to a few individuals from a large oil spill could be lethal. Spill response and cleanup would produce disturbances displacing harbor seals and Steller sea lions from oiled areas while removing oil from the environment. However, if spill response were delayed or precluded, a greater number of individual pinnipeds could be exposed to oil. This OSRA demonstrates the likelihood of spilled oil contacting haulouts for either species would be remote, though some CH for the Western DPS of Steller Sea lions could become oiled. Overall, impacts to pinniped populations from large oil spills would be non-injurious, temporary, and non-chronic, though impacts to a few individuals could be fatal.

Sea Otters

Sea otters occur in the Cook Inlet area year-round and could be affected by oil spills during any season. The potential impacts would be greatest near the coastlines of lower Cook Inlet where sea otters aggregate, particularly in CH for the Southwestern Alaska sea otter stock.

A-3.7.2.5 Small Oil Spills (<1,000 bbl)

While a small spill could contact individual sea otters or their prey, contact remains unlikely because most small spills would cover a small area. Moreover, spills would be cleaned up quickly and cleanup activities would deter sea otters from entering the areas further reducing the likelihood of impacts.

Small spills would also be contained or weather quickly, further reducing chances of contacting a sea otter. If a small spill were to contact sea otters some could perish if their pelts became saturated with oil. Consequently, the impacts of small spills on small numbers of sea otters would be short-term, localized, and most likely inconsequential.

A-3.7.2.6 Large Oil Spill (≥1,000 bbl)/Gas Release

The extent of impact of a large oil spill to sea otters would be influenced greatly by the volume, trajectory, and timing of the spill as well as the residence time of spilled oil in the environment. (Helm et al., 2015). The likelihood of individual sea otters being contacted by spilled oil varies with individual responses to the spill, currents and tides, spill volumes, spill locations, coastal topography, and weather patterns (Geraci and St. Aubin, 1990; Garrott et al., 1993).

A large spill contacting sea otter habitat could compromise its future value to sea otters as hunting, resting, and reproduction habitat and may require a decade or more for populations to recuperate (Ballachey et al. 2014; Monson et al. 2000; Garshelis and Johnson, 2013). If a large spill were to contact a sea otter aggregation area such as feeding areas, higher numbers of fatalities could occur (DeGange et al., 1995).

A pipeline gas release would rapidly disperse into the atmosphere, so the event would not directly impact sea otters unless the gas ignites or explodes, or if they inhale hazardous concentrations of gas. Although high concentrations of natural gas could be hazardous to sea otters in the short-term, the VOCs would rapidly disperse from the release site, for this reason it is unlikely any sea otters, other than those immediately around a gas release, would be impacted.

Other impacts of a gas release would be short-term disturbances from response and possible localized prey reduction for sea otters in the area. An explosion could kill or injure nearby sea otters. For these reasons a pipeline release of gas would not impact sea otter populations. The conditional analyses show contact in summer and winter is most likely along the western coast of Cook Inlet, particularly the CH areas around Kamishak Bay and adjacent areas, including islands, and areas around Kachemak Bay. Gas releases in the Lease Area would not likely affect sea otters.

Oil Spill Risk Analysis

BOEM identified 43 sea otter resource areas for the analysis (Ji and Smith, 2021; Table A.1-6; Figures B-2a, b, e, f, h, 3a-c, and 4b). The OSRA acronyms are: ERA Environmental Resource Area; LS Land Segment; and GLS Grouped Land Segment.

Conditional Probabilities. Table A10 and Figure A8 show 23 sea otter resource areas with a ≥1 percent chance of contact in summer or winter. The areas with the greatest chance of contact occurred in western portions of lower Cook Inlet and to a lesser degree, the entrance of Kachemak Bay and Clam Gulch.

Summer. Within 30 days a large oil spill has a ≥50 percent chance of contacting Outer Kachemak Bay (46); SW Cook Inlet (47); or Kamishak Bay (48). The remaining resource areas identified for sea otters have <25 percent chances of contact.

Winter. Table A10 and Figure A8 show roughly the same patterns as discussed above for a summer spill, with the following notable differences. The chance of contact to Clam Gulch (45) increases and Outer Kachemak Bay (46) decreases to ≥25–<50 percent. The remaining resource areas identified for sea otters would have chances of contact at <25 percent, with most at <6 percent.

Table A10: Highest Percent Chance of a Large Oil Spill Contacting Sea Otter Resources (Assuming a Large Spill Occurs)[1]

OSRA Feature Type	Highest Chance of Contact	Summer: 30 days	Winter: 30 days
ERA	≥0.5–<6	50, 51, 59, 60, 65, 66	50, 57, 59, 60, 65
ERA	≥6–<25	45, 49, 64, 67, 68	49, 64, 67, 68
ERA	≥25–<50	--	45, 46
ERA	≥50	46, 47, 48	47, 48
LS	≥0.5–<6	84, 86, 87	84, 86, 87
LS	≥6–<25	35	35
GLS	≥0.5–<6	124, 152, 159	124, 152, 159
GLS	≥6–<25	141	141

Names of ERAs Contacted: 45 Clam Gulch; 46 Outer Kachemak Bay; 47 SW Cook Inlet; 48 Kamishak Bay; 49 Katmai NP; 50 Becharof NWR; 51 Alaska Peninsula NWR- N; 57 Trinity Islands; 59 Kodiak NWR-south; 60 Kodiak NWR-west; 64 Afognak-west; 65 Afognak-north; 66 Afognak-east; 67 Shuyak; 68 Kenai Fjords-west
Names of LSs Contacted: 35 Chisik Island; Tuxedni Bay; 84 Malina Bay; Raspberry Island; Raspberry Strait; 86 Uganik Bay Uganik Strait; Cape Ugat; 87 Cape Kuliuk; Spiridon Bay; Uyak Bay
Names of GLSs Contacted: 124 Kukak Bay; 141 Seldovia side Kachemak Bay; 152 Barren Islands; 159 Kupreanof Strait

Notes: [1] Highest percent chance from any launch area (LA) or pipeline area (PL) during summer or winter assuming a large spill occurs. Note that all resource areas with <0.5 percent chance of contact are not shown.
-- No highest percent chance in this range.
Source: Ji and Smith (2021).

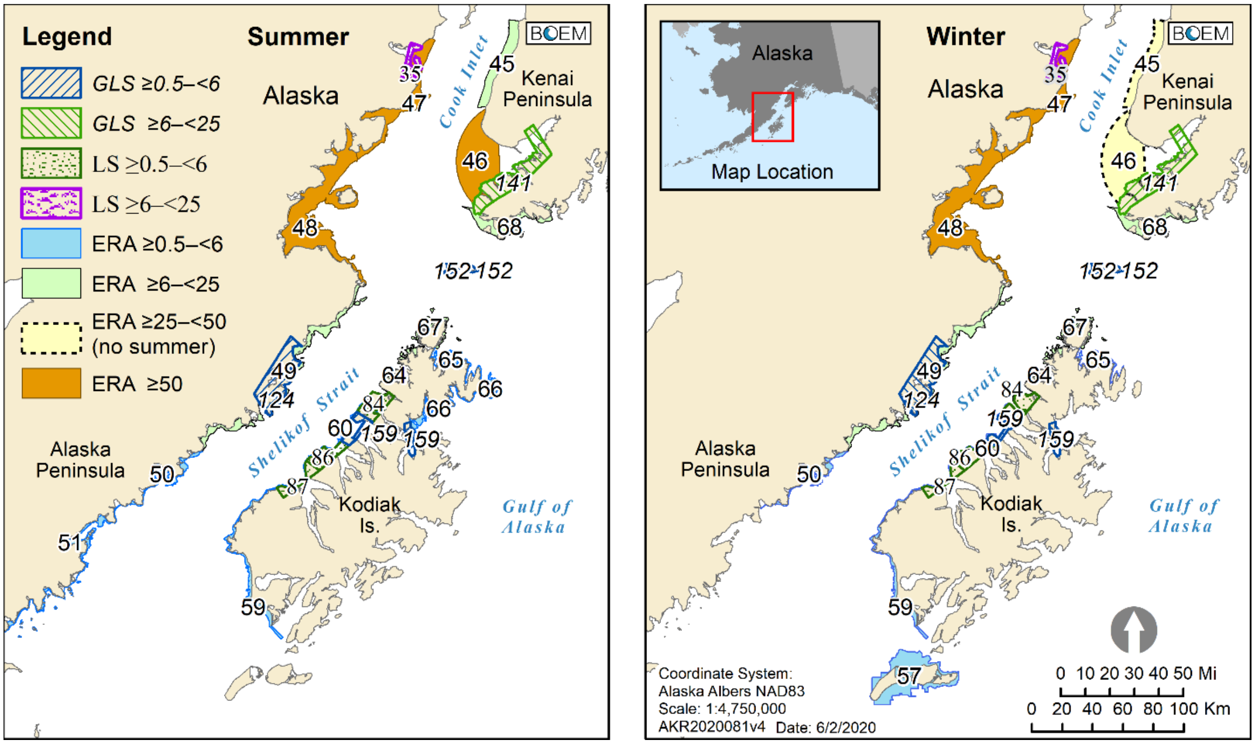

Figure A8: Location and ID number of Sea Otter Resource Areas (Assuming a Large Spill Occurs ≥1% Chance of Contact within 30 Days): Summer and Winter

<u>Combined Probabilities</u>. Combined probabilities for 33 of 43 sea otter resource areas are <0.5 percent and 8 are <6 percent (Ji and Smith, 2021, Tables A.2-61). The estimated percent chance of occurrence and contact within 30 days to sea otter resource areas was greatest for SW Cook Inlet (47) (6 percent) and the Outer Kachemak Bay/IBA (46) (10 percent), which are areas adjacent to the Lease Sale Area.

A-3.7.2.7 Spill Drills and Response Activities

Spill drills, including GIUEs, and spill responses would result in short-term displacement of sea otters from habitats due to increased human interaction and disturbance. Sea otters are expected to resume normal behaviors after the activities conclude. Standard monitoring practices and approved deterrence procedures to move sea otters away from areas of activity would further limit adverse impacts. Impacts associated with response activities were analyzed in the *Biological Opinion for the Alaska Federal/State Preparedness Plan for Response to Oil & Hazardous Substance Discharges/Releases* (USFWS, 2015a).

Some sea otters may be curious and approach personnel who are in vessels. Typically, authorizations from the U.S. Fish and Wildlife Service (USFWS) include hazing as a method of keeping sea otters away from oiled areas. Oiled individuals may be captured and transported for cleaning and treatment (USFWS, 2015a; NMFS, 2019). Although deterrence would likely cause stress and disturbance among individuals, such events would be infrequent so large numbers of individuals would not be affected.

Spill drills and response activities could range from little to no impacts, to infrequent, temporary, and short-term disturbance or displacement of individual sea otters and their prey from preferred habitats. Delays in spill response could cause additional otters to make contact with spilled oil.

A-3.7.2.8 Conclusion

Small spills would not impact sea otter populations, though some individuals could perish. Overall, depending on the trajectory and timing of a large spill, and the residence time of oil in the environment, a large spill could have lethal impacts to sea otters in localized areas, but small and temporary effects on either stock of sea otters. A gas release could be fatal to a small number of sea otters if their pelts became fouled with condensate; however, population-level impacts would not occur. Spill drills and response activities would not produce population-level impacts, mostly disturbing sea otters near drill and response activities.

A-3.7.3 Overall Marine Mammal Conclusion

Small oil spills, a large gas release, spill drills, and spill response are expected to have limited potential to affect marine mammal populations. Due to the relatively small size of the area affected, weathering processes in Cook Inlet, the short duration of incidents, and the remote likelihood for population-level impacts, small spills, a large gas release, spill drills, and spill response are not expected to affect marine mammal populations. Effects to marine mammals are likely to be short-term and temporary, producing temporary behavioral responses for a limited number of individuals. Large oil spills are not expected to substantively affect most marine mammal populations, though fatal effects could occur for a few individuals. Impacts to beluga whale and sea otter populations from a large oil spill would likely be inconsequential. However, beluga whales and sea otters often aggregate in key habitat areas largely designated as Critical Habitat throughout the Cook Inlet region. If a large oil spill impacts an area where beluga whales or sea otters are aggregated and they are subsequently injured, their populations could be adversely affected.

A-3.8 Terrestrial Mammals

The general effects of an oil spill on terrestrial mammals can be both immediate and long-term from physical contact, inhalation, and/or ingestion of contaminants (Osweiler 2018; AMAP 2010; BOEM, 2020, Figure 4-3). Impacts can range from temporary injuries such as skin irritation and damage, to long-term disease and organ failure; for example, cancer, liver disease, and compromised immune or reproductive systems (Osweiler, 2018). Mortality may occur due to just one, or a combination of exposures, but is most commonly associated with hypothermia and inhalation. Spills may also affect vertebrate animals through habitat degradation and prey or forage contamination by toxic compounds, including PAHs (Burns et al., 2014). Potential effects of an oil spill on terrestrial mammals may include:

- Effects of oil contact: irritation, inflammation, or necrosis of skin; chemical burns of skin, eyes, or mucous membranes; absorption of toxic compounds through skin (Osweiler, 2018); and hypothermia resulting from compromised fur (Garshelis and Estes, 1997). Short- and long-term respiratory effects may include inflammation, pulmonary emphysema, or infection (MDNR, 2019).
- Effects of oil ingestion: gastrointestinal inflammation; ulcers; bleeding; liver, kidney, and brain tissue damage; cancer/tumor development; compromised immune/reproductive systems; and altered respiration and heart rate (MDNR, 2019; AMAP, 2010; Burns et al., 2014; Frisch, Øritsland, and Krog, 1974).
- Effects of oil spills on habitat include physical and chemical degradation (Burns et al., 2014).

Additional discussion of the general impacts of oil and gas on terrestrial mammals is provided in the *Beaufort Sea: Hypothetical Very Large Oil Spill and Gas Release* report (BOEM, 2020, Section 4.2.7).

A-3.8.1 Small Oil Spills (<1,000 bbl)

Small spills from an onshore pipeline or machinery leaks are more likely to contact and affect terrestrial mammals or their habitat than offshore small spills, which are highly likely to disperse and weather prior to reaching land. Winter spills would be unlikely to contact terrestrial mammal habitat because ice and snow slow the spread of oil and provide a barrier to oiling of habitat, thus allowing for more effective spill cleanup.

During summer, small spill size (<1,000 bbl), and low densities of highly mobile terrestrial mammals would be expected to limit impacts, and it is likely that few individuals would be contacted. A small summer pipeline spill would be expected to contact a relatively small area of terrestrial mammal habitat, and individuals would readily move away from the affected area. This situation would provide little opportunity for oiling terrestrial mammals. Spills could remain near the soil surface and terrestrial mammals could contact oil until spill cleanup and remediation.

During winter, few terrestrial mammals are present/active, further decreasing the likelihood of contact with a small spill. Impacts from small spills in summer and winter would be limited to avoidance of the area because of the presence and strong odor of hydrocarbons, and the disturbance created by spill cleanup.

A-3.8.2 Large Oil Spill (≥1,000 bbl)/Gas Release

Impacts to terrestrial mammals from oil exposure could include any one or a combination of those impacts summarized above. A large, 3,800 bbl onshore pipeline oil spill could have a large affected area if the oil was discharged under pressure and the spill occurred in summer (Conn et al., 2001). As with small spills, a large winter spill would be constrained by snow and ice, allowing for more effective cleanup. However, a large spill in any season has a greater potential to oil terrestrial mammals, and temporarily or permanently remove habitat, depending on the use and success of cleanup procedures.

Brown bears utilize tidal flats and marshes for spring foraging to recover from hibernation, and salmon runs in area rivers are also heavily used during summer and fall. Because they use these habitats, brown bears could be exposed to oil from a large spill and experience the general impacts described above. Impacts would, however, be spatially limited due to large bear home ranges and the limited extent of oiled shoreline (Table A2). No more than a few bears would potentially be affected.

Overall, the potential impacts of a large spill on terrestrial mammals would be lessened by weathering processes that reduce the quantities and toxicity of oil present in the environment, and by spill cleanup and response activities that disturb or displace terrestrial mammals. These factors decrease the likelihood that terrestrial mammals would come into contact with oil and therefore decrease potential impacts.

A large gas release has a lower potential for impacts on terrestrial mammals because it would rapidly disperse into the atmosphere and be transported away from the release site by winds. Concentrations of methane would not be sufficient to asphyxiate terrestrial mammals in the vicinity of the release. If ignition and/or explosion occurred in association with a gas release, terrestrial mammals could be injured or killed in close proximity to the release site. The loss of habitat due to burning would vary depending on season, weather, and range condition (wet/dry status of vegetation) and whether or not any suppression efforts occurred. Overall, mortality would be expected to be low due to low densities of terrestrial mammals in proximity to onshore pipelines for most of the year, and the unlikely event of a gas release and subsequent fire and explosion.

A-3.8.2.1 Oil Spill Risk Analysis

BOEM identified 15 terrestrial mammal resource areas for the analysis (Ji and Smith, 2021; Table A.1-7; and Figures B4a–b). The OSRA acronym is GLS Grouped Land Segment.

Conditional Probabilities. Table A11 and Figure A9 show 9 resource areas with a ≥0.5 percent chance of contact within summer or winter. Figure A9 shows 5 resources with a ≥6 percent chance of contact in summer or winter. Six biologically important areas for terrestrial mammals are not estimated to be contacted (<0.5 percent). This analysis focuses on the five resource areas with a ≥6 percent chance of contact.

Summer. The chances of contacting resource areas important to terrestrial mammals are highest for Redoubt Bay Brown Bears (129), West Kenai Brown Bears (136), and West Kenai Black Bears (140). Each resource area is generally contacted the most from a large spill directly adjacent to their geographic location. Redoubt Bay (129) habitats provide important high protein forage food for brown bears during the spring and early summer when the animals are recovering from loss of body mass due to hibernation (Smith and Partridge, 2009). Area rivers, particularly the Kustatan River located within Redoubt Bay (129) (ADNR, 2009), support large populations of salmon that return to the rivers to spawn in mid- to late summer. The salmon are an extremely important source of fat and protein for brown bears preparing to return to hibernation (ADF&G, 2020). Portions of West Kenai Brown Bears (136) serve as moose (ADNR, 2009) and caribou (ADF&G, 2003) calving grounds during the spring, providing brown bears with additional food sources. Area rivers support summer and fall salmon runs, which brown bears rely on heavily. Tidal flats and marshes in area West Kenai Black Bears (140) provide important food sources during the spring, with summer and fall salmon runs in coastal rivers. Together with the lower densities of brown bears (Selinger, 2011), these factors make this an important foraging area for black bears.

Winter. The patterns of winter contact are generally similar to summer with lower chances of contact to areas that are not utilized by the resource for much of the winter (hibernation) and contact with a few additional resource areas. Chances of contacting terrestrial mammal resource areas are highest for GLSs Afognak, Raspberry Winter Elk (155) and Afognak Black Tail Deer (157). The beaches in these areas provide important wintering areas for black tailed deer and elk. Woody browse provides the majority of the winter diet for both species (ADF&G, 2020; AKNHP, 2011; Wallmo and Schoen, 1979), and black tailed deer also take advantage of accumulations of kelp washed ashore (Veeramachaneni et al., 2006).

Table A11: Highest Percent Chance of a Large Oil Spill Contacting Terrestrial Mammal Resources (Assuming a Large Spill Occurs)[1]

OSRA Feature Type	Highest Percent Chance Contact	Summer: 30 days	Winter: 30 days
GLS	≥0.5–<6	125, 137	125, 129,131, 136, 137, 140,160
GLS	≥6–<25	129, 136, 140	155, 157
Names of GLSs Contacted: 125 Spring Bear Concentration 1;129 Redoubt Bay Brown Bears;131 Trading Bay Moose, 136 West Kenai Brown Bears;137 West Kenai Moose; 140 West Kenai Black Bears; 155 Afognak, Raspberry Winter Elk; 157 Afognak Black Tail Deer;160 Kodiak Black Tail Deer			

Notes: [1] Highest percent chance from any launch area (LA) or pipeline area (PL) during summer or winter assuming a large spill occurs. Note that all GLSs with <0.5 percent chance of contact are not shown.
Source: Ji and Smith (2021).

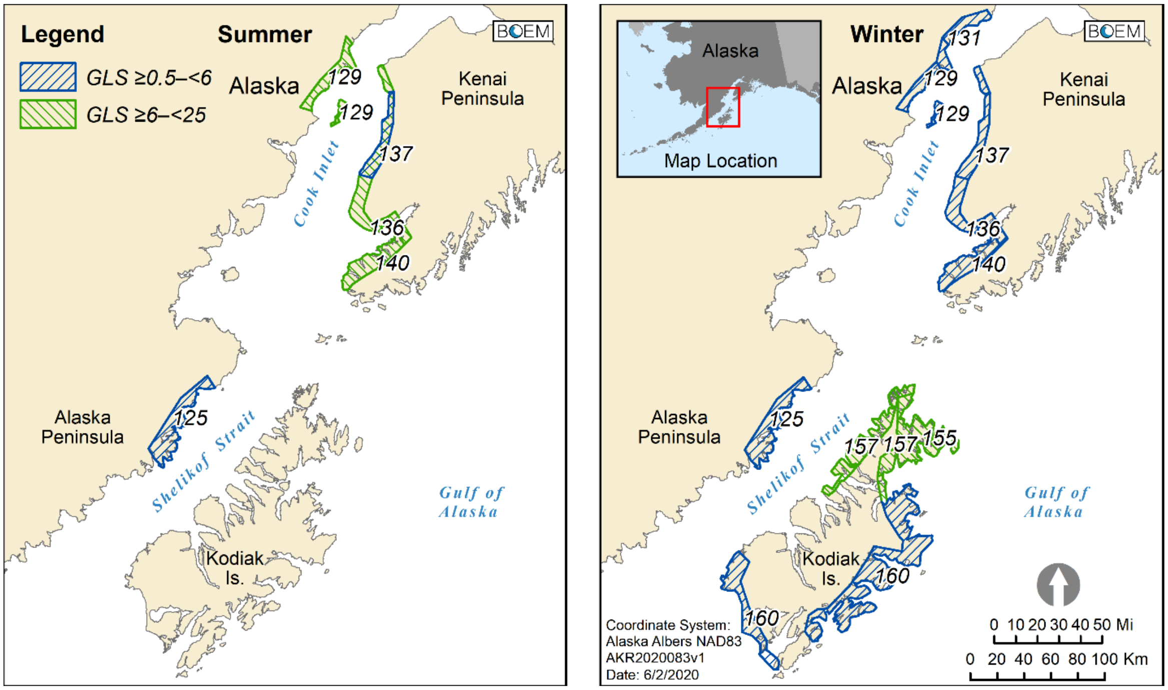

Figure A9: Location and ID number of Terrestrial Mammal Resource Areas (Assuming a Large Spill Occurs ≥1% Chance of Contact within 30 Days): Summer and Winter

Combined Probabilities. There is a 1 percent chance of a large spill occurring and contacting Redout Bay Brown Bears (129), West Kenai Brown Bears (136), West Kenai Black Bears (140) and Afognak& Raspberry Winter Elk (155) within 30 days. All other combined probabilities for terrestrial mammal resource areas were <0.5 percent within 30 days (Ji and Smith, 2021, Table A.2-63).

A-3.8.3 Spill Drills and Response Activities

The presence of humans, vessels, equipment, vehicles, and aircraft during spill drills (including GIUEs), or spill response could displace some terrestrial mammals. Aircraft operating below 1,000 feet above ground level can cause panic and injurious escape reactions among most terrestrial mammals. Vessels usually produce much less of a disturbance unless they are operating in coastal or riverine areas with terrestrial mammals nearby.

Activities such as in-situ burning and animal rescue would most likely displace some animals, and bears could be disturbed while feeding on carcasses. These disturbances could lead to bear-human conflicts, particularly during shoreline cleanup. Although beach cleaning may be performed with greater efficiency using newer technologies (Painter et al., 2011), spill response activities on shorelines may still impact terrestrial mammals. In general, broken ice spill response would have limited impacts on brown bears due to their habitat use and other factors (described above in Section A-3.8.2).

The overall impacts of spill drills and response activities on terrestrial mammals would vary depending on the area disturbed, extent of coastal area contacted by spilled materials, and the scale and effectiveness of the spill response. Mammals subject to other stressors, such as moose displacement from coastal wetland habitat, may be slightly more susceptible to disturbance impacts from these activities. Spill drills and response activities have the potential to discourage access to activity areas, which for spill response would reduce some of the more direct impacts from oil exposure. Overall, the beneficial impacts from spill drills and response activities, including GIUEs, would outweigh any negative impacts on terrestrial mammals resulting primarily from disturbance and temporary displacement.

A-3.8.4 Conclusion

Small spills, a large spill, and a gas release would have no more than minor impacts to terrestrial mammals. This is due to the limited number of resource areas that are estimated to be contacted by an offshore spill; long distances between spill sites and important terrestrial mammal habitats; weathering processes that reduce oil quantity and toxicity; and terrestrial mammal scarcity during winter.

Spill response activities would reduce the likelihood that terrestrial mammals would contact spill materials, and the activities would discourage terrestrial mammals from entering the affected area. Spill drills are generally brief, lasting one to several days, and involve human activity that would temporarily discourage terrestrial mammals from entering or remaining in an affected area. Because of the brief duration of spill drills and low level of disturbance, the impacts of spill response and spill drill activities on terrestrial mammals would be negligible.

Overall, due to a low potential for contacting spill materials, the nature of human activity associated with spills, and the low level of potential behavioral responses, the impacts of small spills, one large spill, a gas release, spill drills, and spill response on terrestrial mammals would be expected to be no more than minor.

A-3.9 Recreation, Tourism, and Sport Fishing

Effects of a spill on recreation and tourism would depend on its size, location, and trajectory. Recreational areas that a spill is most likely to affect are those located adjacent to or along the shoreline. Some of the effects of spills on coastal recreational resources might include altering the use of recreational lands or waters and reducing the scenic quality of the recreational experience. Spills could oil the water and shoreline and cause changes to the scenery, behavior of wildlife, or patterns of visitor use, or visitors' experiences in the natural setting. Impacts to sport fishing would likely be limited to work occurring during summer months, which is the primary sport fishing season. Impacts to sport fishing as a result of accidental spills could extend beyond the summer recreational fishing season, depending on the size of the oil spill involved. Potential effects of an oil spill on recreation, tourism, and sport fishing may include:

- Recreation and tourism industry incur losses caused by direct damage in the spill-affected area(s) (Cirer-Costa, 2015; Eastern Research Group, 2014; McDowell Group, 1990; Ritchie et al., 2013).
- Altered use of recreational lands or waters and reducing the scenic quality of the recreational experiences (Hausman et al., 1995).
- Changed scenery, behavior or wildlife, or patterns of visitor use or visitors' experiences in the natural setting.
- Limited ability of sport halibut and salmon fishers to depart from oiled locations. Sport fishing charter operators could lose business (Herrmann et al.,2001).

A-3.9.1 Small Oil Spills (<1,000 bbl)

Small spills of refined oil (such as lube oil, hydraulic oil, gasoline, or diesel fuel) would float on the water surface and would disperse and weather rapidly. The volatile components of the fuel would evaporate within 24 hours and would be unlikely to have long-lasting or widespread effects on recreation and tourism. Small spills of crude oil would persist longer in the environment and could result in greater impacts than spills of refined products. However, even small crude oil spills are not expected to persist on the water long enough to affect waterborne recreational activities or reach recreational areas along the shoreline. Small spills would result in little or no impact and thus have negligible effects on recreation and tourism.

Small spills would predominantly occur within the confines of or adjacent to the offshore. Furthermore, these small spills are anticipated to be contained with the on-site spill response resources, further minimizing the geographic extent of any impact. Therefore, for isolated small crude oil and condensate spills, minor impacts are expected to sport fishing resources.

A-3.9.2 Large Oil Spills (≥1,000 bbl)/Gas Release

In contrast to small spills, a large, 3,800 bbl spill would persist on the water surface longer than a few hours or days, depending on the type of oil spilled. Large spills of refined oil (such as lube oil, hydraulic oil, gasoline, or diesel fuel) would float on the water surface and would disperse and weather rapidly. The volatile components of the fuel would evaporate within 3 days and would be unlikely to severely affect recreation, tourism, and sport fishing. Large spills of crude oil will persist longer in the environment and could result in long-lasting and widespread impacts to recreation, tourism, and sport fishing.

Oil spill persistence on water or on the shoreline can vary widely depending on the size of the oil spill; the environmental conditions at the time of the spill; the substrate of the shoreline; and, in the case of portions of Cook Inlet, whether the shoreline is eroding. Oil clings to certain types of shoreline, including marshes, peat, fine-grained sediments, and armored cobbled shores, and tends to weather slowly. Oil that reaches the shorelines of recreational areas would have the greatest potential to adversely affect recreation and tourism. The presence of oil on the shoreline of a recreational area would reduce the attractiveness of that area to recreationists and tourists. As long as oil is visually present, those portions of the recreational areas would be closed to visitation. After the initial cleanup is completed and the areas reopened, recreationists and tourists would still likely avoid visiting those areas for some extended time due to a perception of contamination. Consequently, oiling of the shorelines of recreational areas from a large spill would reduce the quality of the recreational experience and alter patterns of use of those shorelines. These effects could be long-term and widespread.

An oil spill could result in closure of ports in Homer, Kenai, and elsewhere along the west side of the Kenai Peninsula. Ports probably would be closed to protect the port and vessels from being oiled. Oil spills can cause economic losses to boat owners and fishers by contaminating fishing gear and vessels. Oiled vessels would need to be cleaned, and oiled gear cleaned or replaced. It is anticipated that fishers would fish alternate areas because of port closures. Charter operators would avoid going out of port into Cook Inlet to avoid fouling their gear and vessels. Public perception of oil spill damage or contamination, real or perceived, would diminish the number of sport fishers. Sport fishers likely would target alternate fishing grounds until the quality of the fishing experience, real or perceived, in the oil spill area returned to previous conditions. These effects could last for one or more fishing seasons and be widespread depending on the timing of the large oil spill.

Oil contacting the beaches could affect clam gathering. People gather razor clams and other clams for sport along the east and west sides of Cook Inlet, and mussels and steamer clams in small bays in Kachemak Bay. Populations of intertidal organisms in any area contacted by oil would be depressed measurably for about a year, and small amounts of oil would persist in the shoreline sediments for more than a decade. The difference in effect between large and small spills is in the extent of areal coverage of impacted shoreline. While small spills would not be expected to impact the nearshore environment, large spills may have a long-term and widespread impact on clam gathering. There is a chance that the oil could migrate to the coastline and nearshore environments resulting in long-term closure of these areas and thus adversely affecting clam gathering.

An accidental release of natural gas into the environment would be expected to rise and disperse and is unlikely to affect recreation, tourism, or sport fishing. A single day release of gas would not be expected to have long-lasting and widespread impacts on sport fishing but could temporarily exclude sport fishers from the immediate area of the blowout. The impacts of a gas blowout and resulting explosion or fire are considered minor.

A-3.9.2.1 Oil Spill Risk Analysis

BOEM identified 28 areas of special concern for the analysis (Ji and Smith, 2021; Table A.1-10; and Figures B3c and B4a–b).

Conditional Probabilities.

Table A12 and Figure A10 show 21 resources with a ≥1 percent chance of contact and 11 resources with a ≥6 percent chance of contact in summer or winter. Seven important areas for recreation, tourism, and sport fishing are not estimated to be contacted (<0.5 percent) and 10 have a <6 percent chance of contact from any location. This analysis focuses on the 11 resource areas with a ≥6 percent chance of contact. The OSRA acronyms are: LS Land Segment; and GLS Grouped Land Segment.

Summer. The chances of contacting resource areas important to recreation, tourism and sportfishing is highest (≥50 percent) for the shorelines in the Alaska Maritime National Wildlife Refuge (NWR) (127) in western Cook Inlet. Shorelines of Tuxedni State Game Refuge (35), Katmai National Park (123), Lake Clark National Park & Preserve (128), Alaska State Management Areas (126, 135, 138, 153), Alaska Maritime NWR (142, 154) and Kodiak NWR (156) are contacted ≥6 percent. These areas provide important outdoor recreation and tourism opportunities for wilderness camping and backpacking, hiking, hunting, wildlife viewing, sport fishing, and exploring. Tuxedni Bay (35), which is located within the Alaska Maritime NWR (127), is the home of seabirds, bald eagles, peregrine falcons, and other birdwatching opportunities. Katmai National Park (123) is a wilderness park that attracts people from all over the world to view brown bears and enjoy world-class fishing.

Winter. The patterns of contact are similar to summer except the highest chance of contact is to the shorelines in the Alaska Maritime NWR (127) and Lake Clark National Park & Preserve (128).

Table A12: Highest Percent Chance of a Large Oil Spill Contacting Areas of Special Concern (Assuming a Large Spill Occurs)[1]

OSRA Feature Type	Highest Percent Chance	Summer: 30 days	Winter: 30 days
LS	≥0.5–<6	38	38
LS	≥6–<25	35	35
GLS	≥0.5–<6	113, 114, 122, 130, 139, 143, 158, 164	114, 122, 130, 139, 143, 158, 161, 164
GLS	≥6–<25	123, 126, 135, 138, 142, 153, 154, 156	123, 126, 135, 138, 142, 153, 154, 156
GLS	≥25–<50	128	--
GLS	≥50	127	127, 128

Names of LSs Contacted: 35 Tuxedni State Game Refuge; 38 Kalgin Island Critical Habitat
Names of GLSs Contacted: 113 Alaska Peninsula NWR; 114 AMNWR SW Shelikof/GOA; 122 Becharof NWR; 123 Katmai National Park; 126 McNeil River State Game Sanctuary & Refuge; 127 AMNWR W Cook Inlet ; 128 Lake Clark National Park & Preserve; 135 Kenai AK State Rec Mgmt Areas; 138 Clam Gulch Critical Habitat 139; Kachemak Bay State Park and Wilderness Park Kachemak Bay State Critical Habitat Area 142; AMNWR E Cook Inlet 143; AMNWR W Outer Kenai/GOA 153; Shuyak Island State Park 154; AMNWR Afognak and Shuyak Islands 156; Kodiak National Wildlife Refuge 158; AMNWR W Kodiak/Shelikof 164; Afognak Island State Park

Notes: [1] Highest percent chance from any launch area (LA) or pipeline area (PL) during summer or winter assuming a large spill occurs. Note that all resource areas with <0.5 percent chance of contact are not shown.
-- No highest percent chance in this range.
Source: Ji and Smith (2021).

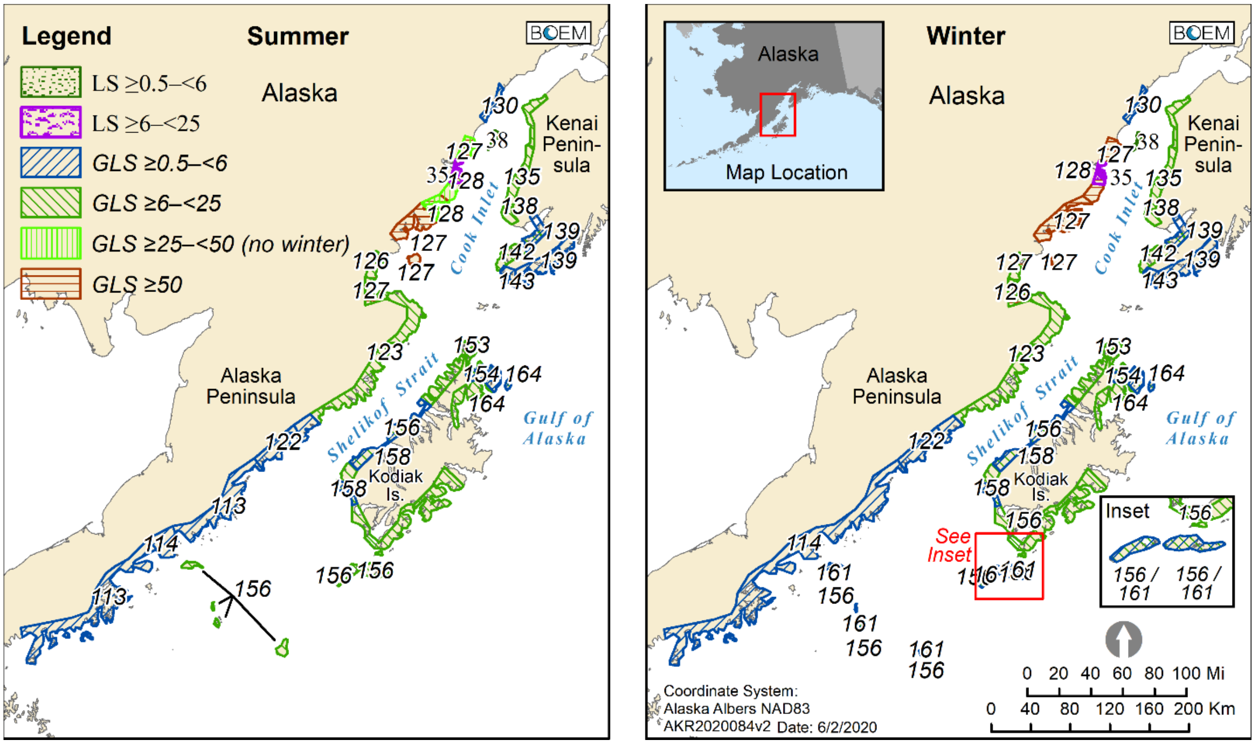

Figure A10: Location and ID number of Areas of Special Concern (Assuming a Large Spill Occurs ≥1% Chance of Contact within 30 Days): Summer and Winter

Combined Probabilities. Except for Alaska Maritime NWR (127) and Lake Clark National Park & Preserve (128), all combined probabilities for recreation, tourism and sportfishing resource areas were ≤2 percent within 30 days (Ji and Smith, 2021, Tables A.2-63). There is a 10 percent and 7 percent chance of a large spill occurring and contacting Alaska Maritime NWR (127) and Lake Clark National Park & Preserve (128), respectively, within 30 days.

A-3.9.3 Spill Drills and Response Activities

Spill drills, including GIUEs, are infrequent, short-term, and use existing equipment. If spill drills were carefully sited away from recreation use areas, they would have little to no adverse impacts to recreation and tourism.

Spill response activities could include mechanical recovery methods, use of dispersants, and in-situ burning of spilled materials. Increased aircraft and vessel traffic, and corresponding increases in vessel discharges and noise, would also be associated with spill cleanup operations. Depending on the size of the spill and whether or not it contacted intertidal and onshore resources, response and cleanup time and extent of response activities could be short-term and localized or long-lasting and widespread.

The effects of response and cleanup for a large oil spill on recreation, tourism, and sport fishing would depend on a variety of factors including location of the spill, time of year, size of the spill, and weather conditions. Waterborne recreational activities such as marine boating, sport fishing, and waterborne wildlife viewing are expected to be directly affected when the spill area is closed to facilitate the spill response. Waterborne activities in portions of the Lease Sale Area that adjoin the spill area would be indirectly affected by the noise, increased level of activity, and number of vessels, which would reduce the quality of the recreational experience. These effects would last at least as long as the spill response and cleanup is ongoing.

A-3.9.4 Conclusion

Impacts to recreation and tourism would be negligible for small spills and moderate with the addition of a large oil spill. A large gas release could have minor impacts to recreation and tourism. Spill drills would have negligible impacts to recreation and tourism. Spill response and cleanup activities could have minor to moderate impacts to recreation and tourism.

Impacts to sport fishing could be minor for small spills and moderate with the addition of a large oil spill. A large gas release could have minor impacts to sport fishing activities. Spill drills would have negligible impacts to sport fishing. Spill response and cleanup would have minor to moderate impacts to sport fishing activities.

A-3.10 Sociocultural Systems

Oil spills cause psychological, social, public health, economic, and cultural impacts in society. The sociocultural system includes social organization, cultural identity, and local institutions. Impacts from an oil spill on the sociocultural system of local communities could come from disruption of subsistence through oiling of habitats and subsistence resources; spill response and cleanup activities, including changes in population, employment, and income; and social and psychological stress due to fears of potential contamination of resources (Palinkas et al., 1993). An oil spill or gas release would likely have impacts on the sociocultural system of communities in Cook Inlet and the surrounding region, with the level of consequences depending on the size, timing, location, movement, and type of product(s) spilled. Impacts could include:

- Increased social stress in communities, including loss of credibility and trust in authorities, frustration and anger, breakdown in family ties, and a weakening of community well-being (Chang et al., 2014; Impact Assessment, 1990; Lord et al., 2012, 1–23; Palinkas, 2012, 203–222; Webler and F. Lord, 2010, 723–738).
- Social and psychological distress over potential losses of cultural values and identity (Palinkas et al., 1993; Webler and Lord, 2010).
- Increased demand on the health and social services available in communities (Chang et al., 2014; Goldstein et al., 2011; Impact Assessment, Inc., 1990; Palinkas et al., 1993; Rodin et al., 1992).
- Higher rates of substance abuse, crime, domestic violence, and mental illnesses (Chang et al., 2014; Goldstein et al., 2011; Impact Assessment, Inc., 1990).
- Disruption of economy and interruption of way of life, along with decreased emphasis on subsistence as a livelihood and increased emphasis on earning wages, particularly through participation by local individuals in spill response and cleanup employment (Lord et al., 2012; Palinkas, 2012; Palinkas et al., 1993; Webler and Lord, 2010). Such disruptions would likely depend in part on the perception of impact by subsistence harvesters.

A-3.10.1 Small Oil Spills (<1,000 bbl)

Potential impacts from small spills of all kinds are not likely to cause disruptions to sociocultural systems except as discussed in Section A-3.11 for subsistence harvest patterns. Small spills of refined oil (such as lube oil, hydraulic oil, gasoline, or diesel fuel) would float on the water surface and would disperse and weather rapidly and would be unlikely to affect sociocultural systems. Small spills of crude oil would persist longer in the environment and could result in more impacts than spills of refined products but are expected to be short-term and localized. Effects on cultural values could occur if oil spills alter subsistence harvest patterns. In subsistence-oriented communities, traditional emphasis is on kinship, community, cultural continuity, cooperation, and sharing. There could be little to no or short-term and localized impacts to subsistence harvest patterns from small spills, and levels of sociocultural impacts in subsistence communities would be the same.

A-3.10.2 Large Oil Spill (≥1,000 bbl)/Gas Release

A 3,800 bbl, large oil spill event would likely have effects on the sociocultural systems of communities in the Lease Sale region with the level of consequences depending on the timing, location, movement, and type of crude or refined product(s) spilled. The effects would be felt in three areas of sociocultural systems: social organization, cultural values, and institutions. For example, a large oil spill that affected salmon fisheries would have effects not only on subsistence and personal use harvests, but also on commercial and sport fisheries. The portion of the regional economy connected to healthy salmon populations would be disrupted, affecting the people whose livelihood is connected to salmon. Kinship relations and commercial fishing crew organization would change to respond to diminished or prohibited fish harvests (Section A-3.14). The cultural values placed on cooperation in fish harvesting, processing, sharing, and distribution could be impacted for one or more fishing seasons.

A large spill has potential to result in long-term and widespread, and possibly severe, impacts to subsistence activities and harvest patterns (Section A-3.11). Disruptions to subsistence harvest patterns from a large spill can cause social stress and anxiety from reduction or loss of traditional practices, cultural well-being, and identity. Interruption of subsistence for one or more seasons would impact sociocultural systems by impeding distribution of harvested resources within and between communities. People who rely on receiving subsistence foods to maintain their cultural values and identities would be impacted. This is especially the case for community members who are not able to hunt and fish for themselves (e.g., elders). Cultural identity would also be impacted from decreases in harvest, processing, and teaching youth the subsistence way of life. In addition, the sociocultural systems of coastal communities could be impacted by social and psychological stress due to potential contamination of subsistence food resources (Impact Assessment, Inc., 2011b; Palinkas et al., 1993).

Existing institutions are less likely to be affected by a large oil spill. Borough, city, and tribal governments would continue in the event of a large oil spill but could take on additional roles to cope with spill response and cleanup activities.

Impacts from a large spill of crude oil could be long-lasting and widespread, and possibly severe, depending on the spill location relative to the resources impacted and the duration and extent of disruption to subsistence activities and social organization. Impacts on the smaller subsistence-oriented communities in the region would likely be a greater disruptor to sociocultural systems than would be felt in larger, more heterogeneous communities less dependent on subsistence harvests. Impacts from a large spill would have a severe effect on sociocultural systems if subsistence harvesting or commercial fishing were disrupted for one or more seasons (Sections A-3.11 and A-3.14).

An offshore gas release over one day would be localized and of short duration with rapid dissipation. Implementation of safety exclusion zones would make it unlikely that subsistence or commercial fishermen would approach close enough to an offshore development to be injured from a potential blowout and gas release. Temporary and localized impacts are possible in the event of a large release of natural gas from an onshore pipeline, especially in the unlikely event of ignition near a community or near active subsistence harvesters. Impacts to the sociocultural system from a large gas release lasting one day are expected to be short-term and localized. Potential impacts to the sociocultural system from a large gas release could be avoided by siting pipelines to come ashore far from communities.

A-3.10.3 Spill Drills and Response Activities

Spill drills, including GIUEs, are infrequent, usually last less than 8 hours, and normally use existing equipment. If oil spill cleanup and response drills were carefully sited away from small communities and subsistence use areas, they would have little to no adverse impacts to sociocultural systems in those communities. Spill drills based out of existing industrial support areas in larger towns or cities would not likely be disruptive to sociocultural systems and would have little to no impact.

Effects to social and institutional organizations can occur due to local employment in spill response and cleanup activities. Cleanup employment of residents could place stresses on local village and town infrastructures by drawing local workers away from community service jobs (Palinkas et al., 1993). Other social impacts, which have been documented for VLOS-size spills but are informative for a large spill, include increased demands on community service providers, increased crime rates, labor shortages, disruption of local government activities, and social conflicts between local residents and outsiders coming to town to work on spill cleanup jobs (Palinkas et al., 1993; Webler and Lord, 2010). Over a longer duration (one or more seasons) and more widespread area, large spill cleanup activities could cause social relations and community cohesion to deteriorate in impacted communities (Palinkas et al., 1993; Palinkas, 2012). The level of impacts would depend on where cleanup activities occur in relation to communities and how long cleanup efforts last. For a 3,800-bbl spill, the impacts on local sociocultural systems would depend on the extent and duration of cleanup activities and how many residents were employed in cleanup work (Section A-3.13). Impacts would most likely be short-term and localized due to the temporary nature of initial response and cleanup jobs.

Because subsistence harvest, processing, and sharing are key supporting elements of sociocultural systems in many rural coastal communities, effects on subsistence activities and harvest patterns (Section A-3.11), would impact sociocultural systems. Short-term and localized or long-lasting and widespread effects on subsistence and sociocultural systems could occur if clean-up operations include sections of the beach or intertidal zones, or if contamination from chemicals used in cleanup generate avoidance of subsistence resources. Overall, impacts to sociocultural systems from spill response and cleanup activities are expected to be short-term and localized, to long-term and widespread, depending on the extent and location of the spill and to what extent subsistence harvest patterns are disrupted.

A-3.10.4 Conclusion

Impacts to sociocultural systems from small spills are expected to be minor due to their limited geographic and temporal effects. Impacts from a large spill of crude oil could be major, depending on the spill location relative to the resources impacted and the duration and extent to which impacts from a large spill disrupt subsistence activities, commercial fishing, and social organization. A large gas release over one day would be expected to have minor impacts to sociocultural systems. Spill drills would have negligible impacts to sociocultural systems, and spill response and cleanup activities could have minor to moderate impacts to sociocultural systems.

A-3.11 Subsistence Activities and Harvest Patterns

Impacts of oil spills on subsistence activities and harvest patterns could occur through changes in the availability, quality, and use of subsistence resources. Impacts would result from contact of crude oil with shorelines and fish and wildlife, and potential contamination of subsistence foods. Subsistence harvesters could purposively avoid affected subsistence areas and reduce their harvests of a particular subsistence food resource due to potential contamination (Fall et al., 2006; Impact Assessment, Inc., 2011a). Important subsistence resources could become unavailable or undesirable for one or more seasons, resulting in substantial and sustained food insecurity (Suprenand et al., 2018). Impacts could include:

- Direct mortality of targeted subsistence resources or their prey, displacement of subsistence resources, or reduced numbers of species used for subsistence purposes (Fall et al., 2006; Picou and Martin, 2007).
- Displacement of people from traditional harvest areas and/or increased competition for subsistence resources (Impact Assessment, Inc., 2011a).

- Contaminated resources unfit for human consumption or undesirability of subsistence resources as foods and avoidance of oiled resources and areas (Impact Assessment, Inc., 2011b).
- Reduced consumption of subsistence foods and other products, food insecurity, and loss of or reductions in traditional subsistence practices (Impact Assessment, Inc., 2011b; Suprenand et al., 2018).

A-3.11.1 Small Oil Spills (<1,000 bbl)

A range of impacts could occur for subsistence fishing and hunting. Impacts would be related to contaminated resources unfit for human consumption, undesirability of subsistence foods, and avoidance of resources and harvest areas affected by small spills. Most small spills would evaporate or disperse within hours to one day and would result in little to no impact on subsistence activities and harvest patterns. Small, refined spills that occur offshore would float on the water surface and would disperse and weather rapidly. Small spills of crude oil would persist longer in the environment and could result in more adverse impacts than spills of refined products. Onshore spills of crude oil or refined products would be contained to localized areas and would mostly evaporate or be cleaned up quickly. Overall, there would most likely be little or no impacts to terrestrial mammal hunting from small spills because hunters would be able to pursue large game at areas outside those contacted by spills. Small spills that contact fishing, marine invertebrate gathering locations, or marine mammal or waterfowl hunting areas at shorelines or river mouths would have localized and mostly short-term impacts on subsistence activities in those areas. Longer-term impacts are possible at locations of chronic spills, at harvest locations that are only available for limited time periods due to regulations, or where spills result in avoidance of the area by subsistence harvesters. For example, 24 percent of a small crude spill is estimated to remain after 30 days in the summer (Table A1), which would result in up to 30 bbl, or 1,260 gallons of oil remaining in the environment. If this occurred in a subsistence use area, harvesters would likely avoid the affected area while the oil remained and potentially for a longer period such as the remainder of the harvest season and potentially longer. Harvester perception of impacts, and of the area and timeframe harvesters avoid affected spill locations, may impact subsistence activity. This impact would be localized, and harvesters may be able to access other locations for targeted resources. However, harvesters may incur economic impacts if they need to travel farther distances for resources that are not affected by a small spill, or if they harvest other resources to replace those affected by the spill (Keating et al., 2020). Harvest locations that, under regulation, are only open for short periods of time such as the set gillnet fisheries around Kachemak Bay and near Seldovia and Port Graham (Brown et al., 2021), could become unavailable for part or all of a season if a small spill contacted those locations in the timeframe of the open season. Because small spills in shoreline areas or at river mouths would not spread over large areas, impacts would remain localized to individual harvest locations. Spills that occur farther offshore would have little to no, to short-term and localized impacts on subsistence fishing, depending on their size and type, but would not make salmon or other fish unavailable to harvesters.

A-3.11.2 Large Oil Spill (≥1,000 bbl)/Gas Release

Potential impacts to subsistence harvest patterns from a large, 3,800 bbl oil spill include direct mortality of targeted subsistence resources or their prey, displacement of subsistence resources making them unavailable or more difficult to access for subsistence harvesters, and contamination of subsistence use areas and subsistence resources. Traditional harvest locations may have resources deflected due to oiling of the environment, or resources may not be available in adequate quantities to satisfy traditional harvest patterns.

A large oil spill could affect the availability of subsistence resources through impacts on the abundance and distribution of subsistence species. Long-lasting and widespread impacts from a large spill may occur for marine invertebrates, fish, and most bird populations (Sections A-3.5 and A-3.6), and these impacts could affect the availability of resources to subsistence harvesters. Most marine mammals harvested for subsistence in the Cook Inlet region are not expected to experience population-level impacts from a large spill, except for beluga whales (for which the subsistence harvest is currently closed) (Section A-3.7).

A large spill that reaches nearshore and shoreline areas could impact subsistence harvest of multiple resources. Resource harvest locations for communities overlap to a large degree. For example, a community may harvest several types of resources from the same area, so a spill contacting that area would affect the community's harvest of several resources. Community harvest locations for Seldovia, Nanwalek, and Port Graham in the Kachemak Bay area overlap to varying degrees for salmon, non-salmon fish, marine mammals, marine invertebrates, birds and eggs, and some terrestrial mammals (Jones, B. and Kostick, M. 2016). Likewise, Tyonek's harvest locations for various resources overlap on the western side of Cook Inlet (Jones et al. 2015). Oil contact to a community's harvest area could disrupt subsistence activities for multiple resources and make those resources unavailable or undesirable for use for a substantial portion of a subsistence season, or for more than one season. A summer spill would have a greater chance of contact to harvest areas for several communities and would also coincide with the harvest season for many resources. In addition, some communities share harvest areas, so a spill contacting one area could impact harvest for several communities. For example, for the communities of Seldovia, Nanwalek, and Port Graham, nearshore waters as well as bays and river mouths in southern Kachemak Bay provide harvest locations for salmon and other resources (Jones, B. and Kostick, M. 2016). A large spill that contacts shoreline areas around Kachemak Bay, especially on the southern shore of outer Kachemak Bay, would potentially affect harvest locations for multiple communities. Residents of other Kenai Peninsula communities also harvest resources in the Kachemak Bay area, and some residents harvest fish or shellfish on the western side of Cook Inlet in or near Tyonek's harvest areas. Similarly, communities on parts of Kodiak Island share general harvest areas as do several communities on the upper Alaska Peninsula (BOEM 2016; Morris, 1987). BOEM estimates a large spill would affect about 26–35 km of shoreline (Table A2), which could affect a substantial portion of subsistence use areas for communities. Subsistence areas could be impacted for a substantial portion of a season or more than one season if oil persists in the substrate of the harvest area. For example, if oil contacts set gillnet fishery areas around Kachemak Bay or shellfish harvest locations, areas may be closed for harvest or avoided for one or more seasons. A large oil spill that contacts communities' harvest areas, would have widespread, long-lasting, and possibly severe impacts.

Contamination of resources, and the concern about tainted subsistence foods may (1) affect harvesters' decisions about the level of effort placed into harvesting resources, (2) limit people's consumption of subsistence products, and (3) cause people to completely stop eating traditional subsistence resources for varying lengths of time following a spill event. Avoidance of subsistence resources potentially impacted by an oil spill was noted following the *Selendang Ayu* spill near Unalaska in 2004. Although state-sponsored subsistence foods testing revealed no significant threat from hydrocarbons a couple years after the spill, some residents continued to express uncertainty about the safety of foods from the affected area (Impact Assessment, Inc., 2011b). Additionally, studies conducted after the 1989 EVOS provide insight into potential effects of oil spills on use of subsistence resources. While the EVOS was a VLOS event and was many times larger than the spill size assumed for this analysis (approximately 240,000 bbl vs. 3,800 bbl), the impacts documented after the EVOS are informative of the types of impacts that could occur from a large spill. A study conducted by the Alaska Department of Fish and Game, Division of Subsistence in 2003 and 2004 found approximately half of the households surveyed reported lower total subsistence uses than before the EVOS, and 39 percent blamed spill effects for continuing lower uses of at least one resource (Fall et al., 2006). Concerns were identified in eight study communities; these were related to paralytic shellfish poisoning, which was linked to the effects of the EVOS, and inhibited marine invertebrate harvesting. Overall, 72 percent of respondents said that the traditional way of life had not recovered from the spill. Over time, other long-term impacts of EVOS on subsistence communities have been documented related to economic and social changes, including abrupt changes in cash economies from settlement payments (Keating et al., 2020). The extent of impacts would be considerably less for a

3,800-bbl spill than for a VLOS; fewer communities would likely experience the levels of impacts documented for the EVOS. However, one or more communities could experience effects within their localized harvest areas based on the conditional analysis of potential for contact from a large spill (Section A-3.11.2.1). Contamination-related impacts caused by a large spill are expected to be long-lasting and widespread and possibly severe for subsistence harvest patterns and traditional practices.

A well control incident and gas release, with a possible explosion and fire could have impacts on subsistence resources (i.e., fish, birds, and marine and terrestrial mammals) in the immediate vicinity of the blowout. A release of methane into the water column has the potential to affect fish utilized as a subsistence resource (Section A-3.5). Fish mortality associated with a gas pipeline release could range from a few to hundreds of individuals without population-level impacts (Section A-3.5). Most gas escaping and contacting water would dissipate quickly, producing no effect on marine mammals hunted for subsistence purposes. If a 1-day natural gas pipeline release occurred, subsistence harvesters would likely avoid searching in the immediate vicinity for a short time period. If the release caused an explosion and fire, there is a chance subsistence resources in the vicinity would be injured or killed. A large natural gas release over one day is expected to have short-term and localized effects on subsistence harvest patterns in the Lease Sale Area.

A-3.11.2.1 Oil Spill Risk Analysis

BOEM identified 12 subsistence use areas (SUAs) for the analysis (Ji and Smith, 2021; Table A.1-9; Figures B-2a, d, and B-4a). The OSRA acronyms include ERA for Environmental Resource Area, and GLS for Grouped Land Segment.

Conditional Probabilities. Table A13 shows 9 SUAs with a ≥0.5 percent chance of contact in summer and winter. Figure A11 shows the location of these SUAs with a ≥0.5 percent chance of contact. Two of the SUAs are not estimated to be contacted (<0.5 percent chance). Four SUAs have a ≥6 percent chance of contact, of which, two have a ≥25–<50 percent chance of contact.

Table A13: Highest Percent Chance of a Large Oil Spill Contacting Subsistence Resources (Assuming a Large Spill Occurs)[1]

OSRA Feature Type	Highest Percent Chance	Summer: 30 days	Winter: 30 days
ERA	≥0.5–<6	2, 7, 8, 9	7, 8, 9
ERA	≥6–<25	5, 6	3, 5, 6
ERA	≥25–<50	3, 4	4
GLS	≥0.5–<6	116	--
Names of ERAs Contacted: 1 SUA: Tyonek Beluga; 2 SUA: Tyonek North; 3 SUA: Tyonek South; 4 SUA: Seldovia, Port Graham, Nanwalek; 5 SUA: Port Lions; 6 SUA: Ouzinke; 7 SUA: Larsen Bay; 8 SUA: Karluk; 9 SUA: Akhiok; 10 SUA: Old Harbor Names of GLSs Contacted: 116 Chignik, Chignik Lagoon			

Notes: [1] Highest percent chance from any launch area (LA) or pipeline area (PL) during summer or winter assuming a large spill occurs. Note that all resource areas with <0.5 percent chance of contact are not shown.
-- No highest percent chance in this range.
Source: Ji and Smith (2021).

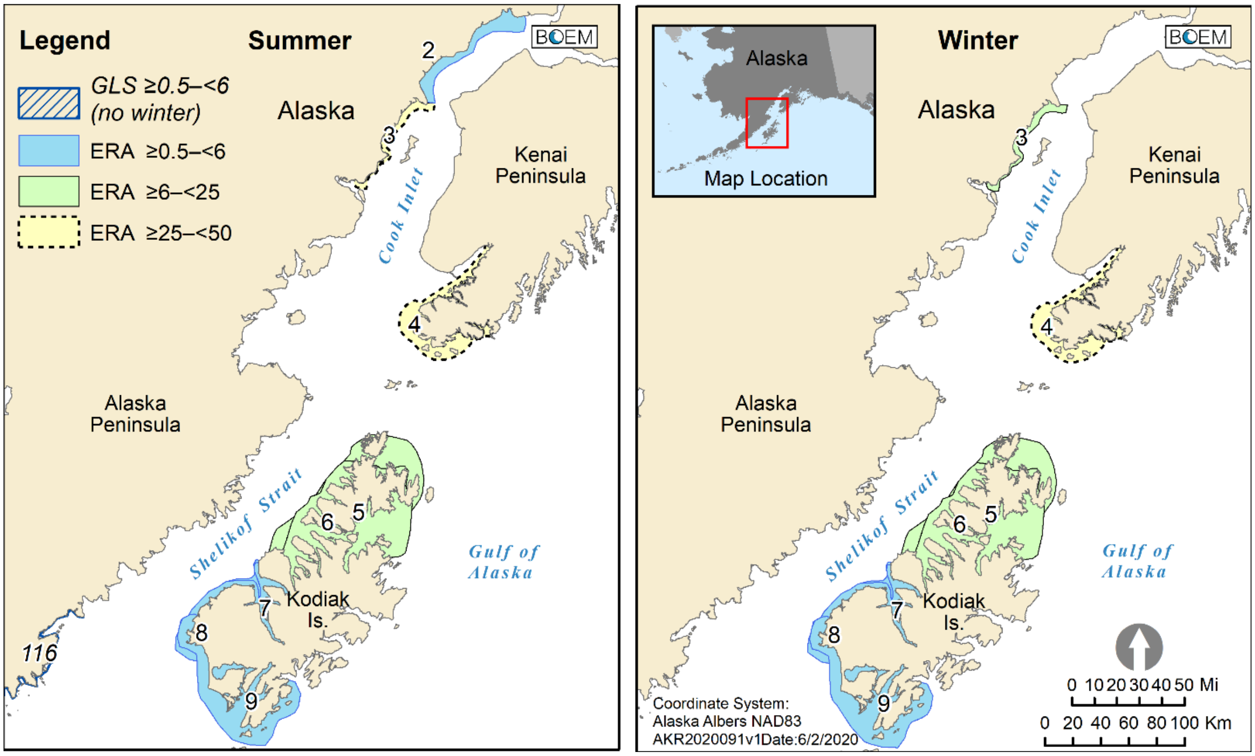

Figure A11: Location and ID number of Subsistence Use Areas (Assuming a Large Spill Occurs ≥1% Chance of Contact within 30 Days): Summer and Winter

Summer. SUAs used by Tyonek, Seldovia, Port Graham, Nanwalek, Larsen Bay, Karluk, Akhiok, Port Lions, Ouzinkie, and the Chigniks have a chance of contact from a large spill within 30 days or less. The Tyonek South (3) and Seldovia, Port Graham, Nanwalek (4) SUAs have the highest chance of contact ranging from ≥25–<50 percent. The northern Kodiak Island SUAs have the next highest chance of contact ranging from ≥6–<25 percent. SUAs farther to the north or south of the Lease Sale Area, Tyonek North (2) in upper Cook Inlet and the Chignik, Chignik Lagoon (116) on the Upper Alaska Peninsula, have a lower chance of contact (≥1–<6 percent).

Winter. The winter patterns are the same as discussed above for a summer spill, with the following notable differences. Chignik, Chignik Lagoon (116) and Tyonek North (2) are unlikely to be contacted (<0.5 percent). The percent chance of contact decreases for the Tyonek South (3) SUA to ≥6–<25 percent.

Combined Probabilities. Except for Tyonek South (3); Seldovia, Port Graham, Nanwalek (4); Port Lions (5); and Ouzinke (6) with a 1–2 percent chance of occurrence and contact, the combined probabilities for other SUAs were <0.5 percent (Ji and Smith, 2021, Tables A.2-61 and A.2-63).

A-3.11.3 Spill Drills and Response Activities

Spill drills, including GIUEs, are infrequent, short-term, and use existing equipment. If spill drills were carefully sited away from subsistence use areas or scheduled outside harvest seasons, they would have little to no impacts to subsistence activities and harvest patterns.

Spill response and cleanup activities may interfere with or disrupt subsistence harvest patterns. This could occur due to the implementation of emergency regulations that create exclusion zones to protect cleanup work areas or prohibit subsistence harvests in certain areas. If cleanup operations include sections of the beach, or intertidal zones, access to subsistence fishing and shellfishing areas, and areas used for coastal hunting of terrestrial mammals, could be restricted. Additionally, increased aircraft and vessel traffic and corresponding increases in vessel discharges and noise associated with spill cleanup operations would create disruptions and space-use conflicts that could extend beyond the immediate area of cleanup activities. Restriction of access to subsistence harvest areas could last for part of a harvest season or for one or more seasons. Impacts would be short-term and localized or long-lasting and widespread, depending on the area affected and the length and season of cleanup activities.

Mechanical methods used to recover spilled oil offshore would most likely not impact fishing practices or other subsistence activities because harvesters would avoid affected areas and active cleanup operations. The use of dispersants and in-situ burning could result in avoidance of harvesting marine resources for one or more harvest seasons due to potential contamination. The potential for contamination of wild foods could result in long-lasting and widespread cessation of subsistence harvest of marine resources including fish, invertebrates, and marine mammals.

Subsistence activities and harvest patterns could be affected by spill response and cleanup activities that involved volunteer or paid employment of residents. Subsistence harvesters' time, effort, and equipment could be diverted from subsistence activities to oil spill response and cleanup. Earning cash from paid work in spill response and cleanup may allow some subsistence harvesters to purchase newer equipment and fuel needed to effectively pursue subsistence activities. Impacts to subsistence harvest patterns caused by spill response and cleanup activities could be short-term and localized or long-lasting and widespread, depending on the extent and location of the spill.

A-3.11.4 Conclusion

Impacts to subsistence activities and harvest patterns could be negligible to minor for small spills. Impacts from a large oil spill could cause severe and thus major impacts to subsistence harvest patterns. Such impacts would be due to the potential to disrupt subsistence activities, or to make subsistence resources unavailable or undesirable for use—or only available in greatly reduced numbers—for a substantial portion of a subsistence season. A large gas release would be expected to have minor impacts to subsistence activities and harvest patterns. Spill drills would have negligible impacts to subsistence activities and harvest patterns. Spill response and cleanup would have minor to moderate impacts to subsistence activities.

A-3.12 Community Health

An oil spill or gas release could impact community health. Potential adverse impacts to health from large oil spills fall into four categories (Goldstein et al., 2011):

- Impacts related to worker safety
- Toxicological effects in workers, visitors, and community members
- Mental health effects from social and economic disruption
- Environmental effects that have consequences for human health

There is evidence in the literature of a positive relationship between exposure to spilled oils and the appearance of physical, psychological, endocrine, and gene-level effects in exposed humans, especially those involved in response and cleanup (Aguilera et al., 2010; Diaz, 2011). Large oil spills have caused serious mental health impacts such as post-traumatic stress disorder. Mental health impacts are caused by social disruption, income loss, loss of economic and subsistence resources, and high levels of worry over contamination of the environment and foods harvested from oiled environments (Eykelbosh, 2014; Grattan et al., 2011; Laffon et al., 2016; Osofsky et al., 2011; Palinkas, 2012).

Additional discussion of the general impacts of oil and gas on human health is provided in the *Beaufort Sea: Hypothetical Very Large Oil Spill and Gas Release* report (BOEM, 2020, Section 4.2.10).

A-3.12.1 Small Oil Spills (<1,000 bbl)

In water, ambient hydrocarbon concentrations of small, refined oil spills would persist for a shorter time than a crude oil spill of the same volume. Gasoline and diesel fuels contain substances such as benzene, toluene, and xylenes, which can enter the environment and cause adverse health effects. Impacts on subsistence harvest patterns could decrease nutritional and social well-being (EIS Section 4.11). Most small spills would likely be contained on a vessel or facility and would occur outside communities, and exposure of community members would be limited. Impacts to community health from small accidental spills are expected to be no more than short-term and localized.

A-3.12.2 Large Oil Spill (≥1,000 bbl)/Gas Release

A large, 3,800 bbl oil spill could have mental health impacts for residents living in the affected area. For example, in Alaskan communities impacted by the EVOS, residents showed changes in indicators of post-traumatic stress including greater degrees of stress in the forms of recurrent, unprovoked, negative thoughts about the spill and avoidance behaviors such as suppression of thoughts and behaviors related to the spill (Picou et al., 1992). Indicators of personal and social stress were observed in community residents following the *Selendang Ayu* incident which spilled approximately 7,990 bbl of mixed fuels near Unalaska in the Aleutian Islands (Impact Assessment, Inc., 2011b). These observations suggest spills smaller than the EVOS can produce localized stress. A 3,800-bbl spill would be expected to have less extensive impacts on mental health than a VLOS, such as the EVOS, but similar effects could occur at a smaller scale in one or more communities. Impacts could range from short-term and localized to long-term and widespread, depending where spilled oil contacts shorelines in relation to communities and resource use areas.

A large oil spill that disrupts subsistence resources and harvest patterns (Section A-3.11) could result in long-lasting and widespread impacts to health in coastal communities. These impacts would primarily be realized through long-lasting, widespread, and potentially severe disruptions to subsistence practices, loss of harvest opportunities, and avoidance of subsistence resources (Section A-3.11). Impacts to community health and individual mental health would include compromised nutrition and general decreases in community organization and cultural well-being due to a lack of traditional foods and inability to engage in traditional practices such as sharing food with elders (Sections A-3.10 and A-3.11).

In the event of an offshore gas release of 20–30 million cubic feet occurring over one day, most gas escaping and contacting water would dissipate quickly, producing little to no effects to public health. While natural gas is a simple asphyxiate in confined spaces, the gas would dissipate quickly upon release. Upon reaching the surface, gaseous CH_4 would react with air, forming CO_2 and water, which would then disperse into the atmosphere. Temporary and localized impacts are possible from a 1-day large release of natural gas occurring at an onshore pipeline, especially if there was ignition and an explosion and fire near a community or near active subsistence harvesters. Air and water quality are not expected to be adversely affected to the point of affecting human health. Impacts to community health from a large gas release are expected to be short-term and localized.

A-3.12.3 Spill Drills and Response Activities

If spill drills, including GIUEs, were carefully sited away from communities and subsistence use areas, they would have little to no adverse impacts to community health.

Spill response and cleanup workers from both inside and outside communities could experience exposure to oil and its toxic components resulting in acute or chronic health impacts. Hazards to oil spill workers include drowning, cold exposure, falls, and back injuries. Additionally, impacts to community members related to social conflicts could occur when they work on spill response and cleanup alongside outside workers who may be unfamiliar with and insensitive to the cultures of Alaska Native peoples.

Impacts of spill response and cleanup activities on subsistence harvests would affect community health if they resulted in reduction of subsistence foods or stress about availability or quality of subsistence resources (Section A-3.11). Subsistence-related impacts could cause short-term and localized, or long-lasting and widespread impacts to community health related to the level of impact to subsistence harvest.

Increased employment in spill response could place stresses on community health infrastructure such as hospitals and health clinics by drawing local workers away from community service jobs or by increased medical visits from outside cleanup workers. These changes could increase healthcare demands and social conflicts between residents and outsiders. The deterioration of social relationships, anxiety, stress, and depression may result from long-term and widespread spill response and cleanup operations (Palinkas et al., 1993; BOEM, 2016). Potential impacts from cleanup efforts for a 3,800-bbl spill would range from short-term and localized to long-term and widespread depending on where cleanup efforts are based and the duration of cleanup efforts.

A-3.12.4 Conclusion

Impacts of small spills to public and community health are expected to be minor, because they would be short-term and localized. In the case of a large oil spill, impacts to public and community health could be short-term and localized to long-lasting and widespread, and thus minor to moderate, depending on the size and location of a spill and whether impacts disrupt resource harvest activities for one or more seasons, alter local health care provisions, disrupt traditional sharing networks, and/or threaten cultural values and identities. A large gas release is expected to have minor impacts to community health. Spill drills would have negligible adverse impacts to community health, and impacts from spill response and cleanup activities are expected to be minor to moderate.

A-3.13 Economy

Oil spills can have both adverse and/or beneficial impacts on local markets, employment, income, and revenues. Geography, type and amount of oil, social values, climatic conditions, laws, timing of the spill, and cleanup logistics all significantly affect an oil spill's economic impact (Etkin, 1999; White and Molloy, 2003; Xin and Wirtz, 2009). The three most important predictors of an impact are determined by its size, location, and the existing natural resources. The economic impacts of oil spills include:

- Mixed economy (market and subsistence economy) losses occur for communities dependent on the marine environment for subsistence resources (Impact Assessment, Inc. 1990, 2011a, b; McDowell Group, 1990; Picou et al., 2009).
- Local businesses incur losses caused by direct damage in the spill-affected area(s) (Cirer-Costa, 2015; Eastern Research Group, 2014; McDowell Group, 1990; Murtaugh, 2010; Ritchie et al., 2013).
- Increases in disaster response spending cause an increase in short-term employment, income, and revenues in the spill-affected areas (Cohen, 1993, 1997; Fall et al., 2001).
- Local governments experience revenue impacts (Impact Assessment, Inc., 1990, 2011a, b; Recovery and Relief Services, 2015).

Additional discussion of the general impacts of oil and gas on economy is provided in the *Beaufort Sea: Hypothetical Very Large Oil Spill and Gas Release* report (BOEM, 2020, Section 4.2.9).

A-3.13.1 Small Oil Spills (<1,000 bbl)

Small spills would be contained to a limited area, and overall impacts would depend on the size and spill response time. Workers would consist of primarily on-site personnel with the exception of a 125-bbl spill which may include additional local oil spill response organization personnel. Wages earned and other economic impacts would range from no impacts to impacts that are short-term and localized.

A-3.13.2 Large Oil Spill (≥1,000 bbl)/Gas Release

The primary economic impacts of a large, 3.800 bbl oil spill would occur through response and cleanup efforts (discussed below). Some communities in the region participate in a mixed economy that relies on subsistence sharing. A large oil spill impacting subsistence (Section A-3.11) would have greater impacts on these participating communities than other, more market-based economies where resources are available for purchase. Commercial fisheries could be impacted as well. A large oil spill (3,100-bbl *Glacier Bay* tanker spill) occurred in upper Cook Inlet in 1987 and affected the salmon fisheries. Losses reported by driftnet fishers ranged from approximately $10 to $108 million; setnet fishers reported losses ranging from $12 to $82 million (MMS, 1990). Beyond subsistence and commercial fisheries, impacts to wages earned and other economic impacts would range from no impacts to impacts that are short-erm and localized. KPB oil and gas property taxes would not be impacted. The State of Alaska would have a short-term minor or negligible revenue loss associated with 8(g) zone petroleum revenue. A gas release would not have measurable economic impacts because the natural gas volume would not be substantially reduced during the 1-day event.

A-3.13.3 Spill Drills and Response Activities

While spill drills, including GIUEs, have little to no economic impact to affected communities, response and cleanup could provide economic benefits. Increases in disaster response spending can create a recovery boom that benefits any tourism business that provides accommodations and transportation for those participating in the recovery process. Recovery spending can also support local retailers, contractors, and workers displaced from primary industries. If local procurement for goods and services takes place after disasters, impacts on the local economy can increase short-term economic benefits (Chang et al., 2014).

Assessment of employment, income, and revenues for oil spill response is based on the most relevant historical experience of a spill in Alaskan waters—the 1989 EVOS—which was 240,000 bbl. Although orders of magnitude larger than a large spill, the EVOS event provides an illustrative example of what could happen on as smaller scale. EVOS generated substantial employment of up to 10,000 workers doing cleanup work in relatively remote locations. Smaller numbers of cleanup workers returned in the warmer months of each year until 1992. EVOS also had adverse impacts on jobs and income associated with commercial and recreational fishing. During EVOS, numerous local residents quit their jobs to work on the cleanup, often at significantly higher wages. This generated additional adverse impacts in the form of sudden and significant inflation in the local economy (Cohen, 1993). This effect could also occur under the Spill Scenario, but at a smaller scale proportional to the volume spilled. Based on employment from EVOS, BOEM proportionally estimates a large spill of 3,800 bbl could generate up to 160 jobs. Local businesses may experience a shortage of workers because of the substantial increase in pay cleanup efforts provide. Cleanup efforts could last several seasons due to ice, but the majority of oil is expected to be removed within the first season. Therefore, the majority of the economic benefit in terms of wages earned would occur in the first year of spill response. This impact would provide a temporary and localized increase in household income in the local economy.

A-3.13.4 Conclusion

Economic impacts for affected communities range from negligible to minor for small spills, and up to minor for a large spill. For small spills, most of the cleanup would stem from those already working. However, for a large spill, up to 160 additional cleanup workers could be required which may provide a substantial, short-term amount of wages earned for the affected community. A large gas release or spill drills would have a negligible impact to the economy. Overall, spill response would have a negligible to minor impact.

A-3.14 Commercial Fishing

Oil spills can affect commercial fishing through impacts to the targeted species, or through direct effects on fishing gear or access to fishing grounds. Impacts could include:

- Federal and state waters closed to commercial fishing in an effort to protect seafood safety and ensure consumer confidence (McCrea Strub et al 2011; Moller et al. 1999; Ritchie, 1995).
- Perception of affected sites as unclean and unsafe to eat from which can undermine the image of the sites and reduce demand of commercially harvested species in the months following a spill (Choeng, 2012; Garza-Gil et al. 2006, Morgan et al 2016; Surís-Regueiro et al. 2007).
- Reduction in product, caused by direct mortality or habitat loss (Chang et al., 2014; Section A-3.5).
- Contamination of vessels and gear (ITOPF, 2014).

Effects of oil on targeted species are discussed in Section A-3.5 of this document. The economic impact of a large oil spill (Section A-3.13.2) to the commercial fishing industry is primarily due to fishing closures, real or perceived catch tainting, and gear contamination. Fouling of gear and equipment could occur, which would limit commercial fishing opportunities. Oil spills during the summer or fall seasons may result in the greatest impact to commercially important migratory species, such as salmon, because this is when they are most abundant and have sensitive life stages (eggs and juveniles) present in the region. Important spawning areas, including subtidal and intertidal habitats, could have small amounts of oil persist for years if contacted resulting in longer-term effects on the fish and invertebrates that rely on those areas. These effects can have cascading impacts on commercial fishers. The occurrence of a large spill during winter is likely to reduce the extent of closures and economic losses that would occur during the following spring and summer. There are fewer ongoing commercial fisheries in winter, so closure of commercial fisheries due to a large oil spill in the winter is much less likely than for a large spill that occurred in the spring. Ice could contain and weather the oil, and most commercially important species are unlikely to be contacted. Therefore, economic losses to the commercial fishing industry due to a large winter oil spill likely would be less than expected for an identical spill occurring in the spring.

A-3.14.1 Small Oil Spills (<1,000 bbl)

The majority of small spills are estimated to be less than 50 bbl and are not expected to have population-level effects on commercially important fish or shellfish species (Section A-3.5); thus, they are unlikely to have impacts on commercial fishing operations. A crude oil spill of 125 bbl would persist longer in the environment and could result in short-term and localized impacts to commercial fishing opportunities if the spill occurred in a targeted fishing area. Most small spills are expected to be contained or rapidly weather; but if chronic small spills occurred near important habitat areas for commercially targeted fish, impacts may be felt during multiple fishing seasons. Rapid cleanup or containment could minimize the geographic extent of potential impacts to commercial fishing opportunities. Small spills are not expected to result in fishery closures or reduced market values of fish over the life of the Proposed Action.

A-3.14.2 Large Oil Spill (≥1,000 bbl)/Gas Release

A large, 3,800 bbl spill could depress numbers of fish in subpopulations of some commercially important fish or invertebrate species in Cook Inlet, although the level of effects would depend on a variety of factors (location, volume, trajectory of the spill, and the time of year, see Section A-3.5). Even if fish stocks were not reduced as a consequence of a spill, specific fisheries could be closed due to actual or perceived contamination of fish or shellfish tissues. Such closures during peak salmon fishing could result in severe impacts to commercial fishing and major losses of income for commercial fishers.

A large oil spill may cause local fish stocks or subpopulations to decline, leading to fishery closures. These declines in population, however, are unlikely to affect the entirety of Cook Inlet migratory fish populations, and recovery within a few generations would be expected. Fisheries for groundfish are less likely to be closed than pelagic fish in the case of a large oil spill, because the target species occur at depths that are unlikely to be oiled and are not expected to come in contact with a floating oil slick. Regardless, groundfish could become commercially unacceptable for market due to actual or perceived contamination and tainting. Gear used to target commercially important species, such as longlines, seines, and gillnets, could be fouled with amounts of oil and become unfit for future use. A large oil spill before or during commercial fishing season could result in closures of high-value commercial fisheries to protect gear or harvests from potential contamination. A large spill could also result in large areas being closed to commercial fishing until cleanup operations or natural weathering occurred and oil concentrations are reduced to safe levels or the target population has recovered. This process can take years and could result in long-term, severe economic impacts. These possibly widespread fishing closures could have major adverse impacts to commercial fishers and their livelihoods. Spills originating near established fishing grounds have the greatest potential to affect commercial fishers.

A large gas release and ensuing explosion and fire could kill some commercially important species or damage fishing gear in the immediate area. Blowouts of natural gas condensates that did not burn would disperse rapidly at the blowout site and would be unlikely to affect commercial species populations or fishing gear. The impacts of a gas blowout and resulting explosion or fire are considered negligible to minor.

A-3.14.2.1 Oil Spill Risk Analysis

Specific resource areas were not defined for commercial fishing resources, since fishing occurs throughout the Lease Sale Area and targets several different species. OSRA results for anadromous fish, which are most likely to experience impacts from large spills, are be used to represent contact to commercial fishing since they are the targeted species most likely to be impacted by contact with oil.

OSRA results for anadromous fish resources (Table A6) estimate a large spill is likely to contact the western side of Cook Inlet in both summer and winter. LSs along the western shore of the Kenai Peninsula and the southwestern shore of Cook Inlet contain numerous rivers and streams with anadromous runs of salmonids that could be affected during the summer and fall. The highest combined probabilities of occurrence and contact within 30 days range from 1–3 percent for the west side of Cook Inlet (LS 25, 28, 30–36) and to 1 percent for the east side of Cook Inlet (LS 56 and 62). Although unlikely, oil contact with the shore and nearshore environment could alter the migratory behavior of returning adult salmon and impact commercially important species for one or more fishing seasons. Oil impacts could restrict commercial fishing activities in the Lease Sale Area and potentially force fishing activities to relocate to avoid the large oil spill.

A-3.14.3 Spill Drills and Response Activities

Spill drills, including GIUEs, would impact commercial fishing through vessel traffic, noise, and possibly through testing of mechanical recovery methods. Spill response activities could include mechanical recovery methods and in-situ burning of spilled materials, as well as use of dispersants (BOEM, 2019). Avoidance behavior of fish could affect availability of targeted species for commercial fishing, but these effects would be short-term and localized to the spill area.

The use of dispersants could result in impacts on targeted species as well as their preferred fish and invertebrate prey. These effects could be multi-generational and widespread for commercially harvested fish and shellfish if a large spill occurs, and dispersants are used on eggs or juvenile fish. Effects would be limited spatially by the settling of oil and dispersant. Increased vessel traffic from drills and cleanup activities could cause space-use conflicts with commercial fishing vessels and closures of commercial fishing areas for cleanup activities could prevent fishing. Depending on the size of the spill and whether or not it contacted intertidal and onshore resources, response and cleanup time and extent of response activities could be short-term and localized or long-lasting and widespread.

A-3.14.4 Conclusion

Impacts from small spills would be minor because commercial fishers in the Cook Inlet would generally experience short-term, localized effects to target species and fishery closures are not anticipated and there would not be a clear, long-lasting change in this resource's function. In contrast, large spills could have moderate effects on pelagic fishes that are important for commercial harvest and sale, including several species of Pacific salmon. This would especially be the case if important fish habitat areas were contaminated from a large oil spill and commercial fishing closures occurred during the peak salmon fishing period. Therefore, as a consequence of reduced catch, loss of gear, and/or loss of fishing opportunities for an entire season or more and during cleanup and recovery periods, the overall effects of a large spill could result in major impacts to commercial fishing in Cook Inlet, depending on the season and location of the spill. A large gas release would have negligible impacts on commercial fishing opportunities in Cook Inlet. Impacts of spill response and cleanup activities on commercial fisheries could range from minor to moderate. Spill drills are short-term and localized and are expected to have negligible impacts on commercial fishing, unless they overlap with ongoing fishing seasons.

A-3.15 Archaeological Resources

Oil spills, the use of chemical dispersants, and cleanup operations can have impacts on archaeological resources resulting in contamination, degradation, disturbance, or vandalism. These impacts can occur to sites both on land and underwater. Potential oil spill impacts to archaeological resources include:

- Oiling of known or unknown cultural or archaeological sites (Jesperson and Griffin, 1992; Reger et al., 2000; Wooley and Haggarty, 2013).
- Changes in the biodegradation rate of wood and the increase of soft-rot fungal activity in the presence of crude oil (Ejechi, 2003).
- Disruption of the composition and metabolic function of biota colonizing archaeological resources degrades wood and corrodes metal (Damour et al., 2019; Mugge et al., 2019; Salerno et al., 2018).
- Crude oil contamination of organic material used in C-14 dating; although there are methods for cleaning contaminated C-14 samples, greater expense is incurred (Dekin, 1993).
- Disturbance and potential vandalism to cultural or archaeological sites (Wooley and Haggerty, 2013; Reger et al., 2000).

Additional discussion of the general impacts of oil and gas on archaeological resources is provided in the *Beaufort Sea: Hypothetical Very Large Oil Spill and Gas Release* report (BOEM, 2020, Section 4.2.11).

A-3.15.1 Small Oil Spills (<1,000 bbl)

Small spills of refined oil (such as lube oil, hydraulic oil, gasoline, or diesel fuel) would float on the water surface and would disperse and weather rapidly. Most of the volatile components of the fuel would evaporate and not impact seafloor archaeological resources. Small, refined spills would likely have little to no impact as they are expected to disperse and volatize or be cleaned quickly. Small crude spills would persist longer in the environment and could affect shipwrecks or terrestrial surface sites through contamination from oiling. Small spills of crude oil could adhere to particles in the water column, sink, and impact a shipwreck site or exposed precontact site on the seafloor. However, due to the high-energy environment of Cook Inlet, it is expected that the portion of small crude spills that had not dispersed would be quickly transported away by strong currents (Johnson, 2008). Offshore small spills that reach the shoreline have potential for localized contact to resources in nearshore areas. Crude oil that may reach the shoreline or the seafloor is expected to be in low concentration and would have little or no impact, to potentially localized impacts, depending on the volume of oil that reaches an archaeological resource.

A-3.15.2 Large Oil Spill (≥1,000 bbl)/Gas Release

A large, 3.800 bbl spill of refined oil would float on the water surface and would disperse and weather rapidly. The volatile components of the fuel would evaporate and would be unlikely to affect seafloor archaeological resources. A large spill of crude oil would persist longer in the environment and could adhere to particulate matter in the water column, sink, and impact a shipwreck site or an exposed precontact site on the seafloor. Submerged materials are usually colonized by organisms and typically achieve a state of equilibrium that protects the material from further deterioration. Oil can destabilize this equilibrium, causing a die off of the biota protecting the site and increasing the potential for renewed degradation. Findings of field and laboratory studies conducted following the Deepwater Horizon spill indicate that exposure to oil and/or dispersants may alter bacterial community composition and corrosion potential of wooden and steel hulled shipwrecks and their debris fields (Damour et al., 2019; Mugge et al., 2019; Salerno et al., 2018). For a 3,800-bbl spill, impacts from such events are expected to be localized, affecting the immediate wreck area, but any damage would be irreversible, and therefore long-term. Impacts to a shipwreck would only occur if an oil spill intersected and contacted a shipwreck location.

Some archaeological resources in coastal land segments and intertidal zones could be directly exposed to oil and contaminated. Oil affecting larger areas of the coastline may have a higher potential to impact archaeological resources. BOEM estimates that up to 35 km of coastline could be oiled by a large crude oil spill (Table A2). Contamination by oil would make radiocarbon dating of a site difficult, because spilled oil would seep into charcoal, bone, wood, or other organic materials that would be used for radiocarbon dating (Dekin, 1993). A large refined or crude spill would be expected to have little or no impact if an archaeological resource is not oiled. If one or more resources are oiled, impacts could be long-term, and could be localized or widespread.

A gas release would dissipate rapidly, with no impact on submerged or coastal archaeological resources expected from exposure to gas. A large gas release that results in a blowout or explosion and possible fire could impact any archaeological resource in the vicinity of the blowout or explosion. Pre-drilling geohazard surveys should preclude the possibility of archaeological resources occurring within the immediate vicinity of well sites, which would reduce the expected impacts of a gas blowout and resulting explosion to little or no impacts. A large onshore gas release from a pipeline and potential explosion and fire could impact archaeological resources should ignition occur and if resources are in the vicinity. Although unlikely to occur, if an archaeological resource was damaged by an explosion or fire it could result in the loss or other permanent damage of the resource within the localized area of the incident. Performing pre-construction site clearance surveys in pipeline rights-of-way and creating avoidance boundaries around identified archaeological resources would reduce the possibility of an impact.

A-3.15.2.1 Oil Spill Risk Analysis

Archaeological resources such as historic shipwrecks, aircraft, and artifacts may be found anywhere within the OSRA study area or along the shoreline. Submerged shipwrecks, aircraft, and precontact sites located within the vicinity of the LAs (**Error! Reference source not found.**) are at most risk of being impacted. BOEM identified 112 LSs for this analysis (Ji and Smith, 2021; Appendix A, Tables A.1-11; Figures B-3a–d). Table A5 and Figure A2, in Section A-3.4.2.1, display 39 LSs with a ≥1 percent chance of contact from any individual LA within 30 days summer or winter. The LAs closest to the shoreline have a ≥6 percent chance of contact to 11 individual LSs: Amakdedulia Cove, Bruin Bay, Chenik Head (28) to Redoubt Point (36) on the western side of Cook Inlet; and Cape Starichkof, Happy Valley (56); Barabara Point, Seldovia Bay (61); and Nanwalek, Port Graham (62) on the eastern side of Cook Inlet.

A-3.15.3 Spill Drills and Response Activities

Spill drills, including GIUEs, would be infrequent and localized and are expected to have little to no impact on submerged archaeological resources, because spill drill activities typically do not disturb the seafloor. Onshore impacts are also not expected as typical spill drills normally do not occur onshore.

Spill response and cleanup activities could damage some archaeological sites. Increased human activity, vessel anchoring and mooring, dispersants, and looting could all contribute to impacts on archaeological resources. Vessels involved in spill response may need to anchor at locations throughout the spill area. Anchors have the potential to contact and damage submerged archaeological resources. Additionally, like the impacts of oiling, introduction of dispersants into the marine environment may impact the resident microbial communities that colonize and provide a protective coating to submerged archaeological resources.

A main source of potential impact during spill response at shorelines and onshore is from looting and vandalism stemming from increased human presence around resources. Spill response workers have, at times, damaged or collected artifacts during response activities (Dekin et al., 1993; Wooley and Haggarty, 2013). Looting and vandalism could be mitigated by employing archeologists on the spill response teams and providing training to cleanup crews. Following proper procedures and cleanup protocols developed during and following the EVOS and Deepwater Horizon Oil Spill events would mitigate impacts of spill response. The first measure is avoidance, which could mitigate negative impacts by informing cleanup crews of culturally sensitive areas to avoid. This measure would require a cleanup crew supervisor to consult with archaeologists that inspected a site to advise on where planned cleanup could impact a cultural site. Additionally, spill response efforts would be coordinated with appropriate land managers to protect documented sites. Second, artifact collection under the management of an archaeologist would mitigate overall impacts to archaeological resources by preventing them from being harmed by cleanup activities or removed by cleanup workers. Third, education and training provided to cleanup crews could mitigate impacts by informing workers about the types of sites and artifacts to be aware of and instructing them on what to do and who to call should they find artifacts (Haggarty et al., 1991; Wooley and Haggarty, 1995).

In some cases, the discovery and reporting of archaeological sites could also result in their documentation and protection. For the EVOS, researchers concluded that <3 percent of the archaeological resources within the spill area suffered any significant impacts (Dekin et al., 1993; Wooley and Haggarty, 2013). While following the established spill response mitigation measures would mitigate most impacts, some impacts may still result in the loss of cultural or historic information. Onshore spills would not cover a large area, and therefore any spill cleanup and looting would be limited. Depending on whether a large spill contacted intertidal and onshore resources, response and cleanup time, and extent of response activities, impacts could be localized or widespread and long-lasting.

A-3.15.4 Conclusion

In the case of accidental spills, some impacts to shoreline archaeological and historic sites, historic shipwrecks, and submerged precontact archaeological resources may occur. Impacts from small spills would be negligible to minor because the oil is unlikely to contact archaeological resources, and any contact that does occur would be highly localized. A large oil spill could have moderate impacts based on the location of the spill and the proximity of archaeological resources. A large gas release resulting in a fire or explosion could have long-term and localized or widespread impacts in the unlikely event of ignition occurring and damaging nearby resource(s). Overall, the impact of a gas release is expected to be no more than minor. Spill response and cleanup could have moderate impacts on archaeological resources from impacts of vessel anchoring, dispersants, and damage caused by response personnel. GIUEs and spill drills would have negligible impacts on archaeological resources because they are not expected to contact a site.

A-3.16 Environmental Justice

Environmental justice (EJ) communities that could be impacted by oil and gas activities or oil spills in the Cook Inlet area are identified in Section 4.15 in the Lease Sale 258 EIS. These communities could potentially be disproportionately affected by adverse impacts from a large oil spill. In this EJ analysis, BOEM focuses on a large spill because no high and adverse (i.e., major) impacts are anticipated to occur from a gas release or small spills associated with the Proposed Action and alternatives (see EIS Table 3-4).

A large spill is expected to have major adverse impacts on subsistence harvest patterns and sociocultural systems, depending on location and timing. Impacts of a large spill on public and community health are expected to be long-lasting and widespread, and thus moderate for the Kenai Peninsula Borough, but have potential to be disproportionately felt in EJ communities due to their distinct cultural practices and subsistence ways of life. A large spill is also expected to have moderate impacts on water quality, and moderate to major impacts to coastal and estuarine habitats, which are important for EJ communities in the region that rely on a healthy marine ecosystem. EJ communities rely more on marine and coastal resources such as invertebrates, fish, and birds for subsistence purposes than other communities in the Lease Sale Area. Invertebrates and fish (Section A-3.5) are expected to be moderately impacted by a large oil spill, and impacts to birds would be moderate to major (Section A-3.6). Many subsistence users also fish commercially, reserving a portion of their harvest for subsistence use. Impacts of a large oil spill on commercial fisheries are expected to be major (Section A-3.14), and while the impacts affect communities throughout the Cook Inlet region, EJ communities that rely on fish, including fish gathered through a commercial harvest, could experience disproportionate impacts. Impacts of a large spill on marine and terrestrial mammals that are used for subsistence are expected to be minor (Section A-3.7 and Section A-3.8), and therefore would not affect EJ communities.

A large oil spill could result in contamination of subsistence foods and concerns of tainting of important marine resources. Contamination and damage to marine resources would likely cause disproportionately high and adverse effects to community health and well-being for EJ communities. These effects would arise from distress and disruptions to social organization and community cohesiveness that would be greater in extent and magnitude for EJ communities than non-EJ communities.

The OSRA model estimates, if a large oil spill occurred, oil could contact subsistence use areas (ERAs or GLSs) within 30 days. Subsistence use areas for Port Graham, Seldovia, Nanwalek, Tyonek, the Chigniks, Akhiok, Karluk, Larsen Bay, Ouzinkie, and Port Lions could be contacted by a large spill within 30 days or less. These communities are all identified as EJ communities, and they could be disproportionately affected if oil contacted their subsistence use areas.

If a large oil spill occurred and contaminated subsistence resources and harvest areas, disproportionately high and adverse effects could occur in EJ communities, especially when impacts from contamination of the shoreline, tainting concerns, spill response and cleanup disturbance, and disruption of subsistence practices are factored together. The adverse effects of a large spill event would be disproportionately felt by rural residents, predominantly Alaska Native Peoples, living off the road system and practicing a subsistence way of life. This includes the communities at Tyonek, Seldovia, Port Graham, and Nanwalek in the Cook Inlet region; Kodiak Island communities; and communities on the southern coast of the upper Alaska Peninsula.

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APPENDIX B

Response to Comments

for the
Draft Environmental Impact Statement
for the Proposed Oil and Gas Lease Sale 258
Cook Inlet, Alaska

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Table of Contents

Acronyms and Abbreviations

ADF&G ....Alaska Department of Fish and Game
AQRV ....Air Quality Related Values
BOEM..............U.S. Bureau of Ocean Energy Management
CEQ ....Council on Environmental Quality
CFR..................Code of Federal Regulations
CWA ....Clean Water Act
DEIS ....Draft Environmental Impact Statement
DPP ....Development and Production Plan
DPS ....distinct population segment
E&D ....Exploration and Development
EFH..................essential fish habitat
EJSCREEN ......Environmental Justice Screening and Mapping Tool
EO ....Executive Order
EP.....................Exploration Plan
EPA..................Environmental Protection Agency
ERA ....environmental resource area
EVOS ....Exxon Valdez Oil Spill
FEIS ....Final Environmental Impact Statement
GHG.................greenhouse gas
GWP ....global warming potential
KPB..................Kenai Peninsula Borough
LNG ....liquefied natural gas
MMPA ....Marine Mammal Protection Act
NAAQS...........Natural Ambient Air Quality Standards
NEPA ....National Environmental Policy Act
NMFS ....National Marine Fisheries Service
NGO.................Non-Government Organization
NPDES.............National Pollutant Discharge Elimination System
OCS..................Outer Continental Shelf
OCSLA ....Outer Continental Shelf Lands Act
OSRA...............Oil Spill Risk Analysis
PM....................particulate matter
ROD ....Record of Decision
SO2 ....sulfur dioxide
TSS ....total suspended solids
USC..................United States Code
USCG...............United States Coast Guard
USFWS ............U.S. Fish and Wildlife Service

Introduction

On October 29, 2021, the Department of Interior (DOI) Bureau of Ocean Energy Management (BOEM) published in the Federal Register (86 FR 60068) a notice of availability of a Draft Environment Impact Statement (DEIS) for the Cook Inlet Outer Continental Shelf (OCS) oil and gas Lease Sale 258 (Lease Sale 258). The Federal Register notice opened a public comment period that extended from October 29 to December 13, 2021.

BOEM received a total of 92,961 public comment submissions electronically via www.regulations.gov (Docket BOEM-2020-0018), and during three public hearings. Of those 92,961 public comment submissions, 195 were identified as unique (81 substantive, 114 relatively non-substantive), and 92,757 were form letters associated with mass mail campaigns. Nine comments were found to be non-germane or duplicates.

BOEM reviewed and considered all comments received in the preparation of the Final EIS (FEIS). Where warranted, BOEM has made additions and revisions to the FEIS text based on information or requests provided by commenters. Throughout this document, “DEIS” is used in conjunction with comments received, while “FEIS” is used to describe the revisions and content of the final document. Where a commenter recommended a revision or addition to the FEIS, that acronym is used.

BOEM utilized the services of an independent contractor to assist in processing and analyzing public comments (ICF and CommentWorks® software). ICF processed comments received electronically via www.regulations.gov and transcripts of public comments from public hearings. A hierarchical coding structure was used to sort and assign comments to issue topics for analysis and response. Additionally, a database of verbatim comments was also created as a cross reference for all unique comments and is included in the administrative record for Lease Sale 258. This summary report is not intended to be an exhaustive discussion of all unique comments received on the DEIS – rather, it summarizes substantive comments due to the exceptionally voluminous submissions received on the draft EIS and summarizes content that contributed to the review and development of the FEIS.

This report identifies the commenters that made particular statements and assertions, as represented by footnotes following summary statements. The footnotes provide representative examples of commenters providing particular statements and are not meant to be exhaustive lists of each commenter providing a similar statement. The footnotes include the submission number for anonymous commenters and the organization name for submissions from organizations.

Issue 1 General Comments on the Draft Environmental Impact Statement

Summary of Comments

Approximately 27,570 commenters, including participants in form letter campaigns, provided general comments on the Draft Environmental Impact Statement (DEIS) for Lease Sale 258 (Proposed Action) as described in Section 2.1 of the DEIS. These general comments addressed issues associated with the lease sale but did not provide enough specificity to warrant alterations in the text or analytic conclusions regarding the potential impacts of the Proposed Action. General comments often expressed opposition or support without offering specific information that would improve or enhance the environmental analyses presented.

Commenters opposed to the Proposed Action made statements regarding safety and endangerment of public health and the environment. In particular, commenters critical of the Proposed Action provided statements highlighting the following issues:

- The Proposed Action would continue a dependence on oil in the American energy economy, perpetuating the harmful effects and further degradation of the environment;[1]
- The Proposed Action would create negative impacts on maritime and commercial fisherman in, both environmental and socio-economic capacities;[2]
- The impact of the Proposed Action would produce harmful effects on local communities, including tribal communities, that would produce significantly negative outcomes within the local sustainable economies;[3]
- As a whole, the Proposed Action would have largely negative effects on the environment as it would preclude efforts to expand clean energy access and reduce carbon emissions by perpetuating "unclean" energy and detract from a clean energy economy;[4] and
- The Proposed Action would be detrimental to commercial, sport, and personal use fisheries that have contributed to Alaska's economy, and which are reliant on intact marine and estuarine habitats and clean water.[5]

One commenter in opposition to the Proposed Action argued that the activities from the Cook Inlet lease developments would further the environmental harm and catalyze the negative impacts of climate change.[6] Another commenter stated that the Proposed Action would tether subsequent generations to the harmful effects of fossil fuels, leading to climate catastrophe and no long-term benefits significant enough to make the perceived risk of Proposed Action tolerable, acceptable, or justifiable.[7] Some individuals asserted that if the Proposed Action occurs, it would be the first drilling in federal waters in Cook Inlet since the 1980s.[8] Other comments included statements that the lease sale area meets the criteria for a United Nations World Heritage Biosphere Reserve designation;[9] an opinion that BOEM has a legal obligation to protect the environment and public health and has the authority to cancel the Cook Inlet

1 W. Sonen
2 A. Bellamy.
3 Natural Resources Defense Council.
4 Natural Resources Defense Council [Form Letter Master].
5 Salmon Habitat Information Program [Form Letter Master].
6 K. Nalven.
7 Natural Resources Defense Council.
8 Chickaloon Native Village.
9 S. Christiansen; N. Pease.

lease sale and reform the fossil fuel leasing program;[10] a request to withdraw the Cook Inlet Planning Area from future 5-year oil and gas lease plans in Alaska;[11] and another comment stating the lease sale process, including the DEIS and Record of Decision (ROD), has met all the legal requirements to conduct a sale. A commenter added that consistent with BOEM's current 5-year oil and gas leasing plan developed under OCSLA, the lease sale should occur.[12]

Summary Response to Comments

Comments that express general opinions about oil and gas development or recommend specific decisions to be made by the Secretary of the Interior will be incorporated into the administrative record and available to the decision maker during the deliberative process for the Cook Inlet Oil and Gas Lease Sale. BOEM does not provide specific responses to such comments in this document. Meeting the criteria of a United Nations World Heritage Biosphere Reserve has no bearing on the impact analyses of the Proposed Action and is outside the scope of this FEIS.

Potential impacts of the Proposed Action on environmental, social, cultural, and economic resources are analyzed in Chapter 4 of the FEIS. BOEM strives to use best practices and best available information during review and analysis of environmental impacts. Where appropriate, BOEM recognizes assumptions, uncertainties, and limitations of data used. BOEM has determined the analysis in the FEIS is adequate and appropriate for evaluation and associated determination of effects.

From July 21, 1978 to December 18, 1984, a total of 13 exploratory wells and one deep strategic test well were drilled in Federal waters in Cook Inlet (data available: https://www.boem.gov/alaska-cadastral-data#GIStable). BOEM has met its OCSLA mandates by providing this oil and gas leasing opportunity. It is usually the Secretary of the Interior's decision whether, or not, to proceed with the lease sale; however, the Inflation Reduction Act of 2022 (Pub. L. No. 117-169, enacted Aug. 16, 2022) requires BOEM to hold Lease Sale 258 by the end of December 2022. While BOEM or the Secretary has no discretion on whether to hold the sale, BOEM is finalizing this FEIS to follow its normal leasing process to the fullest extent possible.

Source of Comments

- Individual/General Public
- Anonymous
- Energy/Non-Energy Industry and Other Associations
- Environmental Advocacy and Other Non-governmental Organizations (NGOs) and Public Interest Groups
- Tribes and Tribal Representation
- State Agencies
- Other

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[10] C. Lish; J. Katzman.
[11] C. Lish.
[12] State of Alaska Dept of Natural Resources; Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).

Issue 2 Lease Sale / Proposed Action

Issue 2.1 Purpose and Need for the Lease Sale

Summary of Comments

Approximately 20,035 of the commenters, including participants in form letter campaigns, discussed the purpose and need for the lease sale.

Some commenters stated that the purpose and need statement in the DEIS is unreasonably narrow. One commenter stated if BOEM does not abandon Lease Sale 258, the commenter would recommend preparing a new or supplemental document that includes a new purpose and need statement centered on the need for energy, as opposed to the need to hold an oil and gas lease sale. According to the commenter, the focus on the need for energy would allow BOEM to consider clean energy alternatives that are consistent with national priorities to undertake "equitable and rapid transition away from fossil fuel development." [13]

Commenters also stated that the purpose and need statement reads as though climate change does not exist and the only path forward is to continue with oil and gas leasing. Commenters expressed concern that the Purpose and Need Statement does not comply with the National Environmental Policy Act (NEPA). The commenters stated that the only option that would satisfy the purpose and need statement as written, is approving the lease sale. Referencing scientific research related to impacts of climate change and the United States' commitment to fighting climate change, the commenters concluded that current research and evidence underlines the urgent need to address the climate crisis by ending new offshore oil and gas leasing and transition away from fossil fuel development.[14]

Climate Change Policy

Some commenters expressed concern that the Proposed Action would contradict the Biden administration's approach to climate change and responsibility to implement the Exxon Valdez Oil Spill (EVOS) Restoration Plan.[15] Other commenters stated the Proposed Action undermines current emissions reductions targets, including Executive Order (EO) 14008 or President Biden's Nationally Determined Contribution (NDC).[16] Further, the commenters urged BOEM to assess the lease sale's greenhouse gas (GHG) pollution in the context of national and international commitments to address the climate crisis, including the Paris Agreement. Other commenters stated the DEIS does not consider the leasing program in the context of national and international GHG emissions reduction goals.[17] One commenter recommended the FEIS assess the extent to which the program is inconsistent with the U.S. and global policy to limit GHG emissions and whether resulting production activities would be economical in a future scenario where there is reduced demand for fossil fuels.[18] A commenter also stated the lease sale is inconsistent with the proposed Northern Gulf of Alaska Marine National Monument, that would prohibit all fossil fuel development (and other industrial activities) in federal waters of the EVOS region.[19]

[13] Ocean Conservancy.
[14] National Resources Defense Council, et al.; Cook Inletkeeper.
[15] Oasis Earth; N. Pease; C. Lish; Center for Biological Diversity [Form Letter Master].
[16] Evergreen Action; Ocean Conservancy.
[17] U.S. EPA Region 10; National Resources Defense Council, et al.; Cook Inletkeeper.
[18] U.S. EPA Region 10.
[19] Oasis Earth.

Climate Change and Transition to Renewable Energy

Several commenters discussed the increased pace of climate change, its impacts, and the need to transition from fossil fuel development to renewable energy forms, including solar, geothermal, tidal and wind energy.[20] Commenters in opposition to Lease Sale 258 stated additional steps must be taken to meet domestic and international obligations and to protect current and future generations from the impacts of climate change. Commenters also encouraged BOEM to cancel Lease Sale 258, withdraw the Cook Inlet Planning Area from future lease sales, and invest the resources needed to promote clean and renewable energy development in Lower Cook Inlet and beyond.[21] Commenters discussed in detail the volume of threats climate change has caused, primarily due to fossil fuel emissions, including: frequent and intense heat waves; floods and droughts; hurricanes and wildfires; rising seas and coastal erosion; increased spread of disease; food and water insecurity; acidifying oceans and increased species extinction; and risk and collapse of ecosystems.[22] A commenter also discussed the Fourth National Climate Assessment, which, according to the commenter, stated Alaska will experience a greater increase in temperature than any other state, with the greatest increase expected in the Arctic. The commenters stated that other recent scientific assessments have similarly documented the extreme impacts of Arctic climate change.[23]

Other commenters expressed the need to protect the environment from the effects of climate change, noting that local economies rely on the thriving environment and natural resources of Alaska.[24] Some commenters expressed the need to protect marine mammals from the impacts of oil spills and climate change.[25] A commenter suggested the best way to prevent a future oil spill is to transition away from fossil fuel.[26] One commenter urged BOEM to enhance the tools and scientific knowledge available to transition off fossil fuels.[27] A couple of commenters discussed the negative impacts of climate change on fisheries and wildlife, noting the effects on the Cook Inlet region specifically, including reduction in fish populations.[28]

Commenters expressed concerns related to reports issued by the Department of Homeland Security, the Department of Defense, the National Security Council, and the National Intelligence Director that highlight the threat that climate change poses on national security.[29]

One commenter stated BOEM should integrate climate impacts into its decision making. The commenter suggested contextualizing the lease sale's monetized climate impacts and incorporating them into a public interest assessment. The commenter recommended balancing those effects against other monetized project impacts in a cost-benefits analysis. The commenter stated economic benefits of the lease sale are well-suited for monetization and can be compared to monetized climate impacts and other adverse environmental impacts.[30]

Commenters stated any additional leasing would be unwarranted and capricious based on current production horizons for already leased federal fossil fuel resources and the urgent need to prevent further

[20] K. Walker; M. Francis; Unitarian Universalists of Homer; R. Gustafson.
[21] Multiple organizations [BOEM-2020-0018-0184].
[22] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[23] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[24] N. Pease; C. Lish; Unitarian Universalists of Homer.
[25] M. Heslin; Unitarian Universalists of Homer.
[26] C. Mom.
[27] Chickaloon Native Village.
[28] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[29] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[30] Institute for Policy Integrity at New York University School of Law.

"carbon lock-in" – where approvals and investments made now can "lock in" decades of fossil fuel extraction that the environment cannot afford.[31]

Alaska's Energy Needs

A few commenters discussed the region's energy needs. To further understand what areas should be prioritized for development, a commenter recommended the FEIS include a discussion that clarifies the use of Cook Inlet production volumes to meet regional energy needs from the leases being offered under Lease Sale 258. Specifically, the commenter recommended discussing how existing Cook Inlet fields at current production levels can supply regional users' needs. The commenter stated their comments are consistent with the Council on Environmental Quality (CEQ) notice of proposed rulemaking (86 FR 55757 (Oct. 7, 2021)).[32] One commenter recommended further analysis to identify what the energy needs really are, beyond maximizing short-term corporate revenues and profits. The commenter also stated a need to review the Proposed Action compared to long-term degradation of an environment that supports the economic needs of the marine trades, fisheries, and tourism.[33] One commenter stated many individuals and businesses in their community have already invested thousands of dollars in solar power to prevent future corruption of the environment.[34]

Support for Continued Oil and Gas and Fossil Fuel Development

Some commenters expressed support for carrying out Lease Sale 258 and oil and gas development in Cook Inlet. A commenter stated the contributions of oil production on economic activity in Alaska, including providing thousands of private and public sector jobs, as well as critical public services.[35] Similarly, a commenter stated responsible natural gas and oil development in Cook Inlet and Alaska is essential to the nation's post-pandemic recovery, long-term economic growth, and energy security.[36] One commenter stated the immense oil and gas reserves in the Cook Inlet have served to fulfill the energy needs of Alaska for over 60 years, generating 70 percent of the electricity that powers homes and businesses in communities along the Railbelt.[37] Further, a commenter stated that natural gas produced in Cook Inlet is the primary source of heat and electricity for most of Alaska's population and that it is critical that Federal resources continue to help meet this demand.[38] Another commenter stated that when considering national energy needs, "a commitment to long-term U.S. OCS oil production will serve to mitigate against dependence on foreign energy; enhance the national security of the U.S. and our allies; generate important revenues for the Federal treasury, the Land & Water Conservation Fund, national parks, and urban outdoor partnership programs; help ensure that we maintain high levels of domestic production to feed U.S. refineries and alleviate inflationary risks to consumers; and support hundreds of thousands of high-paying jobs throughout the country." The commenter stated that for these reasons, the U.S. OCS is a "preferred region" for oil and gas exploration, development, and production.[39]

Citing data from various resources, a commenter stated that production in the U.S. OCS and associated environmental impacts are strictly regulated. Without OCS energy, the commenter predicted an increase in natural gas and oil imports as well as a commensurate increase in global emissions. The commenter

[31] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[32] U.S. EPA Region 10.
[33] Homer Bed and Breakfast Association.
[34] M. Kuszmaul.
[35] Resource Development Council for Alaska, Inc.
[36] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).
[37] Alaska Oil and Gas Association.
[38] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).
[39] K. Nalven.

concluded that development of Alaska OCS energy would result in limited environmental impacts, including limited emissions and impacts from transportation, compared to transport from other foreign locations.[40]

Response to Comments Summary

Comments on the DEIS Purpose and Need Statement

The Secretary of the Interior is charged with developing the National OCS Oil and Gas Leasing Program and is required to balance orderly resource development with protection of the human, marine, and coastal environments while simultaneously ensuring receipt of fair market value for the lands leased and the rights conveyed by the Federal government. The purpose of the Proposed Action addressed in this FEIS is to offer for lease certain OCS blocks located within the federally managed portion of Cook Inlet that may contain economically recoverable oil and gas resources. Production of such undiscovered oil and gas resources may then assist in meeting regional and national energy needs.

The need for the Proposed Action is to meet the requirements of the Outer Continental Shelf Lands Act of 1953 (OCSLA), as amended (43 United States Code (USC) § 1331 *et seq.*). OCSLA states "*the outer Continental Shelf is a vital national resource reserve held by the Federal Government for the public, which should be made available for expeditious and orderly development, subject to environmental safeguards, in a manner which is consistent with the maintenance of competition and other national needs*" (43 USC §1332(3)).

A targeted leasing model was utilized in the *2017–2022 OCS Oil and Gas Leasing Proposed Final Program* which included the Alaska OCS Lease Sale 258 in the Cook Inlet Planning Area. The goal of the targeted leasing approach is to focus oil and gas leasing on the most promising OCS blocks, while protecting important habitats and critical subsistence activities (Chapter 2, Alternatives Including the Proposed Action). Alternatives which excluded oil and gas development did not meet the purpose and need as described above and were not carried forward for detailed analysis.

Climate Change Policy

Activities related to the proposed action would not interfere with the ongoing EVOS restoration plan and are beyond the scope of this analysis. BOEM has determined that the potential production of oil and gas from Lease Sale 258 is compatible with national policies and current as well as future global energy demands. If oil and gas were not produced from the Lease Sale 258, market forces dictate this energy would be procured from other sources to meet energy demands (Table 4-10 in the FEIS). The U.S. achieved its 2020 goal to reduce its net GHG emissions by 17 percent below 2005 levels, in part due to the coronavirus pandemic. Currently, the U.S. has established NDCs for 2025 and 2030, each with a two-percentage-point range (The White House 2021). Refer to Table 4-15 in the FEIS for information related to future emissions targets and a comparison of the Proposed Action and No Action Alternatives and U.S. target reductions for Cook Inlet Lease Sale 258.

BOEM's Lifecycle Greenhouse Gas Methodology is described in the paper OCS Oil and Natural Gas: Potential Lifecycle Greenhouse Gas Emissions and Social Cost of Carbon (subsection *Lifecycle Greenhouse Gas Methodology*, Section 4.3.5) (Wolvovsky and Anderson, 2016). The GHG model was developed to examine the lifecycle GHG emissions associated with OCS oil and gas development activities both pre- and post-production. This includes all operations on the OCS associated with oil and gas leases (exploration, development, and production). Models utilized represent the best science and

[40] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).

methodology available for estimating energy market impacts and substitution rates. These are important factors in the analysis and comparison of GHG emissions that would occur under the No Action Alternative and the Proposed Action, respectively. MarketSim's modeling of oil, natural gas, coal, and electricity for U.S. markets was utilized for substitution between alternate fuel sources. BOEM's modeling shows the No Action Alternative would result in lower GHG emissions when compared to the Proposed Action under both local and foreign consumption (Section 4.3.5).

Conservation and Restoration Programs

Implementation of the Proposed Action would not contradict or interfere with conservation programs such as President Biden's 30 x 30 initiative or the implementation of the EVOS Restoration Plan.

No information was discovered on the status of the proposed Northern Gulf of Alaska Marine National Monument.

Climate Change and Transition to Renewable Energy

The need for the Proposed Action is to develop OCS resources in accordance with the Outer Continental Shelf Lands Act of 1953 (OCSLA), as amended (43 USC § 1331 *et seq*.). The Secretary of the Interior is charged with developing the OCS Oil and Gas Leasing Program and is required to balance development with protection of the human, marine, and coastal environments while simultaneously ensuring receipt of fair market value for the lands leased and the rights conveyed by the federal government. The Cook Inlet Lease Sale 258 was included in the 2017–2022 OCS Oil and Gas Leasing Proposed Final Program as approved by the Secretary of the Interior on January 17, 2017. Based on this, alternatives or comments regarding possible use of renewable energy in lieu of oil and gas did not meet the purpose and need and were not considered further.

Under BOEM's renewable energy regulations at 30 CFR § 585.231, an applicant may request a commercial or limited renewable energy lease. BOEM considers unsolicited requests for a lease on a case-by-case basis. The Energy Policy Act of 2005 requires that BOEM issue leases and grants on a competitive basis, unless it determines that there is no competitive interest in the proposed lease or grant. When only one developer has indicated interest in developing a given site, BOEM may issue a lease or grant noncompetitively. To date, no requests have been received for areas on the Alaska OCS. Currently, BOEM Alaska Regional office is actively engaged with various partners in conducting a feasibility study for renewable energy technologies in Alaska's offshore waters.[41]

Climate change was considered as a cumulative effect and analyzed in Chapter 4, *Affected Environment and Environmental Consequences*. Some examples and issues associated with climate change near the project area are summarized in Section 3.2.2.7 in the FEIS. This section recognizes that "Evidence of warming in Alaska is wide-ranging and includes observed increases in average air and ocean temperatures, melting snow and ice, and sea level rise (IPCC, 2014; NMFS, 2013)." The incremental impacts of the Proposed Action, coupled with cumulative impacts and climate change impacts on fish, marine mammals, terrestrial wildlife, and fisheries are discussed in Sections 4.6.4, 4.8.4, 4.9.4, and 4.13.4 of the FEIS, respectively.

BOEM acknowledges that the national security implications from climate change impacts are far reaching. Section 4.3.5 describes the methodology and assumptions that BOEM uses to quantify the projected GHG emissions that would occur from the Proposed Action. Due to limitations of technology, data, modeling, and methods, it is not presently possible to predict how much the proposed activities

[41] https://www.boem.gov/sites/default/files/documents/IM_AK-21-x07_0.pdf

would exacerbate climate stressors resulting in national security implications from poverty, environmental degradation, and political instability, providing enabling environments for terrorist activity abroad.

BOEM recognizes that the No Action Alternative would result in lower GHG emissions when compared to the Proposed Action under both local and foreign consumption scenarios but determined this difference would not appreciably contribute to climate change or result in "locking in" carbon. BOEM will continue to review and study methods utilized in updating the foreign lifecycle analysis as new data and methodologies become available.

BOEM analyzed the monetized social cost from GHG emissions based on methodology discussed in Section 4.3.5.2 of the FEIS and in accordance with Section 5 of EO 13990, *Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis*. Analysis assumptions, uncertainty, limitations, and results are presented that determined the estimated social cost of GHG emissions on an annual basis (Section 4.3.5.2). BOEM utilized the best available information and methodologies for this analysis. The results provided are considered to be sufficient for the evaluation and associated determinations of effect(s).

Alaska's Energy Needs

The need for the Proposed Action is to develop OCS resources in accordance with the Outer Continental Shelf Lands Act of 1953 (OCSLA), as amended (43 USC § 1331 *et seq.*). OCSLA states "*the outer Continental Shelf is a vital national resource reserve held by the Federal Government for the public, which should be made available for expeditious and orderly development, subject to environmental safeguards, in a manner which is consistent with the maintenance of competition and other national needs*" (43 USC § 1332(3)). While it is assumed the Proposed Action will support current and future regional and national energy needs, this is not a prerequisite for BOEM to hold the lease sale.

Long term environmental effects to marine trades, fisheries, and tourism are considered in the FEIS and discussed as noted in Sections 4.13.2 and 4.10.2, respectively.

Support for Continued Oil and Gas and Fossil Fuel Development

Commenters stated the Proposed Action would generate an energy and revenue source for the region. BOEM concurs that the reserves in Cook Inlet can serve to fulfill the energy needs for Alaska and power homes and businesses in communities along the Alaskan Railbelt. However, as stated in Section 4.12.2, communities in the Kenai Peninsula Borough (KPB) would have limited or moderate beneficial impacts primarily associated with oil and gas property tax revenues while the State of Alaska would receive even fewer beneficial impacts from the Proposed Action oil and gas property tax revenues than the KPB.

Prior to developing Alaska's OCS energy resources, operators who obtain lease rights on the OCS are required to submit an Exploration Plan (EP) prior to exploration activities, and a Development and Production Plan (DPP) prior to placement of infrastructure. BOEM conducts separate, project-specific National Environmental Policy Act (NEPA) analysis prior to approving an EP or DPP in order to assess impacts resulting from emissions and transportation.

Source of Comments

- Individual/General Public
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Energy/Non-Energy Industry and Other Associations

- Federal Agencies
- State Agencies
- Tribes and Tribal Representation

Issue 2.3 Safety Requirements

Summary of Comments

Six commenters discussed safety requirements as they relate to the lease sale. A few commenters expressed concern related to a potential bidder, Hilcorp Alaska, LLC, claiming concerns related to safety violations.[42] Anticipating that Hilcorp Energy Company will bid on the lease sale, a commenter expressed concern for worker safety and regulatory violations. According to the commenter, Hilcorp Energy Company has a history of worker safety violations resulting in loss of life and other injuries as well as repeated environmental and regulatory requirement violations. The commenter also made claims that the "Dunleavey administration" collaborated with Hilcorp Energy Company, including allowing discharge of toxic waste from oil and gas drilling in Cook Inlet, using public funds to hire lawyers and promote Hilcorp's exploration in the Lower Cook Inlet, and proposing to weaken Alaska's stringent oil spill prevention and response regulations.[43] Another commenter objecting to the BOEM DEIS for Lease Sale 258 also expressed concern about Hilcorp and the company's history of penalties related to safety valve shut off specific to Prudhoe Bay and other violations in Cook Inlet and Prudhoe Bay.[44]

A commenter recommended the FEIS include discussion of how "Fitness to Operate" standards will be developed and adopted throughout the leasing program to ensure that companies meet certain safety, environmental, and financial responsibilities, as well as include information about financial assurance requirements to mitigate potential adverse impacts resulting from a worst-case release or spills.[45] A commenter stated that based on the extreme weather in the area, operations could not be safely undertaken.[46]

Summary Response to Comments

BOEM and BSEE regulations require operators to use the Best Available and Safest Technologies (BAST) program with latest proven technologies to ensure safety and protection of people, environment, and property. The BAST program requirement is contained in the 1978 OCSLA amendments and the Energy Policy Act of 2005.

BOEM requires that entities engaging in activities on the OCS demonstrate sufficient financial assurance to be able to meet their legal obligations. BOEM's regulations (30 CFR § 556.900, *Bond requirements for an oil and gas or sulfur lease*) require bonds and other means of financial assurance to demonstrate coverage for compliance with all obligations associated with pipeline right-of-way grants, leases, and activities proposed in a plan. Lessees and operators are also jointly and severally liable for compliance with all non-monetary terms and conditions of each lease, including decommissioning obligations. Operators must also demonstrate sufficient oil spill financial responsibility coverage for proposed facilities and must prove they have the financial capability to drill a relief well and conduct well control operations.

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[42] R. Gustafson, Unitarian Universalists of Homer, K. Walker; N. Schmitt.
[43] Unitarian Universalists of Homer.
[44] K. Walker.
[45] U.S. EPA Region 10.
[46] North Pacific Fisheries Association.

BOEM and BSEE regulators are involved with industry groups, researchers, and others to investigate new technologies and safety methodologies. BSEE has a Technology Assessment Program that funds and supports research associated with all aspects of safety, including operational safety and pollution prevention.

Regarding the request for a discussion of "Fitness to Operate" standards, BOEM may disqualify an operator from acquiring a lease based on unacceptable operating performance (see 30 CFR § 556.403). BOEM has the authority to revoke the designation of an operator if it has unacceptable operating performance and to cancel leases if operators fail to comply with any provision of OCSLA, the lease, or applicable regulations (see 30 CFR § 550.135 and 30 CFR § 556.1102). According to the DOI Report on The Federal Oil and Gas Leasing Program (November 2021), BOEM plans to develop a "Fitness to Operate" standard for companies seeking to be designated as oil and gas operators. The intent will be to require companies to meet minimal fitness to operate standards to ensure companies have the capability to meet their safety, environmental, and financial responsibilities.

Source of Comments

- Individual/General Public
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Federal Agencies

Issue 3 Alternatives

Issue 3.1 Alternative 2 – No Action Alternative

Summary of Comments

Approximately 20,030 commenters, including form letter campaigns, discussed the No Action Alternative. Several of these commenters voiced general support for the No Action Alternative. Commenters stated the No Action Alternative would best address the climate crisis and comply with policies and priorities set by President Biden and EO 14008.[47] Commenters also expressed concern that the current climate crisis could have negative effects on the fishing industry as well as Alaska Native peoples and residents.[48] Many commenters stated the No Action Alternative would allow for development of renewable energy options such as a marine hydrokinetic energy research project, or tidal, solar, or wind energy projects.[49] Two commenters stated modeling assumptions used by MarketSim during GHG emissions analysis under the No Action Alternative, including assumptions about elasticities, were flawed and outdated, and resulted in overestimating the net GHG emissions for this alternative as well as underestimating methane's heating effects on global warming potential (GWP) in general.[50] Finally, commenters stated air quality would be the least degraded under the No Action Alternative.[51]

Many commenters stated the No Action Alternative would have the least negative effect to marine mammals, aquatic species, and habitats due to eliminating the potential for noise from seismic surveys, oil

[47] Ocean Conservancy; Cook Inletkeeper; Lower Cook Inlet Defense Project; Alaska Marine Conservation Council.
[48] T.K. Smith, Animal Welfare Institute; Ocean Conservancy; M. OMeara; R. Highland; S. Pondolfino.
[49] Natural Resources Defense Council, et al.; Alaska Marine Conservation Council; R. Highland; S. Pondolfino.
[50] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[51] Chickaloon Native Village; S. Pondolfino.

spills, drilling waste discharge, and other possible contamination.[52] Commenters stated the No Action Alternative would be the most likely to protect threatened and endangered species as well as their associated designated critical habitat – specifically, the Cook Inlet beluga whale and northern sea otter Distinct Population Segment (DPS).[53] Other aquatic species mentioned include Chum and King/Chinook salmon.[54] Commenters said this alternative would have the least impact to the Cook Inlet ecosystem including nesting habitats for migratory birds and wetlands.[55] One commenter also remarked the No Action Alternative provided meaningful protection of the Western Hemisphere Shorebird Reserve Network Kachemak Bay.[56] Two commenters considered any mitigation and other proposed alternatives would not be sufficient or effective in returning critical habitats to their prior existing conditions and therefore the No Action Alternative was the only viable option.[57]

Several commenters stated the No Action Alternative would be the least disruptive to the current community's way of life and specific segments of the regional economy in the southern Kenai Peninsula and the Lower Cook Inlet region including the subsistence cultures of Port Graham and Nanwalek.[58] Many suggested the No Action Alternative was a safer option based on concern over the potential oil spill effects on human health, marine and aquatic habitats, the local economy (such as ecotourism), and the local fishing industry including salmon, pacific cod, rockfish, and snow crab.[59] Some mentioned concerns over food security and the ability to fish, hunt, and fill their freezer with game annually.[60] One commenter stated only the No Action Alternative was in line with the EOs 12898 and 13985, which require fair treatment of all people regardless of race, color, national origin, or income and advancing equity of those who have been historically underserved.[61]

Some commenters stated BOEM should make the No Action Alternative the preferred option and has the statutory authority to do so. One commenter stated BOEM should not assume future NEPA documents would produce environmental or economically sound decisions.[62] Others stated the historical precedent for BOEM to decline proposed lease sales under other administrations and recommended BOEM not treat lease sales as a "given."[63]

Referencing BOEM's estimated climate costs of the lease sale relative to the No Action alternative, a commenter stated that BOEM has not met its obligations under NEPA regarding "balancing analysis" of environmental costs and economic and technical benefits. Specifically, the commenter claimed that although BOEM states it "seeks to quantify certain impacts related to employment numbers and labor income, BOEM does not compare the monetized climate damage expected to result from the lease sale to the supposed economic benefits of the proposals. Also, it does not explain how and to what extent these costs factored into BOEM's decision to move forward with the lease sale. Further, the commenter argued "BOEM's analysis does not account for the option value of delaying the lease sale, and the cost of foregoing that benefit." According to the commenter, option value is strong given the uncertainties

[52] T.K. Smith; N. Sawaged; Chickaloon Native Village; Animal Welfare Institute; Marine Mammal Commission (MMC); Natural Resources Defense Council, et al.; Lower Cook Inlet Defense Project; Cook Inletkeeper; K. Nalven; P. Vadla; R. Highland; S. Pondolfino.
[53] N. Sawaged; Chickaloon Native Village; Animal Welfare Institute; Marine Mammal Commission (MMC); S. Pondolfino.
[54] Chickaloon Native Village; D. Kasprzak; M. Puckett; N. Schmitt; P. Vadla.
[55] Natural Resources Defense Council, et al.; Cook Inletkeeper; N. Sawaged; K. Nalven; R. Highland.
[56] Lower Cook Inlet Defense Project.
[57] N. Sawaged; K. Nalven.
[58] Cook Inletkeeper; Lower Cook Inlet Defense Project; Alaska Longline Fisherman's Association; M. Puckett; D. Aderhold; S. Pondolfino; S. Mauger.
[59] T.K. Smith; Homer Bed and Breakfast Association; D. Aderhold; Alaska Marine Conservation Council; Alaska Jig Association; N. Schmitt; P. Seaton; S. Mauger.
[60] T.K. Smith; Alaska Longline Fisherman's Association; S. Mauger.
[61] Lower Cook Inlet Defense Project.
[62] Animal Welfare Institute.
[63] Animal Welfare Institute; Natural Resources Defense Council, et al.

regarding the costs and benefits of the lease sale. The commenter suggested BOEM monetize the benefits of the lease sale and then compare those benefits to the monetized climate damages and other key impacts. BOEM could also monetize the private production cost by reviewing available information on industry trends, as done when assessing the costs of its most recent 5-year plan.[64]

Several commenters felt the quantitative analysis used to determine future oil and gas consumption, as well as the resulting GHG emissions, was flawed. Many stated modeling assumptions used to calculate emissions analysis under the No Action Alternative resulted in overestimating net GHG emissions and underestimating the climate harm from the lease sale.[65]

Commenters stated the model was solely based on present and historic data and did not consider future energy sector market trends and policies - both of which are likely to result in lower emissions due to substitute or lower carbon energy sources such as renewable energy.[66] Similarly, commenters stated that the use of historic data, paired with the assumption that oil and gas production will remain constant through 2050, produced an overestimate of the future fossil-fuel demand.[67] Commenters stated that BOEM must also consider improved engine efficiencies and technology in the GHG life cycle modeling as part of the standard best practices requiring reasonable assumptions.[68] Finally, commenters stated that modeling should consider regulatory policies, such as the Paris Agreement, which would result in lower future GHG emissions than predicted by the model.[69] One commenter stated the analysis could not be validated due to lack of transparency in the assumptions and reliance on incomplete data not publicly available which then resulted in arbitrary conclusions. The commenter suggested BOEM refine its methodology and GHG life cycle modeling efforts to improve the estimate of foreign oil consumption. In addition, this commenter felt the analysis did not address welfare losses (the consumers' willingness to pay above market price for oil as well as producers' willingness to supply below market price) under the No Action Alternative from reduced oil consumption.[70] Lastly, another commenter stated BOEM's GHG Lifecycle Model (LCM) and results may not be valid at a regional scale and provided recommendations to clarify Cook Inlet's petroleum resources potential and potential emissions from Lease Sale 258.[71]

Commenters also remarked on the cumulative and incremental GHG analysis. A commenter stated BOEM was required to consider the cumulative and incremental effects of GHG emissions, including downstream, on climate change.[72] Another commenter said BOEM's calculation of incremental climate costs resulted in underestimating the lease sale's actual costs due to the consumption discount rate likely to be well below the predicted 3 percent, based on inflation, and use of a discount rate under 3 percent would then result in greater climate costs under the Proposed Action. This commenter is concerned that while BOEM discusses the economic effects of GHG emissions under the Proposed Action and No Action Alternative it does not discuss how these effects are incorporated into BOEM's decision making.[73]

Many commenters had opinions on the economic analysis or summaries. One commenter stated the substitution analysis methodology was inconsistent. According to the commenter, currently the DEIS states, under the No Action Alternative, oil and gas production would occur elsewhere but while it

[64] Institute for Policy Integrity at New York University School of Law.
[65] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[66] U.S. EPA Region 10; Institute for Policy Integrity at New York University School of Law; Natural Resources Defense Council, et al.
[67] Institute for Policy Integrity at New York University School of Law; Natural Resources Defense Council, et al.; Cook Inletkeeper.
[68] Institute for Policy Integrity at New York University School of Law.
[69] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[70] American Petroleum Institute.
[71] U.S. EPA Region 10.
[72] Evergreen Action.
[73] Institute for Policy Integrity at New York University School of Law.

accounts for the climate impacts of this substitute production it does not account for the economic benefit from tax revenues, employment, and royalties. The commenter stated that if potential oil and gas production were replaced by substitute fossil-fuel production it would result in similar economic benefits under the No Action Alternative as the Proposed Action.[74] The commenter stated this discussion is missing from the DEIS.

A different commenter states the DEIS incorrectly presumes loss or delay of economic benefit under the No Action Alternative since the potential for Federal royalties is not a given but rather currently hypothetical.[75] One commenter recommended BOEM complete an economic analysis of the social and health effects, such as local pollution effects and environmental costs. According to the commenter, BOEM should then also complete an economic projection under the Proposed Action or provide an explanation of why this was not done. The commenter stated that once BOEM completes these two analyses they can then be compared, balanced, and factored into BOEM's decision making process, as required by NEPA.[76]

Some commenters voiced general support for the No Action Alternative, largely due to concerns about the climate crisis.[77] One commenter stated the No Action Alternative would be the most likely to protect threatened and endangered species as well as their associated designated critical habitat. The commenter said this alternative would have the least impact to the Cook Inlet ecosystem including nesting habitats for migratory birds and wetlands and that any proposed mitigation would not be sufficient or effective in returning critical habitats to their prior existing conditions.[78] Similarly, due to concerns about impacts from oil spills and operations to belugas, sea otters, salmon, North Pacific right whales, herring, cod, and migrating birds, another commenter felt the No Action Alternative was the safest option for the wildlife and local population. They stated that even if drilling was isolated to specific areas to protect marine mammals these species may change their movements as sea temperatures warm.[79]

Two commenters proposed delay of the lease sale or 90-day comment period extension to allow for a more complete analysis and public review of the inconsistencies in the DEIS.[80]

Summary Response to Comments

Issues related to national and international climate policy are beyond the scope of this analysis, except to the extent they pertain to regulatory requirements associated with the Proposed Action. However, BOEM disagrees with the notion that producing oil and gas from the Lease Sale 258 is incompatible with various national policies and global GHG emissions goals. Market forces dictate that if oil and gas were not produced from the Lease Sale 258, this energy would be procured from other sources to keep supplies in step with energy demand (Table 4-10 of the FEIS).

The purpose of the Proposed Action addressed in this FEIS is to offer for lease certain OCS blocks located within the federally owned portion of Cook Inlet that may contain economically recoverable oil and gas resources. Production of such undiscovered oil and gas resources may then assist in meeting regional and national energy needs.

[74] Institute for Policy Integrity at New York University School of Law.
[75] U.S. EPA Region 10.
[76] Institute for Policy Integrity at New York University School of Law.
[77] D. Chapman; K. Haber.
[78] N. Sawaged.
[79] D. Chapman.
[80] Institute for Policy Integrity at New York University School of Law; B. Rosenberg.

The need for the Proposed Action is to further the orderly development of OCS resources in accordance with the Outer Continental Shelf Lands Act of 1953 (OCSLA), as amended (43 USC §§ 1331 *et seq.*). OCSLA states "the outer Continental Shelf is a vital national resource reserve held by the Federal Government for the public, which should be made available for expeditious and orderly development, subject to environmental safeguards, in a manner which is consistent with the maintenance of competition and other national needs" (43 USC § 1332(3)).

Under OCSLA, the Department of Interior (DOI) developed the 2012–2017 OCS Oil and Gas Leasing Program utilizing a targeted leasing model. This approach was continued in the 2017–2022 OCS Oil and Gas Leasing Proposed Final Program which included the Alaska OCS lease sale (Lease Sale 258) in the Cook Inlet Planning Area. The goal of the targeted leasing approach is to focus oil and gas leasing on the most promising OCS blocks, while protecting important habitats and critical subsistence activities (Chapter 2, *Alternatives Including the Proposed Action*). Alternatives which excluded oil and gas development did not meet the purpose and need as described above and were not carried forward for detailed analysis.

This FEIS provides an analysis of Cook Inlet Lease Sale 258, and any comments which requested that BOEM perform a detailed analysis of subsequent further exploration, development, and production of oil and gas resources are outside the scope of this FEIS. However, operators who obtain lease rights on the OCS are required to submit an EP prior to exploration activities, and a DPP prior to development and production activities. During the environmental review process, BOEM conducts separate, project-specific NEPA analysis prior to approving the EP or DPP.

BOEM is using the best available information regarding air quality analysis and greenhouse gas emissions. Although commenters pointed out perceived deficiencies of the BOEM air quality modeling, the commenters did not provide better data, alternative information, or approaches for incorporation into the FEIS analyses. BOEM's methodology for determining impacts to air quality have been peer reviewed and widely accepted and generally embody the best practices for conducting this type of analysis (Section 4.3.5).

The FEIS provides a summary of comparison of impacts between the No Action Alternative and Proposed Action in Table 2-2. Specific differences in impacts were identified for each resource in Chapter 4, Sections 4.3 through 4.14 in the FEIS. Exploration and development and production activities and required mitigation would be governed by BOEM and BSEE regulations. Further mitigation may also be required by the National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS) through the ESA Section 7 consultation process. It should be noted, mitigation measures listed in Section 3.3.2 are those which are standard, or typical, for NMFS and USFWS to require under the Marine Mammal Protection Act (MMPA) for "take" authorization; additional project-specific mitigation measures may be required. Finally, mitigation requirements are also required by other regulatory agencies for buried pipelines constructed through wetlands on the Kenai Peninsula and for crossing beneath anadromous fish streams. Again, these additional federal and state mitigation requirements would be project-specific with operator compliance mandatory prior to permitting.

BOEM utilizes models for GHG emissions that represent the best science and methodology available for estimating energy market impacts and substitution rates, both key factors for comparison of GHG emissions under the No Action Alternative and the Proposed Action. Although commenters pointed out perceived deficiencies of the BOEM air quality modeling, no better data, alternative information, or approach was provided to incorporate in an analysis. The GHG emission analysis is a new and evolving process and BOEM will continue to review and study the methods utilized and will update analysis – such as foreign consumption – as new data and methodologies become available. BOEM's GHG quantitative and qualitative analyses together represent the best available approach for comparison of climate change under the Proposed Action and No Action Alternative.

BOEM's Lifecycle Greenhouse Gas Methodology is described in Section 4.3.5.1 of the FEIS. The GHG model was developed to examine the lifecycle GHG emissions associated with OCS oil and gas development activities both pre- and post-production (upstream and downstream) and includes all operations on the OCS associated with oil and gas leases (exploration, development, and production). MarketSim's modeling of oil, natural gas, coal, and electricity for U.S. markets accounts was utilized for substitution between alternate fuel sources.

BOEM acknowledges these models were developed for analysis at a national level for the National OCS Oil and Gas Leasing Program and that there may be limitations on the scalability of the models to this regional analysis. However, the models do incorporate a regional framework and specify assumptions by planning area (e.g., Cook Inlet) when applicable.

BOEM analyzed the monetized social cost from GHG emissions based on methodology discussed in Section 4.3.5.2 of the FEIS and in accordance with Section 5 of EO 13990, *Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis*. This analysis determined the estimated the social cost of GHG emissions on an annual basis. Analysis assumptions, uncertainty, limitations, and results are also presented. BOEM utilized the best available information and practices for this analysis and determined that the results provided are sufficient for the evaluation and associated determinations of effect. Additional information regarding the economic analysis in the FEIS and responses to comments on the substitution analysis are provided in Issue 5.10 of this document.

The FEIS recognizes the No Action Alternative would have the least impacts on biological resources. However, it would not fulfill the purpose of the project as directed by OCSLA.

Source of Comments

- Individual/General Public
- Energy/Non-Energy Industry and Other Associations
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Tribes and Tribal Representation
- Federal Agencies

Issue 3.2 Beluga Whale Alternatives

Summary of Comments

Eight commenters discussed the Cook Inlet beluga whale Alternatives. One commenter expressed concern that the three mitigation alternatives in the DEIS are not adequate as they do not consider the surrounding area near the proposed locations of offshore rig development, which in turn does not consider a possible increase in daily stressors that development would cause outside of the specific lease blocks. The commenter stated that, "Because the beluga whales have migrated to lower latitudes with a circumpolar distribution from their previous habitats due to the availability of prey, decreased sustainability of habitat and increased degradation," the Proposed Action would force whales to utilize alternate habitats because of the disturbance within their habitat range. The commenter recommended a broader area near the site location be considered.[81]

A commenter recommended the following related to the collective beluga whale alternatives: alternatives should ban seismic surveys when beluga whales are present; blocks within beluga whale critical habitat should be removed from the sale; no seismic survey should be permitted within beluga whale critical habitat; and seismic surveys outside of beluga whale critical habitat should only be permitted from mid-August to October 31. Lastly, the commenter recommended alternatives with the highest protections for Cook Inlet beluga whales and their habitats, sea otters and their habitats, and commercial fishing be implemented collectively.[82]

Some commenters discussed combining alternatives to strengthen protection of Cook Inlet beluga whales. Commenters stated that BOEM did not consider an alternative that combines lease sale exclusions identified in Alternative 3A with the additional mitigation measures for all remaining areas identified in Alternative 3C. Commenters recommended BOEM choose not to adopt Alternative 2 but rather proceed with the lease sale, and include in the FEIS and lease sale a combination of the beluga whale critical habitat exclusions of Alternative 3A with the mitigation measures for the remaining areas identified in Alternative 3C.[83] Another commenter suggested that Alternative 3A offers improved protections over Alternative 1.[84]

Further, a commenter stated that it is not clear in the DEIS or public hearing material that BOEM is not asking for public comments to “choose” an Alternative, but rather comment on each Alternative individually, suggesting the potential for a combination of multiple Alternatives in the final decision. The commenter recommended that components of Alternatives 3A, 3B, and 3C be incorporated into the final “Alternative” whereby the lease sale would include Cook Inlet beluga whale critical habitat exclusions, critical habitat mitigations, and nearshore feeding area mitigations. Specifically, the commenter stated that combining components of the three alternatives would result in both removing the 10 OCS blocks that overlap with beluga whale critical habitat and application of mitigations in Alternative 3C to those blocks retained in the lease sale.[85]

Describing the decline of the Cook Inlet beluga whale population over the last few decades and further decline of the condition of beluga habitat over time because of increased industrialization and urbanization in the inlet and surrounding areas, commenters claimed that BOEM failed to consider alternatives that would further reduce impacts to endangered whales.

Summary Response to Comments

BOEM developed the Proposed Action based on a targeted leasing model as described in the DEIS (Chapter 2, *Alternatives Including the Proposed Action)*. In addition to the Proposed Action and No Action Alternatives, BOEM developed three alternatives based on public and agency input received during the scoping process and on alternatives previously analyzed for Lease Sale 244 (held in 2017). Alternatives 3A, 3B and 3C were developed to address potential impacts to the Cook Inlet Distinct Population Segment (DPS) of the beluga whale. Alternative 3A considers the exclusion of beluga whale critical habitat from the lease sale; Alternative 3B would not allow seismic surveys or exploratory drilling in beluga whale critical habitat between November 1 and April 30, when beluga whales are most likely to be present; and Alternative 3C would not allow seismic surveys in the entire lease sale area from

[81] N. Sawaged.
[82] Chickaloon Native Village.
[83] Natural Resources Defense Council, et al.; Cook Inletkeeper; Marine Mammal Commission (MMC).
[84] Animal Welfare Institute (AWI).
[85] Cook Inlet RCAC.

November 1 to April 1 when beluga whales are distributed across the area, and would also not allow seismic surveys from July 1 to September 30 within 10 miles of major anadromous streams when belugas are migrating to feeding areas.

As described in the FEIS Chapter 2, although the alternatives are analyzed separately, the Record of Decision (ROD) could incorporate elements of multiple alternatives. The decision could include the Cook Inlet beluga whale critical habitat exclusion, or critical habitat mitigation, and nearshore feeding area mitigation. A combination of alternative components could be selected and described in the ROD.

The goal of targeted leasing, under OCSLA and the *2017–2022 OCS Oil and Gas Leasing Proposed Final Program*, is to focus oil and gas leasing on the most promising OCS blocks while protecting important and critical habitats (Chapter 2, *Alternatives Including the Proposed Action*). Targeted leasing resulted in the avoidance of the vast majority of the ESA-designated critical habitat for beluga whales. Alternatives or mitigation measures which would overly restrict oil and gas exploration, development, and operation in Lease Sale 258 (Alternative 2, No Action) would not meet the purpose and need of the Proposed Action as directed under OCSLA and the*2017–2022 OCS Oil and Gas Leasing Proposed Final Program*.

Section 4.8.3 in the FEIS, notes "Alternative 3A excludes 10 OCS blocks that overlap with beluga whale critical habitat within the Lease Sale Area and avoids impacts on beluga whales in the excluded area." While the FEIS does not explicitly state temporal mitigation under Alternative 3C having beneficial impacts to the Cook Inlet beluga whales, it does mention this alternative would increase protection of marine mammals as they feed near river mouths.

Alternative 3B was modified to extend the period prohibited certain activities from April 1 to April 30 due to new information discovered since publication of the DEIS. The revised alternative is described below:

Alternative 3B: All available blocks in the Lease Sale Area would be offered for lease. The 10 OCS blocks that overlap beluga whale critical habitat at the northern tip of the Lease Sale Area would be included in the lease sale; however, no on-lease seismic surveys or exploration drilling would be conducted between November 1 and April 30, when beluga whales are most likely to be present. This timing window reflects a minor change from the DEIS, which evaluated a timing window for Alternative 3B that restricted these activities from November 1 through April 1. However, based on conversations with the National Marine Fisheries Service that occurred after the close of the comment period for the DEIS, recent aerial surveys indicate that beluga whale use of this area now extends into the month of April (Gill, Shelden, and Sims, 2022; Gill and Seymore, unpub. data, 2022). After carefully considering this information, BOEM has determined that it does not constitute significant new information warranting a supplemental EIS because the impacts of on-lease seismic surveys, exploration drilling, and other activities on beluga whales were already considered in the analysis of Alternative 1 in the DEIS. However, extending the timing window from April 1 to April 30 is intended to reduce potential adverse effects to beluga whales. BOEM has determined that because this extension is a slight modification to Alternative 3B affecting only 10 OCS blocks it does not constitute a substantial change to the proposed action.

In addition, NMFS may identify additional mitigation measures to protect beluga whales as part of their Biological Opinion developed through ESA Section 7 consultation with BOEM.

Detailed Comments and Responses

NOTE: BOEM received comments referring to the timing restriction in Alternative 3B as beginning on November 1 and ending April 1, consistent with the description of this alternative in the DEIS. The original comments summarized here were not changed and still refer to the DEIS. However, BOEM addressed these comments as they apply to the FEIS's Alternative 3B, which was modified to prohibit certain activities until April 30.

- *COMMENT*: One commenter suggested the best way to avoid effects to Cook Inlet beluga whales is by ceasing activities within Cook Inlet beluga whale critical habitat at any time, nor within 5 miles of any fish-bearing streams from July 1-September 30, which Alternative 3A does. The commenter also suggested that analysis of Alternative 3A should describe how exclusion of the OCS blocks that overlap with critical habitat would reduce impacts to beluga whales.[86]

  RESPONSE: The selection of the preferred alternative could consist of any of the listed alternatives or combination of alternatives. Alternatives 3A/3B/3C were considered by BOEM in the development of the Preferred Alternative. Because beluga whale populations would not be protected from all impacts outside of the mitigated areas or timing windows, the overall impacts of Alternatives 3A, though slightly less, would still be in the same category (negligible to moderate) as for the Proposed Action. See additional discussion under Issue 5.6, Marine Mammals.

- *COMMENT*: A commenter stated that Alternative 3B would ban seismic surveys in ten blocks overlapping with beluga whale critical habitat from November 1 to April 1. Alternative 3B would extend the seismic survey season since surveys permitted in 2019 and 2021 were only permitted from mid-August to October 31.[87]

  RESPONSE: Past permits issued in 2019 and 2021 were specific to those activities and were not representative of the entire available survey time for blocks in the Cook Inlet Lease Sale area (https://www.boem.gov/alaska-gg-permits).

- *COMMENT*: A commenter stated that Alternative 3C applies the same mitigation as Alternative 3B of prohibiting both on-lease seismic surveys and exploratory drilling between November 1 and April 1 but excludes the seasonal restriction on exploratory drilling. The commenter requested BOEM clarify that, "exclusion of this temporal mitigation will likely increase potential impacts to Cook Inlet beluga whales and their salmonid prey." [88]

  RESPONSE: Alternatives 3B and 3C were discussed in Section 4.8, Alternatives Analysis. FEIS was revised to address this issue.

- *COMMENT*: Page 5, Section 2.3: Figure 2-2 suggests that only blocks within Cook Inlet beluga whale critical habitat will be subject to the temporal exclusion of on-lease seismic surveys; however, the mitigation measure text of Alternative 3C states that no on-lease seismic surveys will be conducted between November 1 and April 1 on ALL blocks offered for lease. Please clarify/confirm whether the temporal exclusion of seismic surveys described in Alternative 3C will apply to all OCS blocks or only those identified as "exclusion" or "mitigation" blocks in Figure 2-2.[89]

  RESPONSE: Alternative 3C states that there would be no on-lease seismic surveys on any blocks within the lease sale area between November 1 and April 1, and that there will be no seismic surveys allowed on leased blocks within 10 miles of anadromous fish spawning streams between July 1 and September 30. Changes were made to clarify the differences between alternatives.

[86] National Oceanic and Atmospheric Administration.
[87] Chickaloon Native Village.
[88] National Oceanic and Atmospheric Administration.
[89] National Oceanic and Atmospheric Administration.

- *COMMENT*: Page 5. Alternative 3C. Although Figure 2-2 is referred to, the map does not match the language of this alternative. There are only a few anadromous streams within 10 miles of the lease blocks, but the map shows bands of areas (green hatched) that would have seasonal restrictions. Which is correct, the map or the language? Note that the anadromous streams referred to in this alternative are not shown on Map 2-2.[90]
  RESPONSE: To provide protection near all anadromous streams and watersheds, the mitigation buffer zone extends out 10-miles from all anadromous streams. The language in the EIS is correct, but due to the scale of the map BOEM was unable to show all anadromous streams in clarity.
- *COMMENT*: Page 10, Section 2.6.5: Insert the word "partially" in this sentence: "In addition, the goals of this alternative are *partially* addressed by the Proposed Action as well as the various measures proposed under Alternatives 3A (Beluga Whale Critical Habitat Exclusion); 3B (Beluga Whale Critical Habitat Mitigation); and 3C (Beluga Whale Nearshore Feeding Areas Mitigation)." The various measures do not mitigate for effects upon endangered fin whales or threatened and endangered DPSs of humpback whales.[91]
  RESPONSE: Text revised as suggested. Mitigations in these alternatives were specifically designed for Cook Inlet beluga whales.
- *COMMENT*: Despite information indicating that beluga whales continue to inhabit lower inlet waters south of Kalgin Island throughout the year, and evidence of whales found throughout the inlet, BOEM failed to consider an alternative that would include year-round restrictions on all seismic surveys and exploratory drilling operations north of Anchor Point.[92]
  RESPONSE: Based on the current environmental analysis, BOEM determined that year-round restrictions on seismic surveys north of Anchor Point would unduly restrict oil and gas exploration and are not warranted to protect beluga whales. Section 4.8.1.1 of the DEIS states that beluga whales are found in upper Cook Inlet when sea ice is absent, and farther south into lower Cook Inlet after sea ice formation. In winter, sea ice presence (https://cispri.org/sea-ice/) would likely prevent seismic surveys from being conducted where it could affect them.
- *COMMENT*: Although slowing ships has been shown to greatly reduce the chances of lethal ship strikes, BOEM failed to consider an alternative that would require vessels associated with the lease sale to slow to 10 knots or less to reduce impacts to endangered beluga whales and other marine life. [93]
  RESPONSE: BOEM agrees that reduction of vessel speed is necessary in the vicinity of marine mammals and under reduced sea conditions. Section 3.3.2 of the FEIS describes the typical mitigation measures that NMFS and USFWS require in their authorizations, several of which address vessel operations and speed when in the vicinity of marine mammals that serve to reduce strikes. Additionally, specific details regarding reduction of vessel speeds will be addressed during consultation with NMFS and USFWS and described in the ensuing Biological Opinions.

[90] National Oceanic and Atmospheric Administration.
[91] National Oceanic and Atmospheric Administration.
[92] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[93] Natural Resources Defense Council, et al.; Cook Inletkeeper.

- *COMMENT*: BOEM failed to consider an alternative that would reduce the extent of tugboat and other vessel traffic permitted under the lease sale. The commenters discussed concerns related to commercial shipping as a source of anthropogenic noise in Cook Inlet. [94]
  RESPONSE: BOEM determined that restrictions on vessel traffic, if warranted, would be best handled under the project-specific NEPA reviews that occur post-lease sale and in the NMFS and USFWS consultation processes, when a Letter of Authorization or an Incidental Harassment Authorization is issued for a specific activity. Vessel noise, including commercial shipping, was considered as a potential direct effect as well as a cumulative effect and analyzed where appropriate throughout Chapter 4 of the EIS.
- *COMMENT*: The commenter further stated that, "Reducing the overall level of vessel traffic is particularly important because the mitigation measures on which the agency relies to dismiss the impacts from vessels are insufficient…" Specifically, the commenter explained that mitigation measures are only triggered in the event a marine mammal is observed. However, when visibility is difficult in the turbid waters of Cook Inlet, "researchers find that they have not been accurately estimating the capability of lookouts to monitor and detect marine animals." Further, the commenter stated that species that respond to noise by avoiding an area are unlikely to be observed using traditional methods, as animals may react at farther distances beyond the potential detection range. The commenter also stated that in the event a Protected Species Observers (PSOs) detects a whale, some vessels cannot easily change course or their speed to avoid it. [95]

  RESPONSE: BOEM determined that restrictions on vessel traffic, if warranted, would be best handled under the project-specific NEPA reviews that occur post-lease sale and in the NMFS and USFWS consultation processes, when a Letter of Authorization or an Incidental Harassment Authorization is issued for a specific activity. Vessel traffic was considered as a potential direct effect as well as a cumulative effect and analyzed where appropriate throughout Chapter 4 of the EIS.
- *COMMENT*: Section 2.3, Page 5: Should clarify whether the temporal exclusion of seismic surveys described in Alternative 3C will apply to all OCS blocks or only those identified as "exclusion" or "mitigation" blocks in Figure 2-2.
  RESPONSE: Alternative 3C states that there would be no on-lease seismic surveys on any blocks within the lease sale area between November 1 and April 1, and that there will be no seismic surveys allowed on leased blocks within 10 miles of anadromous fish spawning streams between July 1 and September 30. Clarifications have been made in the Final EIS.

Source of Comments

- Individual/General Public
- Energy/Non-Energy Industry and Other Associations
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Federal Agencies
- Tribes and Tribal Representation

[94] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[95] Natural Resources Defense Council, et al.; Cook Inletkeeper.

Issue 3.3 Northern Sea Otter Alternatives

Summary of Comments

Seven commenters discussed the Northern Sea Otter Alternatives. One commenter stated that additional considerations to avoid habitat destruction to northern sea otter is a decrease in primary production in the case of either a small or large spill. The commenter discussed concerns related to competition between marine species for food sources, causing further reduction in populations.[96] Because of sea otter benthic foraging behavior and their distribution being limited by their ability to dive to the sea floor, commenters recommended BOEM consider seasonal mitigation measures in addition to those already proposed, as well as seismic activity which could affect the availability of prey.[97] Another commenter suggested BOEM consider recent and upcoming winter aerial survey information on northern sea otter spatial and temporal distribution in its FEIS. According to the commenter, limiting oil and gas activities in times and areas where Southwest (SW) Alaska or Southcentral Alaska DPS of northern sea otters are present in high densities may reduce impacts to sea otters.[98] One commenter said that sea otters are especially susceptible animals to oil because of their fur and physiology.[99] Another commenter recommended Alternatives 4A and 4B be merged, allowing for the seven OCS blocks that overlap with the threatened northern sea otter SW DPS critical habitat to be excluded from the lease sale and additional mitigations on the remaining blocks located within 1,000 meters of northern sea otter critical habitat to prohibit discharge of drilling fluids and cuttings and seafloor-disturbing activities.[100]

One commenter suggested that Alternative 4A offers improved protections over Alternative 1.[101] A commenter discussed the sensitivity of northern sea otters to disturbances from vessel activities and actions that affect critical habitat, and prey resources within such areas. Noting that BOEM has initiated an aerial survey to assess sea otter distribution patterns in Cook Inlet and differences between offshore and nearshore foraging habitats, the commenter recommended that until that information is available, BOEM combine the lease sale exclusions of Alternative 4A with the mitigation measures for the remaining areas identified in Alternative 4B in the FEIS and lease sale.[102]

Summary Response to Comments

BOEM is using the best available information regarding the marine mammal analysis and has initiated an aerial survey to further assess sea otter distribution patterns in Cook Inlet. BOEM acknowledges an offshore oil spill could temporarily or permanently affect the northern sea otter and associated habitat until the oil is fully dispersed. These impacts are likely to affect individual sea otters and not whole populations. However, the population could experience a moderate level of impact from a large spill (Section 4.8.2 of the FEIS).

Both Alternatives 4A and 4B would reduce impacts on sea otter foraging areas by either excluding Federally designated critical habitat or prohibiting seafloor-disturbing activities in Federally designated critical habitat year-round. Effects to the northern sea otter from seafloor-disturbing activities under Alternatives 4A and 4B are summarized in Section 4.8.3 of the FEIS. In addition, impacts to the northern sea otter may be further mitigated as required by the NMFS or the USFWS through the ESA Section 7 consultation process.

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[96] N. Sawaged.
[97] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[98] USFWS Marine Mammals Management.
[99] K. Nalven.
[100] Cook Inlet RCAC.
[101] Animal Welfare Institute (AWI).
[102] Marine Mammal Commission (MMC).

Source of Comments

- Individual/General Public
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Energy/Non-Energy Industry and Other Associations
- Federal Agencies

Issue 3.4 Alternative 5 – Gillnet Fishery Mitigation Alternative

Summary of Comments

Three commenters discussed Alternative 5, the Gillnet Fishery Mitigation Alternative. A commenter recommended including Alternative 5 in the FEIS and lease sale, stating that prohibiting lessees from conducting on-lease seismic surveys in areas north of Anchor Point during the drift gillnetting season would further reduce risks to beluga whales, sea otters, and other marine mammals in that portion of Cook Inlet.[103] Another commenter stated that although the Cook Inlet lease sale area is within the Exclusive Economic Zone, which is closed to commercial salmon fishing, they support the mitigation measures in Alternative 5. Should the fishery re-open in the future, the mitigation measure prohibiting on-lease seismic surveys during the drift gillnetting season will prevent disturbance to fish migration.[104] To reduce interference with the Cook Inlet drift gillnet fishery, a commenter recommended revising Alternative 5 as follows: "(1) No on-lease seismic surveys conducted during drift gillnetting season as designated by Alaska Department of Fish and Game (ADF&G) and (2) United Cook Inlet Drift Association (UCIDA) must be notified of any temporary or permanent structures planned during the drift gillnetting season."[105]

Summary Response to Comments

In Table 2-2 and Section 4.13.3 of the FEIS, BOEM recognizes Alternative 5 would have a decreased impact on commercial fishing when compared to the Proposed Action. As noted in the FEIS Chapter 2, although the alternatives are analyzed separately, the Secretary of Interior's decision could incorporate elements of multiple alternatives. Specifically, BOEM includes a lease stipulation (Section 3.3.1, Stipulation No. 1 – Protection of Fisheries) to protect fisheries during the exploration, development and production operations and minimize conflict with, but not limited to subsistence, sport, and commercial fishing. This stipulation will require the operator to make the EP and DPP available for review to all directly affected fishing organizations and subsistence communities as well as appropriate state regulatory agencies. Salmon in federal waters are overseen by NMFS under the Fishery Management Plan for the Salmon Fisheries in the EEZ off Alaska (November 2021).[106] Any changes to this plan will be made through NMFS and undergo a separate environmental review. Finally, verbiage in Alternative 5 continues to state that UCIDA be kept informed regarding placement of any temporary or permanent structure but was revised to clarify that ADF&G shall be consulted to determine timing of the gillnetting season.

[103] Marine Mammal Commission (MMC).
[104] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).
[105] Cook Inlet RCAC.
[106] https://www.npfmc.org/wp-content/PDFdocuments/fmp/Salmon/SalmonFMP.pdf

Source of Comments

- Energy/Non-Energy Industry and Other Associations
- State Agencies

Issue 3.5 Other Alternatives

Summary of Comments

Approximately 10 commenters discussed other topics related to the alternatives. Some commenters stated the four action alternatives are insufficient and other reasonable alternatives should have been considered. A few commenters stated that BOEM failed to consider clean energy alternatives to the Proposed Action. They stated that technologies such as wind, solar power, and hydrokinetics are viable sources that could provide energy to meet regional and national needs and are more ecologically sound than the other action alternatives BOEM considered in the DEIS.[107] Other commenters stated that renewable energy paired with energy storage and efficiency and grid technologies can be rapidly scaled up to meet U.S. and global energy needs. The commenters provided discussion regarding the benefits of renewable energy resources as well as the co-benefits that serve the public interest and avoid catastrophic harms. Commenters also discussed research purportedly demonstrating that investment in clean energy creates more jobs than investment in fossil fuels.[108]

A few commenters stated that BOEM did not include alternatives that would reduce the potential impacts on other vulnerable species or environments surrounding the action area. A commenter stated that an alternative was not proposed that addressed the consequences of surrounding habitat of endangered marine species, terrestrial mammals and migratory birds that would be affected. Rather, the commenter explained, the separated alternatives presented in the DEIS could lead to degradation of environments that are not included in the ROD.[109] Commenters also stated that because oil spills can spread long distances, the impacts of oil and gas activities may affect species outside of the action area. These commenters recommended consideration of an alternative that would prohibit any exploration or drilling activities from June to September when the waters outside Cook Inlet in the Gulf of Alaska are designated as biologically important areas for North Pacific right whales. The commenters also stated that BOEM should consider mitigation measures restricting lease activities during other important migratory, breeding, and birthing periods as well.[110]

A commenter recommended that the FEIS analyze an alternative or a mitigation measure that is more directly protective of the salmon fisheries. According to the commenter, salmon are the most harvested and consumed subsistence resource for Cook Inlet tribes and other users and are of critical importance to the well-being of communities in southcentral Alaska. Given the concerning status of the Cook Inlet salmon fisheries due to "unfavorable oceanic conditions caused by climate change," the commenter disagreed with the assessment that analysis of a salmon-focused alternative is unnecessary. Further, the commenter stated that analyzing potential impacts of the nearshore alternative on beluga whales does not substitute for analyzing potential impacts of an alternative designed to protect migrating salmon and subsistence users.[111]

[107] Ocean Conservancy; N. Sawaged.
[108] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[109] N. Sawaged.
[110] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[111] U.S. EPA Region 10.

A commenter recommended the Alternatives section of the DEIS clarify the Area ID process and explain how specifically the lease sale area achieves each accomplishment attained during the Targeted Leasing Process. Specifically, the commenter recommended clarity on how "important resources" were identified for developing alternatives to protect or mitigate impacts. According to the commenter, beluga whales, otters, and commercial fishing were weighed more heavily than salmon, subsistence activities and human health.[112]

A few commenters recommended BOEM consider the value of not leasing in Cook Inlet at this time. A commenter recommended BOEM factor into its analysis the option value of not leasing at this time. The commenter defined "option value" as "informational value of delay."[113] According to the commenter, by delaying action, an agency can allow time to address valuable information that may clarify an action's costs and benefits and help the agency avoid making erroneous decisions. Given the current uncertainties regarding the costs and benefits of the lease sale, the commenter stated the option value is strong.

Some commenters discussed alternatives that would limit the extent of development. Commenters stated BOEM failed to examine alternatives that would reduce the amount of oil and gas development in the area, citing court cases where NEPA analysis was rejected where the agency failed to consider alternatives that would reduce the scope of the permitted activity. Further, the commenters recalled the DEIS states that, "All action alternatives are presume to entail the same amount of oil and gas activity."[114] Additionally, one commenter stated the DEIS did not consider alternatives that would reduce the affected area and/or the amount of oil and gas activity, such as limiting the lease sale to a smaller area or limiting the number of wells that could be drilled.[115]

A commenter recommended BOEM consider an alternative that would halt Lease Sale 258 and all future sales for oil and gas in the Cook Inlet area, as the risks in this area are too high to be mitigated.[116] Similarly, another commenter stated that the DEIS fails to consider the numerous harmful impacts from the lease sale, including examination of an alternative that would not only cancel the upcoming lease sale but also cancel oil and gas leases previously issued in Cook Inlet.[117]

Summary Response to Comments

The purpose of the Proposed Action is to offer for lease certain OCS blocks located within the federally managed portion of Cook Inlet that may contain economically recoverable oil and gas resources. The need for the Proposed Action is to meet the requirements of the Outer Continental Shelf Lands Act of 1953 (OCSLA), as amended (43 USC §§ 1331 *et seq.*). OCSLA states "…*the outer Continental Shelf is a vital national resource reserve held by the Federal Government for the public, which should be made available for expeditious and orderly development, subject to environmental safeguards, in a manner which is consistent with the maintenance of competition and other national needs*" (43 USC § 1332(3)).

The USDOI's *2012-2017 OCS Oil and Gas Leasing Program* introduced a targeted leasing model to the Alaska OCS lease sale process. Targeted leasing identifies areas considered for leasing that have high resource potential and clear indications of industry interest, while appropriately weighing environmental protection and subsistence use needs. This approach was continued in the *2017–2022 OCS Oil and Gas Leasing Proposed Final Program,* which included this Cook Inlet OCS lease sale.

[112] U.S. EPA Region 10.
[113] Institute for Policy Integrity at New York University School of Law.
[114] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[115] Ocean Conservancy.
[116] N. Sawaged.
[117] C. Lish.

In the Area ID process, BOEM seeks to inform the public of changes that occur after the call process. BOEM uses information and comments received in response to a Call for Information and Nominations (Call) to develop a recommendation for the area to be carried forward for consideration for leasing and environmental and other analyses. The Area ID decision is neither a final decision to lease nor an irreversible or irretrievable commitment of resources.

An alternative applying mitigation measures for the North Pacific Right Whale was considered and dismissed since the North Pacific Right Whale and the designated North Pacific Right Whale critical habitat are outside of the Lease Sale Area and a detailed analysis was deemed unnecessary (Section 2.7.4 of the FEIS). Alternative 5 was included to provide a detailed analysis of effects to resources, especially fisheries, from additional mitigation measures north of Anchor Point. A delay of the Proposed Action is considered under the No Action Alternative. Finally, climate change effects are included in the cumulative analysis for each resource discussed in Chapter 4.

Restrictions and regulations regarding salmon fishing in federal waters are overseen by NMFS under the Fisheries Management Plan for Salmon Fisheries in the EEZ off the Coast of Alaska. Any changes to this plan will be through NMFS and undergo a separate environmental review. Impacts to salmon and salmon fisheries, and the subsistence fishers and beluga whales who depend upon them, were considered in Section 4.13, 4.11, and 4.8 and do not require a separate alternative. In addition, BOEM analyzed Alternative 5 (Section 2.5 of the FEIS) that provides protection to the Cook Inlet drift gillnet fishery if it is reopened by NMFS.

Detailed Comments and Responses

- *COMMENT*: A commenter expressed concern that the overall impact ratings were not different among action alternatives for any resources, except for commercial fishing.[118]

  RESPONSE: BOEM has reviewed the impact ratings presented in the FEIS and determined the analyses supporting those impact ratings are sufficient and accurate. Impact ratings that are similar among alternatives may be the result of a variety of factors. These factors include: all action alternatives are presumed to entail the same amount of oil and gas activity; alternatives excluding critical habitat would not protect marine mammals from potential adverse impacts from OCS activities occurring on other OCS lease blocks; and because marine mammal populations would not be protected from impacts occurring outside of the mitigated areas.

- *COMMENT*: Regarding the Northern Area Exclusion alternative previously considered but dismissed from analysis, a commenter recommended that the mitigation measures to address the objective of the alternative (i.e., to reduce the potential for interactions with the drift gillnet fishery) be implemented as part of the Proposed Action.[119]

  RESPONSE: BOEM has analyzed multiple alternatives that provide protection for marine resources and has determined that the protections provided in Alternative 5, the Gillnet Fishery Mitigation Alternative, are sufficient and practicable and fulfill the purpose and need for the proposed lease sale. In addition, BOEM includes a lease stipulation (Section 3.3.1, Stipulation No. 1 – Protection of Fisheries) to protect fisheries during exploration, development and production operations and minimize conflict with, but not limited to commercial fishing.

- *COMMENT*: To avoid greater impacts on human health and the environment, a commenter recommended BOEM consider the potential "additive and synergistic" impacts of climate change

[118] U.S. EPA Region 10.
[119] U.S. EPA Region 10.

and the proposed program when selecting an alternative or combination of alternatives in the ROD.[120]

RESPONSE: Cumulative impacts on a given resource may result from the additive or synergistic interactions with climate change. Cumulative impacts from past, present, and reasonably foreseeable future actions and the impacts of climate change to resource areas are discussed in detail in their respective sections in the FEIS (Sections 4.3 through 4.14). The environmental consequences, including cumulative impacts from climate change, are considered by the Secretary of the Interior before choosing any alternative, or combination of alternatives after weighing possible benefits and adverse environmental impacts.

Source of Comments

- Individual/General Public
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Energy/Non-Energy Industry and Other Associations
- Federal Agencies
- State Agencies

Issue 4 Assumptions and Analysis

Issue 4.1 Oil Spills and Gas Release Scenarios

Summary of Comments

Approximately 55,355 commenters, including form letter campaigns, discussed assumptions regarding oil spills, as well as spill preparedness and response.

General comments regarding oil spills, gas releases, and other spills

Many commenters were concerned with the probability of one or more large oil spills occurring over the 40-year lifespan of the development and production scenario. Some expressed concern that the "19 percent chance of one or more spills occurring" was excessive, too high, unacceptable, not insignificant, or "almost certain to occur". They expressed concern that this probability is too high of a risk,[121] while one commenter questioned whether this probability is understated.[122] Several commenters also suggested that the DEIS falls short in its analysis of potential impacts from oil spills. One of these commenters stated that the oil spill risk analysis needs to address the impacts more adequately on fish and invertebrates in Cook Inlet.[123] Similarly, another commenter noted inconsistencies in conclusions regarding effects of large oil spills on marine mammals, including Cook Inlet beluga whales.[124] Many other commenters echoed this statement, specifically expressing concern toward potential oil spill impacts on marine mammals.[125] Another commenter expressed concern about the effects of oil spills on

[120] U.S. EPA Region 10.
[121] M. Weibel; Homer Bed and Breakfast Association; D. Aderhold; Chickaloon Native Village; Alaska Marine Conservation Council; Alaska Longline Fisherman's Association; K. Haber; N. Schmitt; P. Seaton; S. Mauger.
[122] M. Byerly
[123] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).
[124] National Oceanic and Atmospheric Administration.
[125] C. Lish.; Center for Biological Diversity; Animal Welfare Institute (AWI); Environmental Action [Form Letter Master]; Cook Inletkeeper; Natural Resources Defense Council, et al.; K. Haber.

subsistence users. Many commentors stated that weather and tidal conditions in Cook Inlet made spills more likely.

A few commentors expressed concern about the possibility of very large oil spills, like the Deepwater Horizon oil spill of 2010 and the Exxon Valdez Oil Spill (EVOS) of 1989, and commented that there is no guarantee that such spills would not occur.

Several commentors expressed concern about information related to small spills, including questioning the assumptions for small spills (number, size, and persistence), the potential impacts of small spills, and one commenter stated that the DEIS did not adequately assess individual or cumulative impacts of small spills.

Other commentors expressed concern about gas leaks, stating that gas leaks from platforms or pipelines are difficult to find, detect, and repair due to weather conditions in Cook Inlet; that gas leaks in Cook Inlet can last for several months; and that the worse-case discharge scenario may be greater than BOEM estimated due to lack of an effective spill response. Commentors mentioned a 2017 natural gas pipeline rupture that took months to repair.

General Comments regarding oil spill preparedness and response

Several commenters discussed oil spill response, many of which cautioned BOEM about the limitations of mechanical spill response technology. These commenters stated that mechanical spill response technology remains inadequate to clean up more than 10 to 20 percent of spilled oil in ideal conditions. They further stated that the weather and tidal conditions in Cook Inlet would likely make cleaning up spilled oil in the area virtually impossible.[126] A few commenters brought up the mechanical recovery efforts employed during the Deepwater Horizon oil spill, which only recovered three percent of the total amount of oil released. These commenters stated that if a major oil spill were to occur in the Arctic OCS, the same mechanical cleanup techniques as those used in the Deepwater Horizon spill response would be applied at a much less efficient recovery rate.[127] One commenter emphasized the potential difficulty of spill containment in Cook Inlet by referencing a 2017 gas release in the area that had a delayed cleanup due to ice in the inlet. They stated that the worst-case discharge scenario may be more likely than estimated by BOEM due to lack of spill response effectiveness from existing environmental conditions as experienced in 2017. Regarding large oil spill mitigation measures, this commenter recommended the FEIS include discussion of how “Fitness to Operate” standards are developed and adopted throughout the leasing program as well as include information about financial assurance requirements to mitigate potential adverse impacts resulting from a worse-case release or spills.[128]

Several commenters recommended that, because conditions found in Cook Inlet are more diverse with large tidal exchanges that limit the types of spill response that are effective in Cook Inlet, the challenging environment of the Cook Inlet should be acknowledged in the FEIS.

Comments regarding the oil spill risk analysis

A few commenters collectively submitted a critical, methodical review of the Cook Inlet oil spill risk analysis (OSRA) used in the DEIS to analyze impacts from a hypothetical oil spill.[129] This critique of BOEM’s OSRA model assessed whether the methodology and the outcomes derived from the OSRA

[126] C. Lish; Kenaitze Indian Tribe; Alaska Marine Conservation Council; Alaska Longline Fisherman's Association; Friends of the Earth [Form Letter Master]; Cook Inletkeeper [Form Letter Master].
[127] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[128] U.S. EPA Region 10.
[129] Natural Resources Defense Council, et al.; Cook Inletkeeper.

model appropriately characterized the nature of a hypothetical oil spill in Cook Inlet. The concerns asserted, but were not limited to: faults and limitations related to the OSRA methodology; model inputs and parameters; trajectory analysis; spill rates; environmental resource areas, and the availability of information.

This same critical review found that the methodology used in the Cook Inlet OSRA does not meet the Environmental Protection Agency's (EPA's) guidelines about mathematical modeling as it uses a large spill rate based on a different geographic area, does not provide any measures of uncertainty, tiers multiple models, and does not account for Alaskan-specific concerns or climate change. The review also discussed the implications of the OSRA. It found that multiple ERAs have conditional probabilities in the possible to probable range, meaning that a large oil spill could harm these important areas. It further stated that the small spill rates computed for Cook Inlet were underestimated in the DEIS, and the combined probabilities for large spills in the lease sale area may also have been underestimated in the DEIS. Additionally, the review found that using site-specific data gave a more accurate and detailed picture of spill rates, substances, and sizes.

Summary Response to Comments

Oil Spills and Gas Releases

As noted in Chapter 4 of the FEIS, an OCS lease sale provides qualified bidders the opportunity to bid on OCS blocks to gain conditional rights to explore, develop, and produce oil and natural gas. Issuance of a lease does not authorize any exploration, development, or production activities. However, to provide the public and decision makers with a picture of post-lease activities and potential impacts that may occur as a result of the lease sale, BOEM analyzes a hypothetical Exploration and Development Scenario (E&D Scenario) that describes the types of post-lease oil and gas activities that could occur as a result of the lease sale (FEIS Section 4.1) and provides an estimate of their timing, frequency, and duration. Impact analyses in the FEIS are as specific and quantitative as reasonably possible given the 40-year timeframe of the described post-lease activities. In concert with the E&D Scenario, BOEM analyzes hypothetical oil spills, a gas release, spill drills, and response activities and their potential impact in relation to proposed lease sales. These analyses inform the overall assessments of environmental consequences of offshore oil and gas exploration, development, and production that may occur in the future as a result of Lease Sale 258.

It is important to note that the E&D Scenario BOEM uses to produce environmental analyses overestimates, as opposed to underestimates, impacts of the Proposed Action. To that end, the E&D Scenario's high case scenario describes a level of activity that exceeds what is expected to result from Lease Sale 258. For example, the E&D Scenario estimates up to 8 exploration and delineation wells over a 3-year time period; however, a total of only 13 such wells have been drilled in the Cook Inlet OCS since 1978, with the last well drilled in 1985. The E&D Scenario also assumes a high-case production of oil (192.3 million barrels) and gas (301.9 Bcf), which is then used to estimate information about potential oil spills and gas releases.

It is inaccurate to suggest that a decision concerning a lease sale would directly lead to a 19 percent chance of a large oil spill. The 19 percent chance of one or more large oil spills does not apply to plans of any particular operator. Rather, it applies to the hypothetical E&D Scenario created by BOEM. In the exploration phase, operators may conduct G&G surveys and drill exploratory wells. The wells in this phase are drilled to discover the location of oil or natural gas. Existing data suggests that a large spill in the exploration phase is not likely (FEIS Tables 3-2 and 3-3). However, it is during development and production activities that BOEM assumes a large spill occurs for purposes of analysis (19 percent chance of one or more large spills; estimated volume 3,800 bbl). In the development and production phase, wells are drilled to extract oil or gas from beneath the seabed. This estimate is based on BOEM's hypothetical high-case E&D scenario, not on an operator's specific plans. In the event Lease Sale 258 results in a proposal to develop and produce oil or gas, BOEM will incorporate site-specific information into new NEPA and OSRA analyses.

While the impact of any spill should not be minimized, BOEM's analysts state that impacts from spills are dependent upon on size, timing, and location of such spills. The potential spills modeled by BOEM for Lease Sale 258 are very unlikely (Section 3.1.5 of the FEIS) to be the very large historical events associated with spills such as EVOS or Deepwater Horizon. For historical perspective, the 1989 Exxon Valdez spill is estimated to have been about 257,000 barrels (Wolfe et al., 1994); the 2010 Deepwater Horizon spill is thought to have been 3.19–4.0 million barrels (Barbier and Shushan, 2015).

The potential impacts of small spills are analyzed in the FEIS, and the assumptions related to small spills are described in Section 3.1.1 of the FEIS. The assumptions for small oil spills include the likelihood of a spill, the estimated total number of spills, and the estimated total volume of a spill. Small spills, while accidental, are relatively routine. Approximately 410 small spills are estimated to occur over the 40-year E&D Scenario, with 403 ranging in size from 1 bbl up to 50 bbl, and 2 spills ranging in size from over 50 bbl to less than 500 bbl. The majority of small spills would be contained on a vessel or facility. Refined spills reaching the environment would evaporate and disperse within hours to a few days, but small crude spills take longer. Additional detail on these assumptions can be found in Appendix A, Oil Spills and Gas Release Analysis, of the FEIS in Section A-3.

Estimates of the oil types that could spill, along with their weathering, inform analysis of the effect of a large spill (3,800 bbl). Weathering includes how much oil evaporates, disperses, and remains after a certain time. BOEM uses the SINTEF OWM, Version 4.0 (Johansen et al., 2010) for diesel, condensate, and crude oil to derive weathering results for up to 30 days. The SINTEF OWM results are validated with data from three full-scale field trials of experimental oil spills (Brandvik et al., 2010; Daling and StrØm, 1999). Additional detail on these assumptions can be found in Section A-3, Oil Spills and Gas Release Analysis, in Appendix A to the FEIS.

BOEM recognizes that multiple stakeholders have different interests and different analytical perspectives that shape the way they think about spill occurrence and identify a preferred policy response. Some stakeholders may consider a 19 percent chance of one or more large spills over the life of the E&D scenario to be high. In this EIS, BOEM has characterized the 19 percent chance of one or more large spills of 1,000 barrels or more occurring (if oil is discovered and produced) over the 28-year development and production life as unlikely. In this characterization, BOEM considered several factors. The estimated mean number of large spills is much less than one, adding up both estimated pipeline and platform spills over the 28-year development and production life of the project. The most likely event that BOEM estimates to occur over the life of the project (over 81 percent of the time) is that a large spill will not occur. The chance that one or more large spills will not occur is characterized as the “likely” outcome.

The estimated chance of one or more large spills occurring assumes development and production occurs and does not factor in the low probability of reaching the development and production stage. For a large oil spill to occur, a series of events must occur. First, there must be a lease sale. In Cook Inlet, 114 leases have been issued from four OCS sales and one resale. Then, through exploration oil must be found (there have been 13 exploration wells in Cook Inlet with no discoveries to date). If oil is found, it must be present in sufficient quantities to justify investing in development. To date, only one development in the Alaska OCS (not in Cook Inlet) has resulted from 86 exploration wells drilled (2,351 leases) statewide. Finally, if development and oil production occur at the levels described in the E&D scenario, BOEM estimates it would not result in a large oil spill. Given all the circumstances that would need to align in order for Lease Sale 258 to result in the level of production contemplated in the Final EIS, and the fact that such a scenario would result in a 19 percent chance of one or more large oil spills, BOEM believes that characterizing large spills as "likely" would be misleading.

Finally, although BOEM characterizes a large spill or gas release as unlikely the Final EIS does assume one spill or gas release occurs, analyzes the impacts of a large spill or gas release, and reaches a conclusion on the impacts of a large spill for each resource. The impact conclusion does not factor in the probability of a large spill occurring – it assumes that a large spill does occur. This "what if" analysis addresses whether such spills could cause serious environmental harm and informs the decision maker of potential impacts should a large spill occur. Assuming one large spill or gas release (which is higher than the most likely number of reasonably foreseeable spills or releases) helps to ensure that this Final EIS does not underestimate potential environmental effects.

While the specific details of any potential future gas release cannot be known, the EIS analyzed a range of gas releases and their impacts, including a short duration (24 hours) gas release and a long duration (80 days) oil and gas release. Information (size of pipelines, pigging, conversion) would be analyzed in further detail if a development and production plan were submitted, and the details of the transportation systems were known. Every oil spill or gas release is unique. While some commenters noted weather and ice as a factor, in the case of the Cook Inlet gas leak in 2017, weather and ice were not the primary factors which led to the long duration release. In its response to the Alaska Department of Environmental Conservation, the operator stated, "Shutting in the Pipeline is complicated by the likely after-effects of the shut-in. The Pipeline was in service carrying crude oil from the platforms to the shore until 2005, when it was converted by the previous operator to fuel gas service from the shore to the platforms. The Pipeline has residual crude oil in it from its use in crude oil service. If the gas supply were shut in, seawater would enter the depressurized Pipeline through the leak displacing the remaining gas. That could displace and mobilize residual oil, causing an unknown quantity of oil to be released through the leak (Hilcorp Alaska, 2017)." The oil spill factor and others were used to determine the best response option considering all the resulting consequences.

Oil Spill Preparedness and Response

OCSLA and its subsequent amendments (43 USC §§ 1331-1356) provide the foundation for regulations currently implemented by BOEM and the Bureau of Safety and Environment Enforcement (BSEE). Governing offshore oil development and operations in federal jurisdictional waters, sections of these regulations (30 CFR Parts 250, 254, 550, 553, and 556) specifically address oil spill prevention and response by requiring specific equipment and procedures at offshore facilities. BSEE Regulations applicable to oil, gas, and sulfur lease operations on the OCS are specified in 30 CFR Part 250, and oil-spill prevention and response rules are specified in 30 CFR Part 254.

Included in OCSLA and the Oil Pollution Act of 1990 is a requirement for all operations seaward of the coastline to submit an Oil Spill Response Plan (OSRP) to BSEE. In an OSRP, the operator must include an emergency response action plan to respond to the worst-case discharge scenario. OSRPs must meet all applicable requirements specified in 30 CFR Part 254 for approval. An OSRP is not required for a lease sale because a lease sale only confers the exclusive right to submit plans to BOEM for potential activities on the lease. Additionally, BOEM does not provide responses to comments specific to BSEE's permitting actions and authorities in this FEIS because they are outside of BOEM's jurisdiction.

As noted in Section 3.1.4 of the FEIS, in the event of an accidental oil spill, response operations could occur that may result in a reduction of the spread of spilled oil, thereby potentially decreasing the environmental effects of the spill. These potential mitigating factors are described in the FEIS but are not factored into the oil spill risk analysis. As such, BOEM's large spill scenario (FEIS Table 3-4) assumes that no oil spill response activities occur, ensuring that the trajectory analysis of an oil spill in Cook Inlet overestimates, rather than underestimates, the potential areas that could be affected.

Oil spill response is addressed generally in Appendix A (pg. A-2), which directs the reader to the BOEM OCS Report 2019-006, Oil Spill Preparedness, Prevention, and Response on the Alaska OCS. This report presents an introduction on the complex authorities of, various institutional frameworks for, and respective roles of government and industry for oil spill preparedness, prevention, and response. The specific response and the tactics employed for any oil spill response reside within BSEE's jurisdiction; BOEM approvals and authorities rely on BSEE's determinations and approval of an operator's oil spill response plan and makes no assumption regarding the feasibility of any oil spill response.

Oil Spill Risk Analysis (OSRA)

The OSRA report is available to the public at: https://www.boem.gov/environment/environmental-assessment/oil-spill-risk-analysis-reports. The OSRA model estimated oil spill trajectories using model-simulated hindcast fields of winds, sea ice movement and concentration, and surface ocean currents in the Cook Inlet and Gulf of Alaska. BOEM used the results from a coupled ice-ocean general circulation model to simulate oil spill trajectories. The wind-driven and density-induced ocean-flow fields and the ice-motion and concentration fields were simulated using a state-of-the-art three-dimensional, coupled, ice-ocean hydrodynamic model based on the Regional Ocean Modeling System.

DOI scientists have conducted cutting edge research and analysis of oil spill probability and behavior for over four decades. The OSRA model in particular was initially developed in 1975. Since that time, DOI has continued to fund new science and update its approach to incorporate the most accurate methodologies, latest and best data, and input from subject matter experts, state and federal agencies, and stakeholders regarding important physical, biological, and social resources. The result is a state-of-the-art model that provides BOEM's environmental analysts with reliable, long-term estimates of spill risks associated with potential exploration and development activities in federal offshore waters. (Ji et al., 2021).

In conjunction with preparation of the EIS, BOEM developed a new OSRA Report specifically analyzing the occurrence, chance of contact, and chance of occurrence and contact of a large oil spill from the Lease Sale area and adjacent potential transportation corridors. The principal author of the OSRA Report is a physical oceanographer in BOEM's Division of Environmental Sciences, Branch of Physical and Chemical Science. He possesses a Ph.D. in physical oceanography and has published multiple peer-reviewed papers. BOEM Alaska region staff contributing substantially to this OSRA Report include an oceanographer who has nearly 33 years of experience conducting oil spill analysis for BOEM and its predecessor agencies. Based on the results of the OSRA Report along with Appendix A, BOEM has derived a set of estimates and reasonable assumptions which inform the analysis of potential oil spills and their environmental impacts provided in the EIS. BOEM determined that the OSRA model provides the most accurate and useful estimates to inform the environmental impacts analyses in the EIS. Several commenters criticized perceived deficiencies of the OSRA model, but no superior approach was identified. One commenter provided a detailed critique of certain technical details of BOEM's spill-occurrence methodology. While there is always room for improvement in analysis techniques, BOEM stands by the use of these spill-occurrence rates, based on OCS spills in the Gulf of Mexico and Pacific OCS, and applied in the Final EIS. The methodology and assumptions behind the Oil Spill Risk Analysis spill-occurrence rates has been peer reviewed multiple times over the last several decades by the oil-spill community, which is familiar with spill data limitations in both white paper literature and "gray" oil-spill literature (conference proceedings, government reports).

Commenters noted various other studies that tend to compute different spill numbers and volumes, but these studies are less applicable to the Proposed Action than the OSRA model. For instance, these studies include Cook Inlet spills that may not be related to the current scenario, such as including tankering spills and other elements of the E&D scenario, and other studies that indicate the sample size of Cook Inlet spills is small and volume was unable to be estimated using Cook Inlet spills (Robertson et al., 2020).

Detailed Comments and Responses

One commenter identified several specific sections of the DEIS related to oil spills that they feel are inaccurate or could use further clarification including:

- *COMMENT*: Page 68, Section 4.4.2.3: "...a large oil spill and any ensuing spill response would increase the overall impact on water quality to moderate because the effects could be long-lasting and widespread." Please explain why long-lasting and widespread impacts on water quality are considered to be only moderate.[130]

  RESPONSE: BOEM uses an impacts scale (Section 4.2) that considers the context and intensity of the impact based on four parameters: detectability, duration (i.e., short term or long-lasting), spatial extent (i.e., localized or widespread), and magnitude (i.e., less than severe or severe, where the term "severe" refers to impacts with a clear, long-lasting change in the resource's function in the ecosystem or cultural context). "Moderate" is defined by the impacts scale as having impacts that are long-lasting and widespread, and less than severe. BOEM determined this impact level for potential effects on water quality after thoroughly analyzing peer-reviewed scientific literature, grey literature, and site-specific data to gauge the context and intensity of a hypothetical oil spill on Cook Inlet water quality.

- *COMMENT*: Page 80, Section 4.6.3: "…impacts to fish and invertebrates from exploration and development scenario activities, accidental small spills and spill drills would remain minor, but could range up to moderate if a large spill occurs." This text indicates that impacts to resources (in this case prey) will only "range up to moderate" if a large spill occurs. Please explain why impacts from a large spill are only moderate.[131]

  RESPONSE: The effects of oil spills on fish and invertebrates are summarized in Section 4.6.2.4. The impacts of a large spill could be widespread, long-lasting, and would require spill response and cleanup, which itself can affect organisms through use of dispersants and mechanical recovery methods (Section A-3.5 in Appendix A). These effects, however, would occur in discrete areas in volumes less than or equal to 3,800 bbls, and are not likely to affect the majority of the lease sale area, or substantially cover available habitat in Cook Inlet, thus limiting the severity of effects.

- *COMMENT*: One commenter stated that BOEM's analysis fails to adequately analyze spills of toxic substances other than oil. ADEC's database discloses that oil activities result in spills of significant amounts of extremely hazardous substances such as phosphoric and sulfuric acid, other hazardous materials, and produced waters.

  RESPONSE: Produced waters result from development and production of oil/gas reserves. A NPDES permit by EPA would be required for the discharge of produced waters. In their evaluation of all NPDES permits, EPA must ensure that there is no unreasonable degradation of the marine environment as defined in 40 CFR 125. Operators for either an EP or a DPP must

[130] National Oceanic and Atmospheric Administration.
[131] National Oceanic and Atmospheric Administration.

provide to BOEM a description of the drilling fluids and chemical products used and transported for the operation. EPA serves as the lead agency within the National Response Team (NRT), and as the lead agency is responsible for initiating appropriate removal action in the event of a hazardous substance release.

In 1994, EPA promulgated regulations for worst case discharges of oil under 40 CFR Part 112, Subpart D, but until recently has not proposed regulations for CWA hazardous substances under Section 311(j)(5). EPA published a proposed rule on March 27, 2022 (Clean Water Act Hazardous Substance Worst Case Discharge Planning Regulations 87 Fed. Reg.17890, No. 59) requiring certain facilities to prepare Facility Response Plans (FPRs) for responding to worst case discharges of Clean Water Act (CWA) listed hazardous substances. The EPA's proposed action considers increased risks of worst-case discharges from climate change as well as impacts to communities with environmental justice concerns and is to be finalized no later than 30 months after the announcement of the proposed rule.

- *COMMENT*: It was mentioned by a commenter that the list of Unavoidable Adverse Environmental Impacts covered in the DEIS does not include oil and other hazardous material spills, which the review states could happen hundreds of times.

  RESPONSE: Unavoidable adverse environmental effects are impacts resulting from the proposed action for which there is no feasible mitigation or for which only partial mitigation is feasible. In BOEM's EISs, the discussion of unavoidable adverse effects is typically provided for each environmental resource category. Typical unavoidable impacts include:
  - Contamination of the water column and seafloor sediments from operational discharges and other waste discharges.
  - An increase in suspended sediments due to seafloor disturbance associated with anchoring, drilling, platform construction, and pipeline installation.
  - Emission of pollutants from diesel engines associated with vessel traffic, construction activities, and operation equipment.
  - Disturbance from sounds associated with vessel traffic, seismic surveys, drilling, construction, and OCS operations.
  - Disturbance and collisions resulting from the physical presence of vessels, aircraft, drilling, construction equipment, and infrastructure OCS structures.

- One of these commenters stated that the oil spill risk analysis needs to address the impacts more adequately on fish and invertebrates in Cook Inlet.[132]

  RESPONSE: Section A-3.5 of Appendix A describes potential impacts to marine invertebrates and fish related to accidental spills including lethal and sublethal toxicity, short- and long-term impacts, and physiological effects of spilled oil on fish and invertebrates. BOEM also cited the report *Beaufort Sea: Hypothetical Very Large Oil Spill and Gas Release* report (BOEM, 2020, Sections 4.2.4 and 4.2.5) for additional information of the general impacts of oil and gas on invertebrates and fish. As stated in Section 4.6.2.4 of the FEIS, most accidental spills or spill drills would be small, localized, and have relatively limited impacts to populations of fish and invertebrates. Small spills would not have population level impacts and would impact relatively few habitats. A large oil spill could have similar toxic effects on fish and invertebrates as described for small spills, but the magnitude and severity would be greater.

[132] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG).

- *COMMENT*: Some commenters stated concerns or perceived inconsistencies in conclusions regarding effects of large oil spills on marine mammals, including Cook Inlet beluga whales.[133]

  RESPONSE: BOEM based the determination of effects to marine mammals and beluga whales on the probability of outcomes as demonstrated by the OSRA (Appendix A). Effects of spills, spill drills, and spill response activities on marine mammals are described in Section A-3.7 of Appendix A. Small spills are likely during oil and gas exploration and development. Due to their small size, localized and temporary impacts, and rapid weathering, it is expected that small and medium spills would not impact marine mammal populations. This led to the overall determination that oil spill effects will be negligible to minor. However, the impacts of a large spill would be minor to moderate. A large spill could temporarily or permanently affect a marine mammal's physiology and behavior and could alter habitat until the oil is removed or disperses. The effects could include avoidance of oiled areas, altered thermoregulation, skin/eye lesions, ingestion or inhalation of oil and VOCs, damage to the organs, compromised organ function, and a few potential marine mammal fatalities. A 3,800 bbl large spill could affect individuals, but would have inconsequential impacts on most marine mammal populations. However, in a limited set of circumstances, depending on the spill location, timing, and duration, the sea and climatic conditions, and the spill response activities, a large spill could result in major impacts to Cook Inlet belugas. These circumstances would be extremely unlikely. Although the possibility of major effects is discussed in the FEIS, the remote probability of this outcome led BOEM to conclude that overall marine mammal impacts range from negligible to moderate and do not include major impacts. Clarifying text has been added. Overall impact conclusions for marine mammals are consistently stated, and would be negligible to minor. With the addition of a large spill, impacts could be moderate.

- *COMMENT*: Page A-32-33, and Section A-3.6.1.2 of Draft Appendix A. No specifics about North Pacific right whales are provided in the large oil/gas spill release section. The only comment is that because of the small size of the North Pacific right whale population in or near Cook Inlet, adverse impacts to a small number of individuals could lead to a cascade of impacts to their populations. Effects to North Pacific right whale critical habitat resulting from a large oil spill should be discussed within the text of this section. The sightings of 4 North Pacific right whales in and around this area in August of 2021 suggest that these areas may be very important to North Pacific right whale feeding from summer into winter.

  RESPONSE: In Appendix A, Table A.7 shows the ERA 74 NPRW CH has a <0.5 percent chance of contact within 30 days summer or winter. ERA 73 NPRW Feeding Area has a 1–2 percent chance of contact in summer and <0.5 percent chance of contact in winter within 30 days. Factoring in the chance of a spill occurring and contacting all values for ERA 73 and 74 are <0.5 percent (Ji and Smith, 2021, Table 61). The OSRA results indicate the NPRW critical habitat or feeding areas are unlikely to be impacted from oil spills or gas releases.

- *COMMENT*: Page A-35: There is inadequate discussion of the potential impacts to pinnipeds from an oil spill. There is documentation that oil spills can cause contamination or mortality of Steller sea lions.

  More information needs to be added to this section on the effects of oil spills on this species.

  RESPONSE: Sea lions were generally discussed with harbor seals throughout the document as "pinnipeds." Section 4.8.2.4 and A-3.7.2 discuss the effects of oil spills on pinnipeds, including Steller sea lions. Specific physiological effects of oil spills on marine mammals are described in

[133] National Oceanic and Atmospheric Administration; Center for Biological Diversity [Form Letter Master].

Section A-3.7. As stated in Section A-3.7.2, small and large oil spills, and a large gas release would not impact pinniped populations because of the limited spatial area contacted, weathering processes, short duration of potential contact incidents, and the mostly temporary duration of impacts on individual pinnipeds, though impacts to a few individuals from a large oil spill could be lethal. Overall, impacts to pinniped populations from large oil spills would be non-injurious, temporary, and non-chronic, though impacts to a few individuals could be fatal.

- *COMMENT*: One commenter stated that they disagreed with the DEIS' determination that post-lease activities would have no major (i.e., high and adverse) impacts to EJ communities (Section 4.15.1, Environmental Justice). In particular, the commenter disagreed with the determination on page 102 of the DEIS that effects from a large oil spill could be reduced by spill response actions to a level of effect ranging from negligible to minor.

  RESPONSE: The commenter appears to have misunderstood the text in Sections 4.15.1 and 4.9.4; those sections have been revised to improve clarity. The analysis in Section 4.15.1 states that there would be no disproportionate effect on EJ communities based on the E&D activities and *small spills* (emphasis added), and stated that there would be a disproportionate effect on EJ communities if a *large spill* is considered. The text on page 102 of the DEIS (in Section 4.9.4) is referring only to effects of spill response on *terrestrial mammals*. Section 4.9.4 and Appendix A (A-3.8.3) continue to state that spill response activities could reduce effects on terrestrial mammals to a negligible to minor level of effect. However, because the effects of spill response activities on EJ communities involves an assessment of more resources than just terrestrial mammals, analyses of the effects of large spills on sociocultural systems and subsistence activities (Appendix A, Sections A-3.10 and A-3.11, respectively) continue to conclude that impacts could range up to major depending on the extent and location of a spill.

- *COMMENT*: One commenter stated that they disagreed with the DEIS' determinations regarding the effects of oil spills and/or effects of spill response, and recommended clarification on the following issues: potential effects of a large spill on terrestrial mammals; potential effects of a large spill as described in 4.6.2.4; potential effects of low levels of crude oil on embryonic salmon and herring; and potential effects of a delayed cleanup response on marine mammals.

  RESPONSE:
  Terrestrial Mammals: Section A-3.8.2 of Appendix A discusses impacts to terrestrial mammals from a large oil spill. A large spill and associated response could affect terrestrial mammals and their habitats until the oil is removed or disperses. While individual animals may be negatively affected, there should not be any effects that could be measured at the population or subpopulation level for terrestrial mammals.

  Embryonic Salmon and Herring: Section 4.6.2.4 of the FEIS states that the effects of a large spill in nearshore tidal areas could persist for generations and may be compounded by affecting more than one life state. Section A-3.5 of Appendix A describes potential impacts to marine invertebrates and fish related to accidental spills and states that immediate mortality or other sublethal impacts to fish can occur, such as abnormal development and growth, reproductive damage, and behavioral changes (Carls et al., 1999; Dupuis and Ucan-Marin, 2015; Hjermann et al., 2007; Incardona, 2017; Nahrgang et al., 2016; Rice et al., 2000; Short, 2003). Section 4.6.2.4 was revised with the following information: "One study into the effects of the 1989 *Exxon Valdez* oil spill in Alaska shows that embryonic salmon and herring exposed to very low levels of crude oil can develop hidden heart defects that compromise their later survival, indicating that the spill may have had much greater impacts on spawning fish than previously recognized." (Incardona, J., Carls, M., Holland, L. et al., 2015).

Marine Mammals: Section A-3.7, Appendix A discusses impacts to marine mammals with and without spill response. Delayed cleanup response was not part of the spill assumptions in the FEIS (Section 3.2) or OSRA analysis (Appendix A) but clarifying text has been added to discuss effects of delayed spill response.

- *COMMENT*: A few commenters asserted that BOEM's oil spill analyses only focused on surface oil, did not consider dispersed oil, and does not use a trajectory analysis for small spills. A few commenters stated that due to these factors the impacts of oil spills were not adequately disclosed.

  RESPONSE: BOEM fully analyzed the effects of potential oil spills and their impacts. BOEM understands that the potential risks of offshore oil and gas development must be analyzed, disclosed, and considered prior to authorizing activities on the OCS. To this end, the OCSLA creates an opportunity to analyze, disclose and consider potential risks at four distinct decision points for OCS oil and gas activities: the Five-Year Program, the lease sale phase, the Exploration Plan phase, and the Development and Production Plan phase. This Final EIS analyzes the potential environmental impacts of a decision at the lease sale phase. The EIS also takes a hard look at potential impacts from numerous impacting factors associated with OCS oil and gas at later OSCLA phases, i.e., exploration, development, and production. The analyses provide BOEM's and DOI's decision makers with an objective appraisal of the severity of potential impacts during each of these phases. In addition, the EIS provides the decision makers and the public with a scenario of the types and levels of activities that may result from Lease Sale 258, as well as a discussion of the history and probability of various sizes of oil spill and gas release events. The EIS also includes a discussion of spill response and cleanup. All of this information is provided to BOEM and DOI decision makers to enable informed decisions that balance the need for domestic oil and gas production, the potential effects of OCS activities, and the mandate to protect sensitive resources.

  The DOI Oil Spill Risk Analysis (OSRA) model was specifically developed to provide the information in the EIS that is the basis that the Secretary of the Interior uses to make decisions about OCS Lease Sales. The purpose of BOEM's oil-spill trajectory modeling analysis for this EIS is to provide information for various factors regarding oil spills to assess the oil spill impacts from an oil and gas lease sale over the life of exploration, development, production, and decommissioning.

  The OSRA model appropriately considered a surface release. In the shallow to moderate depths of lower Cook Inlet an oil spill would be expected to surface rapidly within a short distance from the subsurface release point (Westergaard, 1980; Reed et al., 2006).

  The EIS considered and disclosed the impacts of both large and small spills and gas releases in detail to resources (Section A-3 of Appendix A, and Chapter 4 of the FEIS). The majority of small, refined spills last less than 24 hours (Table A-1, Appendix A). Small spills that last longer than 24 hours do not preclude the use of the OSRA trajectory information. Extensive quantification has been applied to oil spills (Section 3.1 of the FEIS and Appendix A) for the specific purpose of impact assessment. BOEM considers the impacts of dispersed oil and the potential impacts of oil dispersed within the water column. The analysis of oil spills in the EIS not only includes the use of information in Section 3.1, Oil Spills and Gas Release Scenario and the OSRA information but also as the commenters point out information about oil spill weathering, water quality information on hydrocarbons within the water column (Section A-3.3 of Appendix A), and information on the impacts of historical oil spills (Michel, 2021) to assist in analyzing the full range of effects of potential oil spills on resources.

COMMENT: One commenter indicated it is unclear if the trajectories that are modeled represent the areas that the evolving oil spill takes or follow a single point representing a center of mass.

RESPONSE: The description of the calculation of trajectories as a point is described in detail in Smith et al. (1982), referenced in Section A-2.2.3, OSRA Model, of Appendix A, and the OSRA Report (Ji and Smith, 2021). For the oil properties, the OSRA model trajectory calculation assumes a point (non-weathering oil), considered to be a conservative choice because it potentially overestimates the chance of contact (Ji et al., 2021). Additionally, the equations in Ji and Smith (2021), Section 3.2.4, shows the components of motions simulated and used to describe the oil transport for each of the simulated trajectories.

- *COMMENT*: One commenter noted the lack of an introduction to the gross oceanography of Cook Inlet, which would be helpful to readers.

  RESPONSE: A section has been added to Appendix A (Section A-3.1) incorporating by reference the description of the Cook Inlet physical oceanography.

- *COMMENT*: Several commenters expressed dissatisfaction with how the OSRA information was displayed and presented in the EIS. One commenter provided an example of tabular colorized conditional probability results. One commenter stated no maps showing individual trajectories as examples of how spilled oil might travel are shown.

  RESPONSE: To be useful, the OSRA model results must characterize the entire lease sale area. Some generalizations are required, considering initially that the area may or may not be leased. Rather than focus on one specific location and making assumptions, the OSRA is "stochastic." The OSRA has many release points (219) within the lease sale and adjacent area to define the overall trajectory population (3,600 from each point) for a total of 799,350 simulated trajectories. Conditional probability results assume a spill occurs and tabulates their trajectories. These conditional probability results were tabulated and presented in Tables A.2-1 through A.2-60 for all year, summer, and winter in the OSRA Report (Ji and Smith, 2021). Summary conditional probability results from the OSRA Report (Ji and Smith, 2021) are shown in the EIS, Appendix A, both as seasonal tables and maps, in Sections A-3.4, Coastal and Estuarine Habitat; A-3.5, Invertebrates and Fish; A-3.6, Birds; A-3.7, Marine Mammals; A-3.8, Terrestrial Mammals; A.3-9, Recreation, Tourism and Sport Fishing; A-3.10, Sociocultural Systems; and A-3.11, Subsistence Activities and Harvest Patterns. The Section A-3 (Appendix A) tables and maps, along with the OSRA report (Ji and Smith, 2021), provide a wealth of tabular and visual information. The analysts use Appendix A and the OSRA report to make a reasoned assessment of the impacts of a large spill or long-lasting small spills over the life of the Proposed Action and alternatives for individual resource categories in the Final EIS assuming a spill occurs in lower Cook Inlet.

- *COMMENT*: A few commenters submitted information about how the environmental resource areas (ERAs) are constructed or displayed. One commenter stated the ERAs overlap, and may not cover the entire model domain of Cook Inlet.

  RESPONSE: ERAs are spatial areas deemed to have particular importance for one or more social, economic, or biological resources. Estimating the probability that spilled oil would contact a given ERA assuming a spill occurs helps BOEM to evaluate the potential for spilled oil to affect resources of concern. Estimating the probability that spilled oil would occur and then contact a given ERA helps BOEM to evaluate the potential hazard for a spill to occur and to affect resources of concern. While many ERAs are considered on a year-round basis, some ERAs (such as the ERAs designated for certain migratory species) are considered seasonally or within a limited time period. BOEM, Alaska OCS Region analysts designate these ERAs based on their interpretations of data and study of scientific literature. The analysts work with specialists in other federal and state agencies, academia, and various stakeholders who provide scientific information as well as local and traditional knowledge about these resources. The analysts also designate the months in which these ERAs are vulnerable to spills, meaning the time period those resources occupy or use that spatial location.

A wide variety of information is considered during the development of ERAs, including the best available information from resource agencies and the gray and peer-reviewed literature. BOEM uses this information in a variety of formats to synthesize information about environmental resources. When available, BOEM prefers to use information in a geospatial format. However, for many resources, much of the information is found within the peer reviewed or gray literature and is not readily available in a geospatial format.

BOEM receives input from stakeholders and employs internal staff analysts to determine the most appropriate description of the at-sea resources (that is, environmental resources, such as marine mammal migration routes or subsistence areas). These environmental resources include 155 offshore biologic, social, and economically sensitive offshore and onshore environmental resources areas, 112 land segments, 52 grouped land segments, and 16 boundary segments (Ji and Smith, 2021, Section 3.2.5). The names or abbreviations of the ERAs, the general resource they represent, and their vulnerability (i.e., months of habitat or resource use) are shown in the OSRA Report Table A.1-1 (Ji and Smith, 2021). Information regarding the specific ERAs for lower trophic level organisms; anadromous fish; whales; seals and sea lions; sea otters; terrestrial mammals; birds; subsistence resources; and parks, refuges, and special areas is found in OSRA Report Tables A.1-2 through A.1-10, respectively (Ji and Smith, 2021).

For biological resources, ERAs are determined by several factors including density, important habitat, and life history features. While multiple species may occur within an ERA, ERAs are assigned to those species for which there is sufficient information to confidently identify the area as important. The analysts also designate in which months these ERAs are vulnerable to spills—for example, a migrating bird may be at an ERA only from May to October. While species rare to the area or with limited sightings may preclude representation by specific ERAs, the discussion of oil spill impacts in Chapter 4 considers impacts to those species present in the area should an accidental large spill occur.

Land Segments and Grouped Land Segments can be correlated to many environmental and geographic parameters that identify sensitive areas such as parks, refuges, important bird areas, critical habitat, and others. The OSRA model is designed to analyze large areas over long periods of time.

The OSRA Report for Cook Inlet (Ji and Smith, 2021) and the EIS Appendix A, Section A-3 consider a large number of ERAs, grouped land segments, and land segments. This ensures that all potential oil spill impacts are identified and considered during the development of the EIS.

- *COMMENT*: A few commenters requested providing the reasoning behind the time frames selected to track the conditional probabilities of oil contacting resources. One comment indicated BOEM had departed from its practice because longer time frames are used in the Arctic OCS.

  RESPONSE: BOEM has not departed from its practice. BOEM and its predecessors have historically used 3, 10, and 30 days for Cook Inlet oil spill risk analysis trajectory time frames.

The Final EIS Appendix A, Section A-2.2.3.2 and Ji and Smith (2021) discussed that the study area is chosen to be large enough to allow most hypothetical oil spill trajectories to develop without contacting boundary segments through as long as 30 or 110 days. In other Alaska OCS areas where landfast ice develops for long periods, longer trajectory times are required. Cook Inlet is a narrow-confined area, meaning oil spill trajectories are likely to contact the shoreline within in a limited time period. As one commenter points out there is little change in the conditional probabilities from 30 days to 110 days.

- *COMMENT*: A few comments indicated some of the models cited in the OSRA are 40 years old which may not represent current scientific research.

  RESPONSE: The Final EIS; Section A-2.2.3, OSRA Model, in Appendix A; and Ji and Smith (2021) provide detailed information about the OSRA model and its underlying components; all of which are the best available information and the most appropriate for the lease sale stochastic oil spill trajectory analysis. The OSRA model is a component model in which the underlying components are continuously updated with the best available new information. The OSRA model algorithms have been improved many times since the original development (Ji, 2004; Ji et al., 2021, Price et al., 2004). Considerable effort (funding) has been expended to improve the results of OSRA by improving the wind, ocean current and sea ice motion estimates. The studies have focused on obtaining the best ocean circulation and ice information available, and as computers and ocean models improve, the results of the calculations have become more realistic and the quality of output has drastically increased.

  Ji and Smith, (2021) and Section A-2.2.3 of Appendix A describe the OSRA model components. Danielson et al. (2016) completed a state-of-the-art high resolution (~1.5 km) coupled ocean sea-ice model, which was specifically designed for running the OSRA model to simulate a decade of the currents in the Cook Inlet, Shelikof Strait, and adjacent Gulf of Alaska. The model was setup regionally for the northeast Pacific with enhanced resolution (~1.5km) in the northwest Gulf of Alaska.

  The coupled ocean sea-ice model has the capability to reproduce the coastal hydrodynamic features. Danielson et al. (2016) discuss model results and model-data comparisons in Section 3.0. The model skill is extensively verified with the historical and recent field observation data in these areas, such as the satellite tracked oceanographic drifters from University of Alaska Fairbanks (UAF) field campaigns between 2003 and 2015 (Doroff, Johnson and Gibson, 2015; Johnson, 2008; Johnson, 2016; Johnson, 2021) and a set of conductivity-temperature-depth (CTD) observations conducted in Cook Inlet between 2004 and 2006 (Okkonen et al., 2009).

  Ji et al. (2021), Smith et al. (2020), and Li et al. (2021) are BOEM’s most recent publications discussing the OSRA model, its use, and its continuous improvement.

- *COMMENT*: One commenter submitted a detailed analysis of the State of Alaska Cook Inlet region 1995–2020 spill data from the Alaska Department of Environmental Conservation (ADEC) database. Based on that analysis, commenters submitted variations of comments about the use of Cook Inlet spill data. Several commenters discussed the State of Alaska Cook Inlet spill history based on the ADEC data and indicated a preference to use the State of Alaska Cook Inlet spill history rather than OCS data. One commenter indicated BOEM should look at causal factors of oil spills in Cook Inlet. A few commenters indicated BOEM ignored the Cook Inlet data. A few comments indicated BOEM underestimated the number of spills based on ADEC database of the Cook Inlet spill history. Another commenter indicated State of Alaska spill data was used to estimate spills on the Alaska North Slope.

RESPONSE: BOEM used the best available information in our oil spill risk analysis and has invested considerable time, effort, and funding in the past few years to improve the OSRA. No large spills have occurred from Alaska OCS oil and gas activities, the large spill volume assumptions are based on the reported spills in the Gulf of Mexico and Pacific OCS. BOEM conducted a rigorous analysis of both onshore and offshore spills. BOEM used OCS spill rates to estimate large offshore oil spills and gas releases as well as the Pipeline and Hazardous Materials Safety Administration to determine rates for onshore gas pipelines. These analyses are discussed in Sections A-2.2.1 and A-2.3 of Appendix A.

Although the Gulf of Mexico and Pacific OCS are geographically different from the Cook Inlet OCS, regulatory and inspection requirements would be the same throughout the entire OCS and could differ substantially from the State of Alaska. An essential question when addressing oil spill rates is how reliable this data is as it relates to these systems and exposure variables, given BOEM's requirements. The OCS offshore spill data is compiled by BSEE (USDOI), the USCG (DHS), and (for common carrier or trunk lines) the Office of Pipeline Safety (DOT). BSEE carefully quality assures and quality controls (QA/QC) the oil-spill data prior to analyses. Elsewhere in the world, oil-spill data is not publicly available and is difficult or impossible to obtain or QA/QC the data and reporting requirements have changed through time. Oil spill events are relevant to U.S. OCS events to the extent that technology, maintenance, operational standards, and other factors are equal.

Robertson et al. (2020) recently completed a study Oil Spill Occurrence Rates for Cook Inlet, Alaska Oil and Gas Exploration, Development, and Production for BOEM.

"A dataset of 292 spills was compiled from several sources of available records covering 1966–2019. Spills were included in the dataset if they were larger than one barrel and could be associated with Cook Inlet oil and gas exploration, development, or production infrastructure or activities. While this included oil field support, it did not include the distribution of natural gas, or refining and distribution of refined oil products, nor the shipment of crude oil into Cook Inlet. Spills, as recorded in the data, were consolidated into four types: crude oil, diesel, other refined products, and natural gas liquids.

A suitable regression model was identified for the number of spills using oil production as a single independent variable:

N_tot = 2.1557 + Oil_Prod. x 0.3591
Where: N_tot = total annual number of spills for all spill types and classes
Oil_ Prod. = annual volume of crude oil produced from oil wells in million bbl

The model indicated that for every increase of one million barrels (MMbbl) of crude oil production, the number of annual spills is expected to increase 0.36 units (number of spills) for all spill types and classes. This model explains 23 percent of the variation observed in the annual number of spills. The model's calculated multivariate power was 0.7199. The power is adequate but not exceptional. This is attributed to the relatively small sample size.

The model was not useful for predicting annual numbers of refined spills nor calculating large spills. The limitations of the models developed should be noted. These include the small size of the dataset and changes in reporting over time (Robertson et al., 2020)."

BOEM determined using the OCS data that is quality assured/quality controlled, has a large sample size, can be used to estimate large and small spills, and is based on the same OCS regulatory and inspection standards was the best available estimates for use in the Cook Inlet OSRA analysis.

BOEM will continue to invest in research of oil spill events and oil spill occurrence analyses. BOEM has spent considerable time and effort investigating State of Alaska oil spills both in Cook Inlet and on the Alaska North Slope to determine the best available information to use in NEPA analyses (Mach et al. 2000; Robertson et al. 2020a, b; Robertson et al. 2013).

- *COMMENT*: Several comments noted the time period used for the hindcast input to the oil spill trajectory model. A few comments noted that the ice and ocean circulation models use data from 1999 to 2009. The DEIS describes a project that is expected to last for 40 years. Commenters asked how uncertainty regarding the effects of climate change for the next several decades is incorporated into the models.

  RESPONSE: The EIS analyses do not assume a static environment and, where appropriate, implications of environmental change and uncertainty have been considered. For example, stochastic variation in oil-spill trajectories is presented in a conservative manner. Underlying circulation models rely on updated data and a continual process of improvement in predictive approaches. BOEM continuously seeks to improve its oil spill trajectory modeling results. BOEM convened a workshop entitled "Evaluation of the use of Hindcast Model Data for OSRA in a Period of Rapidly Changing Conditions" and assembled experts in ocean, meteorological and sea ice modeling in 2011 (SAIC, 2011). BOEM uses the results of these types of workshops to guide BOEM-funded environmental studies including oil-spill trajectory modeling. One conclusion from this study was that "forecast models are not exact and display a wide variance among themselves; so much so that they cannot be relied upon for applications with OSRA in the near term (Samuels, Amstutz and Crowley, 2011)." Therefore, updated hindcast models remain the best tool available to BOEM for use in OSRA. In 2015, BOEM funded work for a new coupled ice-ocean model for the region of interest and used the results of that most recent simulation in the OSRA model for this EIS as discussed above. It is impractical to use data from the most recent years because the high-resolution forcing fields do not exist.

  The circulation in lower Cook Inlet is largely tidal driven. Knowledge of the tidal and subtidal currents in Cook Inlet is essential for determining and predicting transport pathways as they play a critical role in affecting potential pollutants and the fate of spilled oil. The physical forcing factors of tidal circulation will not change with the effects of climate change. Johnson (2021) describes that much of the characterized circulation patterns remain the same since the 1970s with refinements to localized areas within the Inlet. The level of analysis in the Final EIS complies with recent CEQ guidance and is an appropriate level of detail for the decision at hand. It is not presently possible for science to predict with confidence what precise (i.e., fine scale) geographical changes to oceanography may occur over long time scales and as the result of climate change.

- *COMMENT*: One commenter indicated the matrix algebra used to find the combined probabilities was confusingly and incompletely presented.

  RESPONSE: Smith et al. (1982), referenced in Section A-2.2.3, OSRA Model, of Appendix A, and the OSRA Report (Ji and Smith, 2021) details the matrix multiplication. The trajectory analysis in the OSRA used 6 hypothetical launch areas (LAs) and 4 pipelines (PLs) as locations where the hypothetical oil spill trajectory simulation starts. The resource volumes for each launch area were based on the 2021 National Oil and Gas Assessment (BOEM, 2021) and were added to Appendix A in response to the comment.

- *COMMENT*: One commenter noted the lack of assessing the variances around the model results, especially given the tiered nature of the models.

  RESPONSE: The OSRA model is sufficient to support long-term planning as it considers various sources of uncertainty including spill location, spill season, spill trajectory timeframe, and ocean and meteorological variances. Seasonal variability in the oceanographic fields (i.e., ocean currents and wind-induced currents or Stokes drift), and in the atmosphere are included in the analyses. The OSRA model results are based on what are known as ensembles, which are the mean result of all the trajectory simulations. For Lease Sale 258, BOEM ran slightly less than 800,000 simulated oil spill trajectories simulations within three separate timeframes (annual, summer, and winter). These trajectories cover the estimated oil spill dispersion patterns under the meteorological and oceanographic conditions for the region. In other words, the variety and sheer number of modeled trajectories provides reasonable assurance that the behavior of an actual oil spill would be encompassed by the results of the OSRA Report.

  BOEM references all the reports used for the model results and calculations to provide the reader the ability to access additional information on the assumptions, variability, and uncertainty.

  Danielson et al. (2016) describe their model data comparisons to evaluate inputs to and the results of the general circulation model as follows: "These model data comparisons are designed to highlight both the strengths and the weaknesses of the numerical model results. With this approach, we ensure that BOEM and the other stakeholders can more easily interpret the model and OSRA results in the context of real-world applications."

  2016 Update of Occurrence Rates for Offshore Oil Spills (ABS, 2016) updates oil spill occurrence rate estimates applicable to offshore oil exploration and development activity in the U.S. Outer Continental Shelf (OCS). Within ABS' (2016) estimates of uncertainty for OCS oil spill rates are provided as confidence intervals. ABS (2016) Tables 9 and 22 provide confidence intervals for the large spill rates. These intervals use the bootstrap method to overcome the statistical challenge of a small number of data points. Table 0-1 summarizes the lower and upper bound confidence intervals from Tables 9 and 22 in ABS (2016) for the mean platform and pipeline OCS spill rates (number of spills per Bbbl).

Table 0-1: Large (≥ 1,000 bbl) OCS Oil Spill Rates: Confidence Intervals

Spill Source	Mean Number of Spills per Bbbl	Lower Bound (95% Confidence)	Upper Bound (95% Confidence)
Platform	0.22	0.00	0.56
Pipeline	0.89	0.50	1.28

Source: ABS Consulting, Inc. (2016), Table 9 and Table 22.

  For purposes of analysis in the FEIS, BOEM assumes one large spill will occur. One large spill is inclusive of these upper bound spill rate confidence intervals and discloses the potential consequences to the decision maker.

- *COMMENT*: Several comments were concerned about very large oil spills including outlier events like the Deepwater Horizon oil spill and a long-term gas leak in Cook Inlet.

  RESPONSE: The Final EIS, Section 3.1.5 considered a hypothetical long duration oil spill and gas release resulting in 120,000 bbl of oil and released gas by relying on the analyses completed for the LS 244 EIS (BOEM, 2016). This Final EIS analyzes the potential environmental impacts of a decision at the lease sale phase including a very large oil spill and gas release. BOEM has conducted numerous analyses on the likelihood of very large oil spills (Ji et al., 2014). This information is provided to BOEM and DOI decision makers to enable informed decisions that balance the need for domestic oil and gas production, the potential effects of OCS activities, and the mandate to protect sensitive environmental resources.

- *COMMENT*: A few commenters noted aspects of mechanical response in relation to oil spill analysis. Several commenters provided references indicating the efficacy range of mechanical response. One comment indicated BOEM did not disclose the limits of spill containment.

  RESPONSE: BOEM conservatively analyzed the impacts of oil spills and a gas release assuming no response, as noted in Section 3.1, Table 3-4. This ensures that the impacts are not underestimated. Response efforts and their success can be variable depending upon the circumstances of the spill, the weather, and other variables that affect response. BOEM's 2019 report *Oil Spill Preparedness, Prevention, and Response on the Alaska OCS* referenced in Section 3.1.4, states "Spills to open-water or broken-ice conditions may result in lower recovery rates of 10 to 30 percent of the spilled oil (Gundlach and Boehm, 1981; Gundlach et al., 1983; Lubchenco et al. 2010; Wolfe et al., 1994)."

- *COMMENT*: One commenter provided estimates of cumulative number of spills in different substance and size classes and asserted the effects of small spills were dismissed.

  RESPONSE: The EIS Appendix A, Section A.2-4 presents a reasonable spill estimate for the cumulative case. BOEM conservatively assumes that the entire estimated resource from any given lease sale will be produced at the high activity level. BOEM also assumes all resources on State lands will be leased and produced and all reserves will be produced. A lease sale would not necessarily precipitate spills. For spills to occur, a series of events must occur. First, a lease sale must occur. In the Cook Inlet OCS, 114 leases have been issued from four OCS sales and one resale. Then, exploration must occur and find oil (there have been 13 exploration wells in Cook Inlet with no discoveries to date). If oil is found it must be in sufficient quantity. If enough oil is found, it must be developed; to date, only one development (Northstar) in the Alaska OCS has occurred from 86 exploration wells (2,351 leases) statewide. Consideration of cumulative impacts to resources stemming from oil spills is intrinsic to each resource, and stems from robust analysis of oil spill impacts by resource in Section A-3 of Appendix A, and Chapter 4. Each resource analyzed in Section A-3 of Appendix A has a dedicated section on the impacts of small oil spills. In Chapter 4, cumulative effects analysis is continued in each individual resource section. As a direct result, each resource analyzed in Chapter 4 carries an explicit analysis of small oil spills into its cumulative effects consideration.

Source of Comments

- Energy/Non-Energy Industry and Other Associations
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Federal Agencies
- Individual/General Public
- State Agencies
- Tribes and Tribal Representation

Issue 4.3 Regulatory and Administrative Framework

Summary of Comments

A commenter emphasized the importance of oil spill response prevention in reducing long-term ecosystem impacts and recommended BOEM consider additional lease stipulations that reduce the risk of oil spills based on lessons learned in the oil industry. The commenter further expressed support for the four lease stipulations evaluated as part of the Proposed Action. The commenter requested clarification of Stipulation 2 related to when a decision would be made to conduct biological surveys.[134]

Summary Response to Comments

OCSLA requires that all OCS technologies and operations use the best available and safest technology that the Secretary of the Interior determines to be economically feasible, and include a requirement for an oil spill response plan. As noted in Section 3.1.4 of the FEIS, in the event of an accidental oil spill, response operations could occur that may result in a reduction of the spread of spilled oil, thereby potentially decreasing the environmental effects of the spill.

Section 3.3.1 of the FEIS includes lease stipulations considered as part of the Proposed Action that would apply to all leases issued as result of the lease sale. Stipulation 2 – Protection of Biological Resources states that the Regional Supervisor for Leasing and Plans may require the lessee/operator to conduct biological surveys. The decision to require a biological survey may result from environmental reviews of proposed exploration or development and production plans in consultation with BOEM biological analysts.

Source of Comments

- Federal Agency

Issue 4.4 Mitigation Measures Proposed

Summary of Comments

Five commenters discussed the mitigation measures proposed in the DEIS, as well as the importance of mitigation measures in general. One commenter suggested that the "observer program" on seismic vessels does not offer much help in the way of mitigation because the range of observation is very limited.[135] Another commenter stated the bullet related to noise and the bullet on vessel traffic mitigation measures in the DEIS are unclear.[136] A few other commenters emphasized the importance of including strong mitigation measures in the FEIS. These commenters stated that a "perfunctory description" of mitigation measures, such as a mere listing of mitigation measures, is insufficient to meet NEPA's requirements.[137] Another commenter expressed concern that due to the lack of any comprehensive study on water quality and noise in Cook Inlet, any proposed mitigation measures would be baseless.[138]

[134] National Oceanic and Atmospheric Administration.
[135] J. Whittier.
[136] National Oceanic and Atmospheric Administration.
[137] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[138] K. Nalven.

Summary Response to Comments

The mitigation measures identified in Section 3.4 of the FEIS include typical mitigation measures incorporated into MMPA take authorizations and typical mitigation measures incorporated into Biological Opinions issued pursuant to Section 7 of the Endangered Species Act. Section 3.4 also contains proposed mitigation measures that were developed as a result of scoping comments and comments on the DEIS or through impacts analysis.

In developing the EIS, BOEM identified various ways that potential impacts could be reduced. These potential mitigation measures are identified and analyzed in the FEIS. BOEM also considered all relevant and reasonable mitigation measures identified in public comments on the FEIS. Based on the requirements in applicable laws and regulations, mitigation can be implemented through binding and enforceable measures known as lease stipulations. Decisions on whether to adopt specific mitigation measures will be made in the Record of Decision. BOEM may require additional mitigation as part of the environmental review and approval of proposed EPs and DPPs. Further mitigation may also be required by NMFS or the USFWS through the ESA Section 7 consultation process.

As described in Section 3.3 of the FEIS, post-lease activities resulting from LS 258 will take place pursuant to BOEM regulations governing Ancillary Activities, EPs, and DPPs. Post-lease activities will also be covered by BSEE regulations and oversight, particularly with regard to platform design and installation, and oil spill prevention and response.

Source of Comments

- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Federal Agencies
- Individual/General Public

Issue 4.5 Exploration and Development Scenarios

Summary of Comments

Seven commenters discussed E&D scenarios. One commenter discussed perceived unjustified assumptions that were made regarding decommissioning activities. Specifically, the commenter suggested that the statement in the E&D Scenario in the DEIS that "platforms would be disassembled and removed from the area and the seafloor site restored to a practicable predevelopment condition" only describes how the decommissioning process should work in theory. They requested that BOEM include more information to justify its assumption that any platforms that result from post-lease activities will actually be removed and environmental disturbance will be reclaimed.[139] Another commenter pointed out that there is a difference in the E&D scenarios between Lease Sale 244 and Lease Sale 258 and requested the rationale for the differences.[140] A few commenters expressed confusion regarding the time frames exploration and drilling will occur during the year.[141]

Another commenter proposed a list of recommended information to be covered in other project-specific (exploration and development) sections of environmental review documents including:[142]

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[139] Ocean Conservancy.
[140] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).
[141] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[142] U.S. EPA Region 10.

- Description and figures showing the geophysical data used to evaluate the shallow geological and archaeological hazards.
- Discussion and figures showing the location, stratigraphy, and structure of the hydrocarbon resource(s).
- Description of the predicted rate profile for oil, water, and gas with the corresponding rate of injection for water and gas.
- Description of the reservoir rock properties, reservoir fluid properties, and an estimate of the recoverable resources supported by information within the document.
- Description of the subsurface depletion plan including well count, well placement, well profiles, well depth, and bottom hole locations.
- Analysis of surface and subsurface conditions that may present hazards to rig set down, construction, drilling operations, production and processing operations, pipeline construction, and/or pipeline operation.

Summary Response to Comments

Decommissioning activities are regulated by BSEE under 30 CFR Part 250, Subpart Q. Lessees and owners of operating rights are jointly responsible for meeting decommissioning obligations for facilities on leases under this subpart of the federal regulations. Methods and equipment used in decommissioning vary with types of equipment and structures removed as well as bottom type and installation methods of the decommissioned equipment. BOEM will conduct separate, project-specific reviews after the operator submits applications to decommission and remove structures and equipment no longer used.

BOEM reviews project-specific information submitted as part of an exploration or development and production plan and uses this information to assess impacts as part of BOEM's NEPA review.

Additional information regarding the exploration and development scenario for lease sale 244 are outside the scope of analysis for this FEIS. Commenters interested in learning more about Lease Sale 244 are encouraged to review BOEM's 2016 Cook Inlet Planning Area Oil and Gas Lease Sale 244, Final Environmental Impact Statement.

Source of Comments

- Energy/Non-Energy Industry and Other Associations
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Federal Agencies
- State Agencies

Issue 5 Affected Environment and Environmental Consequences

Issue 5.1 Air Quality

Summary of Comments

Approximately 20,030 commenters, including form letter campaigns, discussed air quality. Commenters expressed concerns related to impacts of oil and gas development on air quality and climate change, including increased production of GHG emissions. Multiple commenters urged that the lease sale be cancelled since it will contribute significantly to climate change and have permanent consequences on the planet and people of Cook Inlet.[143] Multiple commenters stated that the agency's analysis shows that the lease sale will produce 88.3 million metric tons of GHGs, which is the carbon equivalent of burning 97.6 billion pounds of coal.[144] A commenter said that the combustion from the oil and gas extraction from the lease sale would produce GHG emissions equivalent to that of about 25 coal-fired power plants. The same commenter expressed that the downstream Scope 3 emissions will increase GHG pollution across the planet.[145] Based on the latest Intergovernmental Panel on Climate Change (IPCC) report, a commenter concluded that Arctic sea ice cover will be melted for most of the year if carbon emissions are not significantly curbed soon, impacting marine species and the surrounding ecosystem.[146] One commenter stated that the lease should be cancelled and there should be a moratorium on any lower Cook Inlet lease sales because the proposed buffer area in the sale will not protect the Inlet's natural environment from GHGs emissions.[147]

Several commenters stated that although the DEIS acknowledges that the lease sale will increase GHG emissions, it should be updated to include the detrimental impacts climate change will have on Alaska, its fisheries, and its resources.[148] A commenter suggested that BOEM assess the cumulative and incremental impacts of "Scope 3" (downstream) emissions. They recommended that BOEM assess the impacts that the Proposed Action and No-Action Alternatives would have on commitments to limiting global warming to below 1.5 degrees Celsius.[149] A commenter said that while BOEM recognized the importance of potential formation, fate, and toxicity of oxygenated compounds in Cook Inlet, its analysis did not acknowledge an entire class of polar compounds, and historical data should not be used to conclude whether hydrocarbons pose a risk in Cook Inlet.[150]

Several commenters stated that the MarketSim model does not adequately analyze potential impacts from GHG emissions, miscalculating both the climate benefits of the no action alternative and the climate harm caused by the lease sale.[151] A few commenters expressed that MarketSim uses elasticity estimates that depend on outdated data and assumes near constant domestic demand for oil and gas for up to 70 years in the future, even though evidence shows future oil and gas demand is likely to diminish with the transition to other forms of energy.[152]

A commenter advised BOEM to reexamine its GHG analysis in the DEIS to show that the impacts of GHG emissions from a lease sale in the U.S. OCS would be inconsequential or diminished. The commenter further reasoned that preventing a lease sale in a lower carbon producing region could worsen inflation and reduce employment and investment opportunities without adequately addressing GHG emissions.[153]

A commenter expressed that the Audubon Society's Climate Atlas demonstrates the importance of watersheds in this area for mitigating climate change and its impacts on ecosystems.[154] A commenter said

[143] S. Christiansen; M. Francis; N. Pease; Evergreen Action; Center for Biological Diversity [Form Letter Master].
[144] C. Lish; Center for Biological Diversity [Form Letter Master].
[145] Evergreen Action.
[146] Unitarian Universalists of Homer.
[147] N. Pease.
[148] S. Christiansen; N. Pease; Unitarian Universalists of Homer; Lower Cook Inlet Defense Project; National Oceanic and Atmospheric Administration.
[149] Evergreen Action.
[150] Cook Inlet RCAC.
[151] Ocean Conservancy; Institute for Policy Integrity at New York University School of Law; Natural Resources Defense Council, et al.; Cook Inletkeeper.
[152] Institute for Policy Integrity at New York University School of Law; Cook Inletkeeper.
[153] National Ocean Industries Association.
[154] Unitarian Universalists of Homer.

that it was not necessary for BOEM to include a quantitative analysis of the impacts of foreign oil consumption and the resulting GHG emissions under the "No Action" alternative to satisfy NEPA.[155] The commenter suggested BOEM amend its lifecycle GHG modeling since the current methods used for this analysis are not sufficient. The commenter further recommended that BOEM present a range of estimated GHG impacts based on differences in elasticities, justify deviations from previously used values, and perform a sensitivity analysis to support the reliability of variable data and to assess the GHG impact of sourcing energy from various geographical locations.

A commenter recommended that BOEM make public the potential air quality and Air Quality Related Values (AQRV) effects on the Tuxedni Wilderness caused by this lease sale and describe mitigation measures, emission reduction plans, or lease block development restrictions in the FEIS, if Air Quality or AQRV impacts are found.[156] The commenter suggested that the methods in Federal Land Managers' Air Quality Related Values Work Group (FLAG 2010) be used for this air analysis and that BOEM conduct near field (plume blight) and far-field modeling (CALPUFF) to prevent screening failures, since the lease sale covers areas within and greater than 50 km from the Class I area.

Summary Response to Comments

Several commenters recommended mitigation measures to offset for emissions and air quality impacts. BOEM has identified various ways that potential impacts could be reduced. These potential mitigation measures are identified and analyzed in the FEIS. BOEM also considered all relevant and reasonable mitigation measures identified in public comments on the DEIS. Based on the requirements in applicable laws and regulations, mitigation can be implemented through binding and enforceable measures known as lease stipulations. Decisions on whether to adopt specific mitigation measures will be made in the Record of Decision.

BOEM shares commenters' concerns about climate change and the many unique challenges it presents to Alaska. The FEIS provides a multi-faceted, comprehensive analysis of relevant climate change issues. Section 3.2.2.7 of the FEIS describes how climate change is important to the cumulative effects analysis because of the potential for the changing climate to influence the established climatic pattern of Cook Inlet and identifies ways in which a changing climate could contribute to cumulative effects. It discusses the mechanisms of climate change and describes how climate change is affecting environmental resources in Alaska and the Cook Inlet.

Each resource-specific subsection of Chapter 4 of the FEIS analyzes potential impacts from the Proposed Action and alternatives in the context of this changing environment. Section 4.3.5 of the FEIS quantifies projected lifecycle GHG emissions that would occur from the Proposed Action and the consumption of the produced fuels. These "lifecycle GHG emissions" include GHG emissions from upstream as well as mid- and downstream activities. Upstream activities include the exploration, development, and production described in the E&D Scenario. Mid- and downstream activities are associated with the transportation, refinement, and consumption of the fuels produced from leases issued via LS 258.

The GHG analysis also estimates GHG emissions associated with the No Action Alternative, which assumes there would be no development or production activities as a result of this lease sale and no oil and natural gas attributable to LS 258 would be transported or consumed. However, in the absence of production stemming from LS 258, demand for oil and gas would not disappear. Rather, it would be fulfilled from alternative sources, which is referred to as "substitute" sources. To estimate the energy

[155] American Petroleum Institute.
[156] DOI U.S. Fish and Wildlife Service.

market substitutions that would occur in the No Action Alternative, BOEM uses the Market Simulation Model (MarketSim).

Separately, BOEM estimates the increase in oil consumption that would occur in foreign energy markets as a result of the lower oil prices associated with the Proposed Action. GHG emissions are estimated for this increase in foreign oil consumption. BOEM also discusses how this increase in foreign GHG emissions resulting from oil consumption only is an overestimate of the Proposed Action's impact on foreign emissions. This is because BOEM is unable to quantify other shifts in foreign energy markets attributable to the Proposed Action. However, even if these missing components of foreign GHG estimates were to be quantified, BOEM doesn't believe it would change the overall conclusion that the Proposed Action would increase foreign emissions. Reference Section 4.3.5.4 of the FEIS for additional explanation on why the results would remain unchanged. These quantified and qualitative estimates of GHG emissions serve as a proxy for assessing the Proposed Action's contribution to climate change globally.

BOEM evaluated air impacts to the Tuxedni Wilderness Class I area using conservative scenarios for modeling, including the use of the highest activity year. The incremental impact from modeling at the Tuxedni Wilderness Class I area was larger than the Prevention of Significant Deterioration (PSD) Class I Increment. Therefore, the operator proposing exploration or development and production activities may be required to obtain an EPA PSD permit and submit air quality analysis to the United States Fish and Wildlife Service (USFWS) for review.

Market Substitution. MarketSim is a Microsoft Excel-based model for the oil, gas, coal, and electricity markets that is calibrated to a special run of the U.S. Energy Information Administration's (EIA's) National Energy Modeling System (NEMS) from the 2020 Annual Energy Outlook reference case. BOEM's model adopts assumptions from the EIA—the primary federal government authority on energy statistics and analysis—and from economics literature. These assumptions help BOEM estimate where substitute sources of oil and gas would come from (i.e., oil and gas production from state submerged lands, onshore domestic production, international imports) and the other types of energy sources that would be utilized to help energy supplies keep pace with demand (i.e., coal, biofuels, nuclear, renewable energy). Estimating this mix of substitute energy sources is important because each substitute energy source entails a different capacity to produce lifecycle GHG emissions over the course of its production, transportation, refining, and/or consumption.

More information about the model is included in Section 4.3.5.1 of the FEIS and a full description of this model is provided on BOEM's website (Industrial Economics, Inc., 2021).

Modelling Limitations. Readers and the decision maker should bear in mind that estimating lifecycle GHG emissions is an inherently complex endeavor requiring the consideration of many variables and the development of many assumptions. Each of the assumptions incorporated into BOEM's model and applied in this project-specific analysis was developed by BOEM physical scientists and economists based on their best professional judgment using the best available science. Some of these assumptions may suggest a tendency to overstate the potential for GHG emissions, while others may suggest a tendency to understate the potential for GHG emissions. One hundred percent accuracy in these matters is not possible, much less anticipated by BOEM or implied in this FEIS. However, BOEM is confident that the estimated lifecycle GHG emissions provided in the FEIS represent a reasonable approximation of what is likely to occur under each alternative.

Monetizing Impacts from GHG Emissions. As described in Section 4.3.5.2 of the Final EIS, the "Social Cost of Carbon" (SCC), "social cost of nitrous oxide" (SCN), and "social cost of methane" (SCM) – together, the "social cost of greenhouse gases" (SC-GHG) – are estimates of the monetized damages associated with incremental increases in GHG emissions in a given year. On January 20, 2021, President Biden issued EO 13990, Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis. Consistent with EO 13990, the CEQ rescinded its 2019 "Draft National Environmental Policy Act Guidance on Considering Greenhouse Gas Emissions" and has begun its review for updating its "Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews" issued on August 5, 2016 (2016 GHG Guidance). While CEQ works on updated guidance, it has advised agencies to consider and use all tools and resources available to them in assessing GHG emissions and climate change effects including the 2016 GHG Guidance. Section 5 of EO 13990 also established an Interagency Working Group on the Social Cost of Greenhouse Gases, which published an interim report that updated the previous guidance from 2016, and agencies are advised to follow until the final report is published.

BOEM's analysis of monetized impacts from GHG emissions is consistent with the prevailing guidance. In accordance with this direction, Section 4.3.5 of the FEIS provides estimates of the monetary value of changes in GHG emissions that could result from selecting the No Action or Proposed Action Alternatives. Such analysis should not be construed to mean a cost determination is necessary to address potential impacts of GHGs associated with specific alternatives. These numbers were monetized and annualized; however, they do not constitute a complete cost-benefit analysis, nor do the SC-GHG numbers present a direct comparison with other impacts analyzed in this FEIS. SC-GHG is provided only as a useful measure of the benefits of GHG emissions reductions to inform agency decision-making.

Specific to comments recommending BOEM engage in a full cost benefit analysis of the social cost of GHGs, the 2016 GHG Guidance noted that NEPA does not require monetizing costs and benefits. Furthermore, it stated that "the weighing of the merits and drawbacks of the various alternatives need not be displayed using a monetary cost-benefit analysis and should not be when there are important qualitative considerations."

Comments beyond the Scope of Analysis. While national issues such as energy policy, energy prices, and domestic energy production are largely outside the scope of the environmental analysis in the FEIS, BOEM acknowledges that large changes in energy policies could impact the analysis. BOEM also provides information on how the leasing impacts U.S. Carbon Emissions targets. Likewise, comments related to national and international climate policy such as recommendations that the FEIS assess consistency with the national and global GHG reduction policies are beyond the scope of this analysis, except to the extent they pertain to regulatory requirements associated with the Proposed Action. BOEM disagrees with comments that suggest any additional contribution of GHG from the Proposed Action would lead to irreversible problems and costs caused by climate change. At this time, a single, discrete project's contribution to climate change cannot be reliably linked to particular climate change-related impacts. Section 4.3.5 of the FEIS evaluates the effect of the Proposed Action and its alternatives on lifecycle GHG emissions and the social cost of greenhouse gases.

Detailed Comments and Responses

COMMENT: A commenter also recommended that BOEM evaluate the Air Quality and AQRV impacts by:

- Preparing and submitting a comprehensive emission inventory for each phase and year of the lease sale that includes quantified emissions of regulated air pollutants from all direct and indirect sources related to the lease sale;
- Preparing an air analysis to evaluate the oil and gas leasing activities near-field, far-field, direct, indirect, and cumulative impacts to air quality and AQRVs using approved methods;

- Requiring air quality mitigation measures and implementing emission reduction strategies within its authority and consulting with local, state, federal and tribal agencies with responsibility for managing air resources, in addition to imposing regulatory requirements and emissions reduction measures not otherwise regulated by Alaska Department of Environmental Conservation (DEC) or EPA;
- To the extent practicable, requiring all oil and gas operations to be powered by natural gas or electric power rather than diesel fuel (or gasoline rather than diesel if not possible) and requiring vehicles and equipment that require diesel to use ultra-low-sulfur diesel (ULSD); and
- To the extent practicable, implementing methane capture and/or green completion techniques to prevent methane leakage and flaring that contribute to climate change.

  RESPONSE: A comprehensive emissions inventory can best be performed during subsequent phases of the exploration and development process because operator submittals and planning will better inform the NEPA review process. NEPA review is required after the operator submits the Exploration Plan, and after submittal of the Development and Production Plan. The Bureau of Safety and Environmental Enforcement (BSEE) may also impose conditions associated with the review and permitting for Applications for Permits to Drill (APDs). The U.S. EPA will have jurisdiction over air quality permitting and compliance for OCS facilities and activities; and Alaska Department of Environmental Conservation's Air Quality Division will perform permitting and enforcement activities for the Corresponding Onshore Areas (COAs). Stipulations and conditions imposed may include requirements for use of Ultra Low Sulfur Diesel in marine vessels; flare monitoring; specific emissions controls on internal combustion engines; and, for marine vessels, monitoring, recording, and recordkeeping.

COMMENT: A commenter also offered the following extensive recommendations for the FEIS:[157]

- Avoid expressing program-level emissions as a percentage of national or state emissions. Substitute a qualitative discussion disclosing the increasing conflict between GHG emissions and GHG reduction polices and address mechanisms for mitigating that conflict.

  RESPONSE: BOEM provides the percentage of Proposed Action GHG emission estimates relative to global GHG emission estimates for context only regarding consumption. This comparison is not meant to characterize the relative impacts of the Proposed Action GHG emissions to those of the No Action Alternative.

  For assessing the impact of the Proposed Action on climate change, BOEM provides further comparisons of Proposed Action vs. No Action Alternative GHG emission estimates relative to targets and carbon budgets, as well as by using the social cost of greenhouse gases. See the Foreign Oil Consumption Greenhouse Gas Analysis sub-section within Section 4.3.5.1 of the FEIS. Also, see the new Section 4.3.5.1, Life Cycle Emissions Compared to Targets and Carbon Budgets in the FEIS.
- *COMMENT*: Run several sensitivity analyses using assumed distributions of end uses to estimate the uncertainty introduced into the calculations by the assumption of using one emission factor for foreign oil consumption.

  RESPONSE: BOEM is interested and plans to incorporate sensitivity analysis in the future. However, until such time that BOEM is able to construct an appropriate set of sensitivity tests to quantify areas of uncertainty, the discussion surrounding uncertainty will remain qualitative.

[157] U.S. EPA Region 10.

- *COMMENT*: Include additional detail on the regional framework and region-specific assumptions used in these analyses in the FEIS. Specifically, clarify the relationship between natural gas produced in the relevant OCS leases, and its consumption in Alaska or elsewhere in the US. Provide any available details about the Proposed Action's potential to reduce coal consumption.

  RESPONSE: Model assumptions, including regional-specific assumptions, can be found in the model documentation, primarily for the Offshore Environmental Cost Model (OECM): https://espis.boem.gov/final%20reports/BOEM_2018-066.pdf.

  For example, to investigate how the OECM distributes substitutions and their impacts among regions see Appendix F: Spatial Distribution of Oil and Natural Gas Substitutes under the No Action Alternative in Volume 1 of the OECM documentation (linked above).

  BOEM appreciates this feedback and will investigate opportunities to improve the regional specificity of its assumptions within the models.

  As to the Proposed Action's potential to reduce coal consumption, BOEM has disclosed MarketSim's substitution estimates in Table 4-10 of the DEIS and FEIS. One of the substitution rates in that table is an estimate of the amount of coal that would be displaced by anticipated production of the Proposed Action.

- *COMMENT*: Describe if natural gas produced under these leases would replace imported liquefied natural gas (LNG) currently used by an Alaskan petroleum refinery, and what impact this substitution may have on Alaskan refined petroleum product prices and in-State consumption.

  RESPONSE: BOEM's economic response model, MarketSim, does not include the level of detail necessary to specifically consider Alaska LNG consumption. MarketSim uses data from the EIA's Annual Energy Outlook (AEO). The categories available are a single Alaskan natural gas supply, Lower 48 separate onshore and offshore natural gas supplies, and a single aggregate national LNG import supply. The demand side does not distinguish between demand for bulk natural gas and LNG nor that for Alaskan LNG imports versus bulk natural gas. However, once MarketSim determines the balancing amounts of Alaskan versus Lower 48 versus imported LNG supplies, the OECM takes that national information and distributes the LNG imports among regions, including Alaska, based on historical imports values.

- *COMMENT*: Provide additional detail on the density and sulfur content of the petroleum anticipated to be produced from the Cook Inlet.

  RESPONSE: Density and sulfur content of petroleum anticipated to be produced from Cook Inlet could vary depending upon its composition which may vary across the Lease Sale area. However, in production from the nearby Cosmopolitan field referenced in the analysis as a suitable analog, there was no H_2S present based upon a PVT analysis of oil samples. Section A-2.2.2 of Appendix A describes the properties of oil used in the Oil Spills and Gas Release Analysis.

- *COMMENT*: Include information about the assumed competitiveness of the international petroleum market.

  RESPONSE: BOEM's MarketSim model assumes a perfectly competitive global market for crude oil and refined petroleum products. The competitiveness is described further via MarketSim's published elasticity values which can be found in the model documentation.

- *COMMENT*: Clarify the difference between the emissions estimate based on the estimated recoverable reserves compared to the indirect upstream emissions data provided by MarketSim.

  RESPONSE: BOEM understands this question to be asking about the difference between emissions from the Proposed Action and those of substitute energy sources under the No Action Alternative. Estimated emissions from the Proposed Action are those that stem from the exploration and development of recoverable resources identified in the Exploration and Development scenario. Estimated emissions that stem from energy production estimated by MarketSim are for substitute energy sources that BOEM estimates would occur in the absence of OCS production from the Cook Inlet. These results are published in Table 4-11 (domestic full life cycle GHG emissions) and Table 4-12 (change in GHG emission due to shift in foreign oil consumption) in Section 4.3.5.1 of the Draft EIS. They are updated and published in similarly located tables in Section 4.3.5 of the Final EIS, Tables 4-12 and 4-13, respectively.

- *COMMENT*: Discuss the potential increase in emissions that could occur via successful long-term development over time.

  RESPONSE: BOEM discusses the emissions that could occur from activities resulting from this lease sale in Section 4.3.5 of the Final EIS, Tables 4-12 (domestic full life cycle GHG emissions) and 4-13 (change in GHG emissions due to shift in foreign oil consumption). Any activities resulting from sales beyond this one would be considered in future environmental reviews as necessary.

- *COMMENT*: Clarify how midstream assessments factor into the FEIS GHG analysis.

  RESPONSE: The midstream emissions are totaled along with upstream and downstream emissions when BOEM calculates the GHG life cycle emissions. The midstream emissions are calculated in the Greenhouse Gas Life Cycle Energy Emissions Model. The documentation and the model can be found at: https://www.boem.gov/environment/greenhouse-gas-life-cycle-energy-emissions-model.

- *COMMENT*: In Section 4.1, the DEIS indicates, "So as not to underestimate the potential impacts of the Proposed Action, BOEM is analyzing the high case." However, Figure 4-2 implies that gas production assumed in the Lease Sale 258 DEIS is the E&D Scenario's low case. Clarify which case is used in the analysis and adjust associated disclosures accordingly.

  RESPONSE: BOEM discusses the methodology behind the construction of E&D scenarios within the document published on BOEM's website at: https://www.boem.gov/sites/default/files/documents/oil-gas-energy/leasing/LS258-Exploration-and-Development-Scenario.pdf.

- *COMMENT*: Provide additional information regarding the petroleum resources in Cook Inlet, and how this understanding may change over time. If possible, the expected characteristics of the crude oil (including sulfur content and density) should be reported.

  RESPONSE: BOEM's estimates for recoverable resources in Cook Inlet are published in the 2021 National Assessment of Undiscovered Oil and Gas Resources and their implementation into the LS 258 analysis is described in the Revised E&D Scenario for EIS Lease Sale 258 Cook Inlet, Alaska found at: *https://www.boem.gov/sites/default/files/documents/oil-gas-energy/leasing/LS258-Exploration-and-Development-Scenario.pdf*

  Density and sulfur content of petroleum anticipated to be produced from the Cook Inlet could vary depending upon its composition which may vary across the Lease Sale area. However, in production from the nearby Cosmopolitan field referenced in the analysis as a suitable analog, there was no H_2S present based upon a PVT analysis of oil samples. Section A-2.2.2 of Appendix A describes the properties of oil used in the Oil Spills and Gas Release Analysis.

- *COMMENT*: Include a regional assessment of how technological advances have changed the amount of petroleum hydrocarbon extracted from Cook Inlet over time by comparing the initially estimated recoverable reserves with current production values.

  RESPONSE: The E&D scenario document references how the proposed development ranks in comparison to previous developments within upper Cook Inlet. The lower Cook Inlet is a frontier area without historical production values for comparison. https://www.boem.gov/sites/default/files/documents/oil-gas-energy/leasing/LS258-Exploration-and-Development-Scenario.pdf.

- These scenarios are derived from BOEM's 2021 National Assessment of Undiscovered Oil and Gas Resources which considers these technological advancements over time. This 2021 publication and historical regional assessments can be found at: https://www.boem.gov/oil-gas-energy/resource-evaluation/undiscovered-resources

- *COMMENT*: Consider the regionally specific emissions that may occur, considering the types of drilling and completion techniques that are most often used in Cook Inlet.

  RESPONSE: BOEM bases its upstream emissions estimates on exploration, development, and production activities the Alaska Region anticipates occurring if leases are awarded as a result of the lease sale. The activity is specific to Alaska and based on the BOEM Resource Evaluation team's expertise. Information on those assumptions is included at: https://www.boem.gov/sites/default/files/documents/oil-gas-energy/leasing/LS258-Exploration-and-Development-Scenario.pdf.

  BOEM's emissions model translates those anticipated activities in emissions estimates using emissions factors specific to Alaska. The emissions factors associated with the different activities and water depths are available in the OECM documentation at: https://espis.boem.gov/final%20reports/BOEM_2018-066.pdf.

- *COMMENT*: To minimize or avoid environmental harms caused by GHG emissions that exceed previous estimates, use a mitigation measure that requires a NEPA adequacy review be completed if the barrels per day gross annual average exceeds the original barrels per day production target over a two-year period or when the cumulative recovered reserves exceed the original estimated recoverable reserves by 10 percent.

  RESPONSE: BOEMs existing regulations for the submission of Exploration Plans and Development and Production Plans at 30 CFR 550.283(a)(3) already give BOEM the authority to require a revision or supplement to an approved EP or DPP when a lessee proposes to "Change the type of production or significantly increase the volume of production or storage capacity." BOEM retains the discretion to define what is considered a significant volume increase and to determine whether the NEPA analysis completed for an individual EP or DPP is adequate for the proposed change.

- *COMMENT*: Ensure that future development project environmental reviews that result from the Lease Sale 258 program include geological and geophysical information that supports the estimates of the recoverable reserves. Include a mitigation measure or lease stipulation that restricts gas flaring unless necessary for safety.

BOEM's estimates for recoverable resources rely on all available geologic and geophysical data collected on the OCS. These estimates are published in BOEM's 2021 National Assessment of Undiscovered Oil and Gas Resources and their implementation into the LS 258 analysis is described in the Revised E&D Scenario for EIS Lease Sale 258 Cook Inlet, Alaska found at: https://www.boem.gov/sites/default/files/documents/oil-gas-energy/leasing/LS258-Exploration-and-Development-Scenario.pdf

Natural Gas flaring on the OCS is regulated by BSEE and is presently restricted by regulation to only those circumstances where necessary for safety unless otherwise specifically authorized by BSEE under defined circumstances. These circumstances can be found in BSEE's NTL-2020-N04 https://www.bsee.gov/sites/bsee.gov/files/notices-to-lessees-ntl//ntl-2020-n04-flaring-and-venting-requests.pdf

- *COMMENT*: Add additional discussion to the FEIS to disclose that modeling results indicate sources located in lease blocks nearer to Tuxedni could contribute to violations of Class I increment and could therefore possibly not be able to obtain an air permit without mitigation.

  RESPONSE: BOEM evaluated such impacts to the Tuxedni Wilderness Class I area using conservative scenarios for modeling, including the use of the highest activity year. The incremental impact from modeling at the Tuxedni Wilderness Class I area was larger than the Prevention of Significant Deterioration (PSD) Class I Increment. Therefore, the operator proposing exploration or development and production activities may be required to obtain an EPA PSD permit and submit air quality analysis to the United States Fish and Wildlife Service (USFWS) for review. Additional mitigation measures may be required for OCS-related activities that occur near the Wilderness area.

- *COMMENT*: Include an expanded discussion in Section 4.3.2 to explain AQRV protections and the process Federal Land Managers (FLMs) use to analyze project impacts during New Source Review (NSR). Current or additional modeling analysis should be leveraged to estimate project impacts to AQRVs at Tuxedni.

  RESPONSE: Protections via mitigations are more appropriately applied during the NEPA analysis at the plan stage for exploration and development plans by lessees which describe expected emissions during OCS-related activities. At that time BOEM will coordinate with the USFWS if air quality impacts are found near a Class I area. The methods in the Federal Land Managers' Air Quality Related Values Work Group (FLAG 2010) will then be used to conduct near field (plume blight) and far-field modeling (CALPUFF) to prevent screening failures, since the lease sale covers areas within and greater than 50 km from the Class I area.

  Regarding comments on air quality-related effects to Tuxedni Wilderness Area, BOEM evaluated such impacts to the Tuxedni Wilderness Class I area using conservative scenarios for modeling, including the use of the highest activity year. The incremental impact from modeling at the Tuxedni Wilderness Class I area was larger than the Prevention of Significant Deterioration (PSD) Class I Increment. Therefore, the operator proposing exploration or development and production activities may be required to obtain an EPA PSD permit and submit air quality analysis to the U.S. Fish and Wildlife Service (USFWS) for review.

- *COMMENT*: Expand the modeling results section to compare maximum modeled offshore impacts (project design concentrations) to all the applicable National Ambient Air Quality Standards (NAAQS). Ensure that the expanded comparison includes all short-term and long-term averaging period NAAQS with short-term nitrogen dioxide (NO_2) and sulfur dioxide (SO_2) impacts and particulate matter (PM) 2.5 and ozone impact.

RESPONSE: Refer to tables 4-7 and 4-8. There is no need for additional modeling. The dispersion modeling from LS 244 was used specifically as a surrogate for LS 258 because the lease areas were identical. There are differences in E&D scenarios, available blocks, and the number of surveys, but these differences are not substantial enough to warrant a new modeling study.

- *COMMENT*: Clarify that higher water vapor is expected to decrease tropospheric ozone background concentrations.

  RESPONSE: Higher concentrations of water vapor in the troposphere result in the formation of more clouds. Increases in cloud cover decrease the formation of ground-level ozone because the main ozone precursors (hydrocarbons and NOx) require sunlight in order to produce ozone (photochemical smog).

- *COMMENT*: Assess in detail the extent to which the program is inconsistent with U.S. and global policy to limit GHG emissions and whether resulting production activities would be economically viable in a future where such policies have reduced demand for fossil fuels. Specifically identify how climate resiliency has been considered in the Proposed Action and alternatives.

  RESPONSE: BOEM has presented a quantitative analysis of the GHG emissions estimated from anticipated production using a baseline from EIA that assumes current laws and policies. BOEM has included qualitative analysis of how those results might look different in a future that is successful in meeting climate goals. However, quantitative analysis of the results in a net-zero future is not possible given uncertainty of the pathway that might be taken to successfully achieve net-zero.

- *COMMENT*: Include a detailed discussion of the Lease Sale 258 program's GHG emissions in the context of national and international GHG emissions reduction goals, including the U.S. 2030 Paris GHG reduction target. Include, for comparison, a scenario or scenarios that incorporate existing and potential policy changes that are consistent with the 2030 and 2050 reduction targets. Incorporate practicable mitigation measures to reduce GHG emissions, e.g., a Lease Stipulation to apply to all leases issued under Lease Sale 258.

  RESPONSE: BOEM has added a section to the FEIS that discusses the emissions from the lease sale, and its substitute emissions in comparison to the U.S. emissions reduction targets.

  Regarding mitigation measures to reduce GHG emissions, this would be more appropriately addressed as part of the NEPA analysis for exploration or development and production plans, not at the lease sale stage. Lessees are required to submit to BOEM an exploration plan (EP) or development and production plan (DPP) for proposed drilling and production activities. In addition to reviewing submitted plans for compliance with regulations, BOEM evaluates air emissions information in a plan for purposes of identifying the impacts to air quality that may occur as a result of exploration or development. In each EP and DPP, operators must describe estimated emissions, proposed emission reduction measures, the emission reduction control technologies or procedures, the quantity of reductions to be achieved, and any monitoring system proposed to measure emissions (see 30 CFR 550.218 and 30 CFR 550.249). If during the plan review process and in consultation with other agencies, BOEM determines that the operator is not adopting practices to reduce GHG emissions, BOEM could place mitigation measures on that specific plan to meet the performance standards outlined in 30 CFR 550.202. In accordance with 30 CFR 550.121, BOEM could also require additional measures to ensure the use of Best Available and Safest Technology (BAST) identified by BSEE during plan reviews.

- *COMMENT*: Address additive and synergistic impacts of climate change (from additional GHG emissions) to the existing baseline conditions of the Cook Inlet salmon fisheries, the Cook Inlet beluga population, and the high potential of an oil spill in Cook Inlet.

  RESPONSE: Cumulative impacts on a given resource may result from the additive or synergistic interactions with climate change. Cumulative impacts from past, present, and reasonably foreseeable future activities, impacts of climate change, as well as oil spills to fisheries and beluga whales are discussed in detail in their respective sections in the FEIS (Sections 4.6 and 4.8).

COMMENT: A commenter provided the following recommendations regarding specific tables and chapters in the DEIS:[158]

- Chapter 4; Page Number: 37; Figure/Table: Table 4-5: The table quotes N/A for the Alaska LNG Nikiski values for the 3-hour, 24 hour and annual SO_2 concentrations.

  RESPONSE: BOEM reviewed the referenced document and verified that SO_2 concentrations should read zero rather than N/A, as in the source spreadsheet. The concentrations are calculated and then rounded down to zero, following the EPA rounding convention for the pollutant.

- *COMMENT*: Section 4.3.2 notes that emissions from diesel combustion would locally and temporarily increase the concentrations of nitrogen oxide (NOx), carbon monoxide (CO), and $PM^{2.5}$ and PM^{10} (including black carbon). Combustion of diesel usually generates SO_2 emissions; either include in the list of pollutants or explain why SO_2 emissions are not considered here.

  RESPONSE: BOEM agrees SO_2 should be included in the referenced sentence. Any time diesel is combusted, we can assume creation of SO_2 emissions. The FEIS was edited to reflect this change.

- *COMMENT*: Chapter 4; Page Number: 39; Figure/Table: Table 4-6: Paragraph five and Table 4-6 on this page discuss a decrease in GHG emissions when comparing the 2016 Lease Sale 244 with Lease Sale 258. Explain the reason for this decrease. Was it due to a decrease in the number of wells, a decrease in the number of years of production or some other factor?

  RESPONSE: There are many reasons the results of the GHG analysis for Lease Sale 244 and 258 are different. First, the underlying activity assumptions for each sale were different. Lease Sale 258's exploration and development scenario (https://www.boem.gov/sites/default/files/documents/oil-gas-energy/leasing/LS258-Exploration-and-Development-Scenario.pdf) explains the prospects which were leased in Lease Sale 244 and how different prospective targets were used for Lease Sale 258's analysis. Further, BOEM periodically updates its models including assumptions and underlying data. Since the completion of the Lease Sale 244 EIS, BOEM has posted new MarketSim documentation and an updated GLEEM documentation.

- *COMMENT*: Chapter 4; Page Number: 48: It should be discussed in this section that the court decisions provided a two-prong approach. (1) Estimate the change in foreign GHG emissions or (2) determine whether missing information identified by the agency was relevant or essential under 40 Code of Federal Regulations (CFR) Section 1502.22 and determine whether the cost of obtaining the missing information was exorbitant, or the means of doing so unknown. Given the number of qualifiers that BOEM has used in describing their modeling efforts, it is reasonable to

[158] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).

also discuss the cost to collect the data to make the modeling accurate or whether the means of collection of the data is unknown.

RESPONSE: With regard to (1), the court focused on GHG emissions from an increase in foreign oil consumption resulting from the Proposed Action. BOEM has estimated these emissions specifically given its limited modeling capability with respect to foreign energy markets. In regard to (2), within Section 4.3.5.3, Global Life Cycle Greenhouse Gas Analysis of the FEIS, BOEM has included comments from the contractor that developed MarketSim, Industrial Economics, Inc. (IEc), detailing the difficulties in obtaining the data required to address the missing components of a global GHG emissions analysis. While these aspects of the analysis are treated qualitatively, they still represent the best available analysis of Lease Sale 258's effect on GHG emissions globally.

- *COMMENT*: A commenter stated that although the conclusion that the same volume of GHGs will be emitted from global production whether production from Lease Sale 258 occurs or not may be correct, this conclusion might not carry out the purpose of EO 13990 Section 5(a) for agencies to capture the full costs of GHG emissions and does not consider the capacity to lessen operational GHG emissions.[159] The commenter suggested the following recommendations to reduce operations-associated methane emissions and prevent climate impacts:

  - Implement or expand infrastructure leak detection and repair campaigns
  - Replace or upgrade high-emitting devices
  - Reduce flaring and venting
  - Reduce venting in new and existing assets

  RESPONSE: Requirements for facility operators to reduce operations-associated methane emissions would be more appropriately addressed as part of the NEPA analysis for exploration or development and production plans, not at the lease sale stage. Lessees are required to submit to BOEM an exploration plan (EP) or development and production plan (DPP) for proposed drilling and production activities. In addition to reviewing submitted plans for compliance with regulations, BOEM evaluates air emissions information in a plan for purposes of identifying the impacts to air quality that may occur as a result of exploration or development. In each EP and DPP, operators must describe estimated emissions, proposed emission reduction measures, the emission reduction control technologies or procedures, the quantity of reductions to be achieved, and any monitoring system proposed to measure emissions (see 30 CFR 550.218 and 30 CFR 550.249). If during the plan review process and in consultation with other agencies, BOEM determines that the operator is not adopting practices to reduce methane emissions, BOEM could place mitigation measures on that specific plan to meet the performance standards outlined in 30 CFR 550.202. In accordance with 30 CFR 550.121, BOEM could also require additional measures to ensure the use of Best Available and Safest Technology (BAST) identified by BSEE during plan reviews.

Lifecycle GHG Emissions and Social Cost of GHG Emissions

COMMENT: A few commenters stated that an annual net cost of $340-700 million would be imposed on the Alaskan government from climate change, citing studies regarding the economic effects of climate

[159] National Oceanic and Atmospheric Administration.

change in Alaska.[160] One of the commenters further said that about $6 billion in infrastructure costs will be needed over the next 20 years due to permafrost thaw.[161]

RESPONSE: Comment noted. BOEM provides multiple comparisons of GHG emissions from Lease Sale 258 for context. One such comparison is the relative contribution of GHG emissions from Lease Sale 258 to U.S. GHG emissions reduction targets (see Section 4.3.5.1, Life Cycle Emissions Compared to Targets and Carbon Budgets). Lease Sale 258 has an extremely small proportional share of the U.S. GHG emissions reduction targets, as seen in Table 4-15 of the FEIS. Therefore, BOEM is unable to calculate annual costs to Alaska from the small incremental increase of emissions that would result from activities occurring as a result of Lease Sale 258.

COMMENT: A few commenters suggested that BOEM conduct a complete cost-benefit analysis in its analysis of the social costs of GHGs. One commenter stated that the DEIS does not disclose the jobs, wages, revenues, and other economic indicators generated by other industries in the region, nor does it discuss the economic effects the Proposed Action could have on subsistence communities.[162] One commenter recommended that BOEM link the lifecycle assessment of the total GHG emissions from the action to the social cost of those emissions as they relate to Alaska fisheries. The commenter suggested that the analysis include the social and economic impacts and loss of earnings with increasing GHG emissions, including from fisheries decline, closures and associated impacts to fisheries, fishers, and coastal communities.[163] A commenter recommended that the FEIS consider including a climate reciprocity ratio (CRR) into the social cost of carbon (SCC) methodology to calculate the effect climate action in the U.S. has on the behavior of other countries.[164]

RESPONSE: BOEM's inclusion of the greenhouse gas emissions and social cost of greenhouse gas analysis should not be construed to mean that a cost determination is necessary to address potential impacts of GHGs associated with specific alternatives. Although NEPA requires consideration of "effects" that include "economic" and "social" effects (40 CFR § 1508.8(b)), NEPA does not require an economic cost-benefit analysis (40 CFR § 1502.23). The GHG emission estimates were annualized and monetized; however, they do not constitute a complete cost-benefit analysis nor does the cost of GHG numbers present a direct comparison with other impacts analyzed in the DEIS nor in the FEIS.

COMMENT: A commenter asserted that MarketSim's methane modeling is outdated and thus underestimates methane's GWP. The commenter also said that BOEM should use the updated and more accurate 20-year GWP for methane from the authoritative Intergovernmental Panel on Climate Change rather than the outdated 100-year GWP.[165]

RESPONSE: BOEM's models do not use Global Warming Potential (GWP). Instead, BOEM applies that outside the model to calculate aggregate CO_2 equivalent metrics. BOEM continues to review the different factors and may present multiple values in future documents.

COMMENT: A commenter stated that due to a recent court decision, BOEM will carry out a global GHG analysis based on many uncertainties, which will produce an estimate of little significance. The commenter further concluded that trying to produce a global GHG emissions estimate from a single oil

[160] Animal Welfare Institute; Unitarian Universalists of Homer.
[161] Animal Welfare Institute.
[162] Natural Resources Defense Council, et al.
[163] National Oceanic and Atmospheric Administration.
[164] Evergreen Action.
[165] Natural Resources Defense Council, et al.

and gas lease sale provides little useful information against the global uncertainties of future energy use and emissions.[166]

RESPONSE: BOEM appreciates the comment, but presents the analysis with appropriate caveats and discussion of uncertainties for the Secretary, decision makers and the public.
COMMENT: A commenter expressed that BOEM's lifecycle GHG analysis and conclusions are inaccurate and provided the following reasons and recommendations:[167]

- When analyzing market impacts of energy projects and production activities, treat the world as one market.

  RESPONSE: BOEM's MarketSim models oil as a global market. The other energy sources (natural gas, coal, and electricity) are not modeled as a global market because their prices are more regionally influenced even though there is international trade in those other energy sources. See the MarketSim documentation for details on how BOEM models energy markets domestically and globally. Available at: https://www.boem.gov/marketsim-model-documentation

- *COMMENT*: Given the vast global energy demand, the impacts of one individual U.S. lease sale would be insignificant to global oil market demand and global GHG emissions. U.S. offshore lease sales help preserve and expand domestic supplies that are vital to the energy, economic, and national security of the U.S. economy. The world will still demand energy services at such a massive scale even if BOEM does not hold a lease sale.

  RESPONSE: As the commenter suggests, BOEM's modeling does indicate that under the current laws and policies included in EIA's Annual Energy Outlook, decisions regarding whether to hold a lease sale have very minor impacts on global energy demand. BOEM's modeling suggests only slight changes to global consumption as a result of having a lease sale. BOEM includes the results of both the emissions from the Proposed Action as well as the energy substitutes (in the absence of leasing) and takes the difference between these emissions to calculate the incremental emissions attributable to the Proposed Action. These incremental emissions, even when considering foreign emissions from a slight increase in foreign oil consumption, are lower than they would be if only considering gross domestic emissions from the Proposed Action alone.

COMMENT: BOEM does not acknowledge the risks and associated GHG impacts in sourcing oil from other parts of the world and instead resolves that US consumers will do without that energy.

RESPONSE: BOEM indirectly acknowledges this in the Purpose and Need statement in the FEIS. Further, BOEM acknowledges these concerns at the National OCS Oil and Gas Leasing Program stage of analysis. See Section 1.2, Energy Needs, in the 2023-2028 Proposed Program Document https://www.boem.gov/oil-gas-energy/national-program/2023-2028-proposed-program; or the same section in the 2017-2022 Program Document: https://www.boem.gov/oil-gas-energy/leasing/2017-2022-ocs-oil-and-gas-leasing-pfp

BOEM's modeling analysis recognizes that without an OCS lease sale, U.S. consumers will substitute other energy sources to fulfill remaining demand. BOEM considers the emissions of these substitute sources in its analysis. BOEM acknowledges that most of the forgone production under a No Action Alternative would be substituted for by other energy sources, and most of that would be oil imports.

[166] L. Pugliaresi.
[167] National Ocean Industries Association.

COMMENT: The court decision in CBD v. Bernhardt in no way requires BOEM to conduct its analysis in a specific way. In fact, the DEIS states that the agency can explain why a quantitative assessment of shifts in foreign consumption cannot be done. BOEM should focus on doing a correct analysis by treating the world as one market and by determining the impacts of a single lease sale on that one market.

A correct analysis will determine that GHG emissions impacts are negligible or possibly even decreased under a decision to have a lease sale in the U.S. OCS.

> *RESPONSE:* BOEM's current analysis uses the best available data and methods to provide decision makers what they need to make informed decisions. BOEM supplements its quantitative analysis with qualitative information.

COMMENT: A commenter asserted that BOEM appropriately applied the social cost of GHG in the DEIS and fulfilled its legal obligations under NEPA.[168] The commenter then said that although BOEM acknowledges that the Proposed Action will result in about $1.39 billion in climate damages, the DEIS does not quantify economic benefits from the lease, does not weigh costs against benefits, and does not expound how costs were considered nor how costs justify the action. The same commenter also stated that significant costs, like health effects from local pollution, are not monetized, and the DEIS disregards the substantial option value of delaying leasing at this time. The commenter recommended that BOEM improve its analysis by:

- Fully integrating climate impacts into its decision making and not move forward with the lease sale unless it determines that the sale's benefits justify its substantial climate costs.

  RESPONSE: Within the FEIS, BOEM provides analysis on all of the issues raised in this comment for consideration by the Secretary and stakeholders. Climate change is considered directly and indirectly throughout the GHG analysis in Section 4.3.5 within the FEIS.

- *COMMENT*: Monetizing the impacts of "local" pollutants and, to the extent feasible, other effects such as impacts to wildlife and commercial fishing.

  RESPONSE: BOEM has discussed impact of local pollutants on the environment and biological populations, while not monetizing them. BOEM's inclusion of the greenhouse gas emissions and social cost of greenhouse gas analysis should not be construed to mean that a cost determination is necessary to address potential impacts of GHGs associated with specific alternatives. Although NEPA requires consideration of "effects" that include "economic" and "social" effects (40 CFR § 1508.8(b)), NEPA does not require an economic cost-benefit analysis (40 CFR § 1502.23). The GHG emission estimates were annualized and monetized; however, they do not constitute a complete cost-benefit analysis nor does the cost of GHG numbers present a direct comparison with other impacts analyzed in the DEIS nor in the FEIS.

- *COMMENT*: Considering the option value of delaying leasing given various uncertainties including the economic benefits of the lease sale and the accuracy of the agency's cost estimates.

  RESPONSE: BOEM considers option value in its hurdle price analysis which is explained in its National OCS Oil and Gas Leasing Program documents and conducted as part of the Notice of Sale process.

- *COMMENT*: Reconsidering its analytical reliance on MarketSim, which likely overestimates emissions in the no action alternative and relies on inputs that are arbitrary and insufficiently justified.

[168] Institute for Policy Integrity at New York University School of Law.

RESPONSE: BOEM provides extensive discussion of MarketSim's capabilities and limitations for the Secretary and stakeholders to place the results in context. BOEM provides extensive documentation for the methodology and data supporting the model. Despite the limitations of the model, MarketSim still represents the best available tool to the agency for estimating market responses to additional leasing and resulting substitution.

- *COMMENT*: Using lower discount rates, consistent with the recommendation by the federal Interagency Working Group on the Social Cost of Greenhouse Gases ("Working Group") and updating the analysis when the Working Group updates its social cost valuations to reflect the latest scientific and economic data.

  RESPONSE: Within the FEIS, BOEM uses the four sets of interim social costs recommended by the IWG in February 2021 for translating the estimated GHG emissions into estimates of social costs. These four sets of social costs assume statistical levels of damages and three different discount rates. BOEM intends to use the updated IWG social costs when they are published.

COMMENT: A commenter provided the following requests regarding specific tables and chapters in the DEIS:[169]

- Chapter 4; Page Number: 43: The use of these models appears reasonable for crude oil resources, but it is not clear how the national and international energy market substitutions would yield accurate results for natural gas, since all the Cook Inlet natural gas is consumed in the immediate region. Explain how this special circumstance was factored in or how the national model would yield accurate results.

  RESPONSE: BOEM acknowledges within the FEIS that the MarketSim model was designed for modeling national responses. BOEM recognizes that the natural gas market is much more regional relative to oil, though the growth in LNG infrastructure and transport is changing that. While MarketSim uses a national price and national demand elasticity for natural gas, it does have Alaska-specific elasticities for natural gas supply.

  While data limitations prevent an Alaska focused natural gas demand component, the model still provides a reasonable approximation of how markets would react to additional supply.

- *COMMENT*: Chapter 4; Page Number: 52: Paragraph three on this page discusses lifecycle GHG emissions from crude oil resources but does not appear to address the GHG emissions from natural gas resources in the Cook Inlet region. It is not clear how the national and international energy market substitutions would yield accurate results for natural gas, since all the Cook Inlet natural gas is consumed in the immediate region. Explain how this special circumstance was factored in or how the national model would yield accurate results when natural gas is not considered.

  RESPONSE: BOEM's modeling takes a national approach and is not able to capture regional nuances. Paragraph 3 on page 52 is BOEM's description of its Global GHG emissions discussion which focuses on changes in oil consumption. Because oil is a global commodity, the model considers global changes in response to oil production and development. BOEM does not have the capability to model natural gas in this way.

[169] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).

- *COMMENT*: Chapter 4; Page Number: 52: Explain in detail how the conclusion in paragraph five was reached or cite to the section of the document that supports this conclusion.

  RESPONSE: In Section 4.3.5.3 of the FEIS, Global Life Cycle Greenhouse Gas Analysis, BOEM provides a detailed explanation for the conclusion. BOEM lays out the components of the global analysis that are not quantified and that are only treated qualitatively: foreign market emissions from upstream and midstream oil and the full life cycle of foreign substitutes. When doing so, BOEM explains that, even if these emissions were to be modeled quantitatively, the conclusion that global emissions would be higher with leasing than without, would be unchanged.

Source of Comments

- Energy/Non-Energy Industry and Other Associations
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Federal Agencies
- Individual/General Public
- State Agencies

Issue 5.2 Water Quality

Summary of Comments

Approximately 15 commenters provided feedback on water quality. A few commenters argued that the implementation of Lease Sale 258 would increase ocean acidification, thus threatening the entire marine ecosystem.[170] One commenter stated that the conclusion in Section 4.4.4 of the DEIS that "the cumulative impact to water quality resulting from climate change…would be minor" is incorrect as the harmful impact of ocean and coastal acidification on marine life, especially shellfish, will affect the foundation of the marine food web, including the livelihood of vulnerable indigenous communities in Cook Inlet.[171] A commenter generally stated that ocean acidification poses a serious threat to Alaska's economies and coastal communities that the ocean supports.[172] Another commenter stated that oil and gas exploration and development in Lower Cook Inlet would pollute the area's pristine lands and waters. Further, the commenter said that ocean acidification poses the greatest threat to tribal existence and its way of life.[173] A commentor stated that drilling fluids (oil, water, and other materials) are complex formulations of chemicals that are often toxic, some long lived and pose significant and cumulative effects to the benthic habitats, water quality, and fish. [174]

One commenter stated that Lease Sale 258 would increase wastewater discharge.[175] Another commenter stated that the Lower Cook Inlet is like an artery – pumping nutrients into the heart of the Gulf of Alaska – claiming that if an oil spill were to occur in Lower Cook Inlet, the strong currents and gyres would spread oil, drilling waste, and pollutants throughout the Gulf of Alaska.[176] A commenter said that alarming die-offs of gray whales, seals, sea birds, salmon and other freshwater and marine species are

[170] N. Pease; U.S. EPA Region 10; Natural Resources Defense Council, et al.; Cook Inletkeeper.
[171] U.S. EPA Region 10.
[172] C. Lish.
[173] Kenaitze Indian Tribe.
[174] National Oceanic and Atmospheric Administration.
[175] W. Sonen.
[176] Cook Inletkeeper.

occurring in Alaskan waters as a result of high water temperatures, loss of sea ice and increased harmful algal blooms.[177]

One commenter quoted the following from chapter 4.4.1 of the DEIS: "oil and gas production in upper Cook Inlet does not appear to be a source of petroleum contaminants." The commenter said that none of the sampling sites in this report were located within the lease sale area. Further, more recent samples of polycyclic aromatic hydrocarbon (PAH) levels in water and sediment in Cook Inlet were taken, but it appears none or few of those samples were collected within the lease sale area.[178]

Summary Response to Comments

BOEM addresses the impacts of climate change on water quality, particularly the effects of ocean acidification, in Section 4.4.4 of the FEIS. As described in this section, global biogeochemical models have suggested that surface water corrosivity resulting from ocean acidification in the Chukchi and Beaufort seas would exceed the range of natural variability within the next 10–15 years, with Cook Inlet also potentially experiencing higher corrosivity levels. Analyses on the Proposed Action's contribution to GHG emissions that contribute to climate change globally are described in Section 4.3.5 of the FEIS. Cumulative impacts, including climate change, to water quality are addressed in Section 4.4.4, to Fish and Invertebrates in Section 4.4.6., and to Communities and Subsistence in Section 4.11.4. An analysis on the level of impact from climate change to each resource section, along with impact conclusions, are provided for in each section. BOEM is aware that climate change induced impacts to water quality will result in a level of effect on these resources and those resource specific impact conclusions are provided in the appropriate section within the FEIS. Impacts to the aquatic food web and to consumers of aquatic life resulting from climate change are not located in the water quality section, but rather can be found in each specific resource section.

Drilling discharges, including drilling muds and fluids, are regulated by the EPA as a point-source discharge through the NPDES permitting program and must not cause an unreasonable degradation of the marine environment. BOEM expects that all discharges from lease activities associated with Lease Sale 258 would comply with permit limits set forth by the NPDES program, and as a result, cumulative impacts resulting from drilling fluid discharges would not be expected. Impacts of oil spills and gas releases on water quality are described in Section A-3.3 of Appendix A. As described in this section, the impacts of oil spills are dependent on the type of oil and its chemical characteristics, how and where the oil is released into the water, the ambient temperature, quality and type of sediment, and other environmental factors at the time of the release. A small spill would cause minor impacts, whereas a large spill would likely cause moderate impacts to water quality based on the volume of oil spilled. Large spills are categorized as "moderate" because the impacts are long-lasting and widespread but less than severe, whereas "severe" refers to impacts with a clear, long-lasting change in the resource's function in the ecosystem or cultural context.

In describing the affected environment and current conditions of Cook Inlet, BOEM determined that hydrocarbon concentrations in Cook Inlet are comparable to values reported in Alaska offshore coastal waters. Both the study referenced in the FEIS and the study provided by commenters include sample locations within the proposed lease sale area and were determined to be representative of the planning area.

[177] Unitarian Universalists of Homer.
[178] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).

Detailed Comments and Responses

COMMENT: A commenter provided several critiques, and recommended revisions on Lease Sale 258's DEIS content relating to water quality, wastewater discharges, total suspended solids, ocean discharge criteria, major waste streams, and cumulative impacts. These comments included:[179]

- Section 4.1.2: BOEM's E&D scenario should indicate that discharge of produced water may occur and subsequently analyze the impacts or indicate that a stipulation of the lease will be prohibition of discharge of produced water.

  RESPONSE: BOEM's E&D scenario (Table 4-2 in the FEIS) identifies that for development and production activities, produced water would either be injected into disposal wells or discharged in accordance with an EPA NPDES permit.

- *COMMENT*: Section 4.4.2.1: Any discharge from the lease sale found to cause an unreasonable degradation of the marine environment should not be permitted.

  RESPONSE: The U.S. EPA is responsible for permitting authorizations for discharges in waters of the U.S. In accordance with EPA's Ocean Discharge Criteria, discharges may not cause an unreasonable degradation of the marine environment. Therefore, it is EPA's mandate that a permit not be issued if it is found to cause unreasonable degradation of the marine environment. BOEM expects that all operations/operators comply with other agency permitting requirements.

- *COMMENT*: Section 4.4.2.1: BOEM should include quantitative data to explain what the expected temporary increases from seafloor disturbance are and how these would compare to ambient Total Suspended Solid (TSS) levels mentioned in DEIS Section 4.4.1.

  RESPONSE: TSS data for riverine input into Cook Inlet in the water quality affected environment section of the FEIS (Section 4.4.1) is provided to demonstrate the levels of known TSS entering Cook Inlet from various freshwater sources. Seafloor TSS in the 5.3 million-acre offshore planning area, which is influenced by oceanic currents and circulation, is not comparable to the TSS in the nearshore areas adjacent to major rivers and streams. Attempting to draw comparisons between nearshore riverine inputs of TSS and offshore seafloor TSS would not, for the stated purpose of helping the "public understand the scale of TSS", provide a useful comparison. Quantitative data for site-specific TSS levels at the seafloor for on-lease activities would more appropriately be provided to the public during the review of either an EP or DPP NEPA document where site-specific data could be evaluated.

- *COMMENT*: Section 4.4.2.1: As turbulence tends to maintain particles in suspension, suspended sediment might be rapidly dispersed but not rapidly resettled. This should be included in the TSS discussions.

  RESPONSE: TSS, and the variables affecting settling rates of suspended solids, is thoroughly discussed in Water Quality Section 4.4.2.1 Discharges, including language on the variables affecting transport distances of finer-grained sediment that does not rapidly settle.

- *COMMENT*: The FEIS should include that Section 403(c) of the CWA requires that NPDES permits authorizing discharges into the territorial seas, the contiguous zones, and the oceans, including the OCS, comply with EPA's Ocean Discharge Criteria (40 CFR Part 125, Subpart M).

[179] U.S. EPA Region 10

RESPONSE: Numerous references to EPA's regulatory role overseeing discharges to the marine environment, compliance with EPA's Ocean Discharge Criteria, and EPA's NPDES program are provided throughout the document (see specifically pages 55–61). Additionally, EPA's Ocean Discharge Criteria for Oil and Gas Exploration Facilities on the OCS in Cook Inlet for the NPDES General Permit is discussed, cited, and a full reference is provided on page 165.

COMMENT: Another commenter offered the following comment regarding water quality:[180]

- Section 4.18: The analysis and conclusion in this section may not achieve the intent of EO 13990 Section 5(a) for agencies to capture the full costs of GHG emissions. Further, Lease Sale 258 and greenhouse gas emissions generally lead to an increase in the concentration of atmospheric greenhouse gasses, which result in changes in water quality, including changes in temperature, salinity, and pH, which adversely affect living marine resources.

  RESPONSE: BOEM uses the interim social cost of greenhouse gas values published in February 2021 by the Interagency Working Group (IWG) on the Social Cost of Greenhouse Gases. BOEM and the IWG acknowledge that many impacts from GHG emissions are not able to be quantified or monetized, such as ocean acidification. However, BOEM speaks to these impacts qualitatively in Section 4.3.5 of the FEIS.

Source of Comments

- Individual/General Public
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Federal Agencies
- State Agencies
- Tribes and Tribal Representation

Issue 5.3 Coastal and Estuarine Habitats

Summary of Comments

Four commenters discussed impacts on coastal and estuarine habitats. One commenter stated the lease sale contradicts the special designations for the Kachemak Bay watershed, which serve as protection for the Bay's fish and wildlife resources thus requiring sustainable management. A commenter disagreed that there would be "no cumulative impact" because of the different discharges. Rather, the FEIS should say that cumulative impacts associated with wastewater discharges could occur, though they are anticipated to be minimal. Similarly, one commenter suggested oil spills would impact fish, coastal, and estuarine habits, and community subsistence. They asserted that though the impact of fossil fuel extraction may be difficult to calculate, their value is not zero.[181] Another commenter focused on the lack of understanding in the DEIS for the repercussions and risks of drilling where State of Alaska critical habitat areas, both coastal and aquatic, are located. They stated that because the Cook Inlet is looped around much of the state-run and designated area, interconnected coastal and aquatic systems would be impacted by offshore drilling and the damage would be irreversible.[182] Another commenter expressed concern about the

[180] National Oceanic and Atmospheric Administration.
[181] Institute for Policy Integrity at New York University School of Law.
[182] B. Rosenberg.

potential damage noise may cause to coastal and estuarian habitats which is an important consideration for the Alaska Maritime National Wildlife Refuge.[183]

Summary Response to Comments

Coastal and estuarine habitats within the Cook Inlet provide habitat for many species and other ecological functions, such as flood flow moderation by wetlands. The potential effects of noise and oil spills were evaluated and considered in the FEIS within individual resource areas as noise and oil spills can affect species that use coastal and estuarine habitats differently. See the following sections of the FEIS for the impact evaluation of noise and oils spills as a result of the Proposed Action on Fish and Invertebrates (Section 4.6), Birds (Section 4.7), Marine Mammals (Section 4.8), Terrestrial Mammals (Section 4.9), and Communities and Subsistence (Section 4.11). Additionally, potential impacts from the lease sale on marine mammals within federally designated critical habitat are described in Section 4.8.2 of the FEIS.

As described in Section 4.5.2 of the FEIS, the localized impacts from post-lease activities associated with Lease Sale 258 on coastal and estuarine habitats would be minor and would not have long-lasting, detrimental effects on overall ecological functions, species abundance, or composition of marine or freshwater wetlands or plant communities. Most wetland habitat would be expected to recover following decommissioning of pipelines.

Cumulative impacts on coastal and estuarine habitats resulting from discharges are provided for in Section 4.5.4 (Coastal and Estuarine Habitats). After thoroughly discussing the various discharges to coastal and estuarine environment, the conclusion for cumulative impact in the FEIS states specifically, "little to no cumulative impact." BOEM concluded that the final cumulative impact to coastal and estuarine habitat from all potential impacts would be minor, and when considering impacts resulting from an oil spill, the cumulative impact could increase to major. At no point does BOEM state that "no cumulative" impact would occur.

Source of Comments

- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Energy/Non-Energy Industry and Other Associations
- Individual/General Public

Issue 5.4 Fish and Invertebrates

Summary of Comments

Approximately 25 commenters provided comments on the impacts of the Proposed Action on fish and invertebrates. A few commenters suggested that FEIS should expand its analysis of ongoing noise productions. They stated that the FEIS should quantify the noises of drilling operations, seismic testing, and their effects on surrounding wildlife like pelagic fish stocks and invertebrates.[184] One commenter spoke to their involvement in the seismic exploration of Cook Inlet in the summer of 2015. The commenter shared a personal perception that the continuous seismic arrays on a grid pattern across Cook

[183] D. Raskin.
[184] J. Whittier; Kenaitze Indian Tribe; National Oceanic and Atmospheric Administration; State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC); Cook Inlet RCAC.

Inlet would not allow various fish species to have survived the compression produced by the explosions.[185]

In relation to drilling, some commenters cautioned on how potential oil spills could impact fish and invertebrate species and called for the FEIS to includes more details about the potential impacts from oil spills.[186] One commenter recommended BOEM reconsider the conclusions drawn about toxicity in the DEIS and reevaluate the essential fish habitat (EFH) assessment to reflect the current understanding of the state of the science specific to the potential toxicity of drilling fluids to marine habitat, fish, and invertebrate species.[187] One commenter said that the illustrations of biological impacts of oil contamination, Section A-3.5 on invertebrates and fish were inconsistent with Section A-3.14's analysis on commercial fisheries impacts.[188]

A commenter identified the Kachemak Bay area near the lease sale area as a State of Alaska critical habitat area. They cited a provision pertaining to State of Alaska critical habitat areas in the state constitution that says [these areas are meant] "to protect and preserve habitat areas especially crucial to the perpetuation of fish and wildlife, and to restrict all other uses not compatible with that primary purpose." The commenter emphasized that oil and gas development in federal waters adjacent to Kachemak Bay would impact these areas meant to protect fish.[189]

Some commentators focused on climate change and the impact of dramatic temperature increases in the ecosystem. Commenters stated that warming waters would result in the loss of wildlife including fish. The commenters also stated that increased temperatures would affect the ecosystem for numerous fish species due to changes in the water's oxygen levels and production of algae blooms. Commenters suggested that high temperatures would result in a decline of fish populations and create a risk to food security in Alaska.[190] One commenter asserted that fisheries would fail due to marine heat waves and the worsening conditions that would occur overtime. The commenter suggested that BOEM read the request for federal disaster relief for the numerous fisheries by Governor Dunleavy.[191] Another commenter suggested that the FEIS address the additive and synergistic impacts of climate change on fish and fisheries.[192]

One commenter suggested the FEIS address the potential impacts to the Lower Cook Inlet Salmon Purse Seine Fishery because it is established throughout the Lower Cook Inlet fishing district and was affected by the 1989 EVOS.[193]

Summary Response to Comments

Impacts of sound are adequately addressed in Section 4.6.2 of the FEIS, including the possibility of lethal and sub lethal impacts. Comments received did not provide new evidence that would change the impact designation. As addressed in this section, noises from drilling tend to be stationary, less intense, and persistent when compared to noises from seismic surveys, which are in motion, more intense, but short-term. Impacts from noise to fish and invertebrate communities may have acute effects on individuals close to the noise source, but overall population impacts are not expected as the noises will be temporary,

[185] J. Whittier.
[186] Lower Cook Inlet Defense Project; National Oceanic and Atmospheric Administration.
[187] National Oceanic and Atmospheric Administration.
[188] Alaska Marine Conservation Council.
[189] Alaska Longline Fisherman's Association.
[190] Unitarian Universalists of Homer; National Oceanic and Atmospheric Administration; Kenaitze Indian Tribe; Cook Inletkeeper; N. Schmitt; P. Vadla.
[191] J. Whittier.
[192] U.S. EPA Region 10.
[193] Alaska Longline Fisherman's Association.

and individuals will likely habituate or leave the area. Noise impacts are characterized as "short-term" as effects may extend beyond construction but would not last several years or longer.

BOEM addresses the effects of climate change on fish and invertebrates in Section 4.6.4 of the Draft EIS. This section discusses the potential effect of climate change on the habitat, behavior, abundance, diversity, and distribution of populations Additional information on how climate change impacts fisheries can be found in Section 4.13.4 of the FEIS.

An evaluation of the effects of discharges associated with exploration drilling on fish and invertebrates is included in Section 4.6.2.3 of the FEIS. As described in this section, discharged water may be a different temperature than the ambient levels and may contain trace amounts of chemicals, which could shock or kill some individual organisms that are next to the discharge point. Discharged water would rapidly dilute, mixing to background levels. Additionally, discharges can disturb the water column and seafloor, which could result in localized impacts on the benthos and prey organisms through chemical toxicity, change in sediment texture, or burial of individual organisms.

Effects of spills, spill drills, and spill response activities on fish and invertebrates are described in Section A-3.5 of Appendix A to the FEIS. As described in this section, small spills would have localized, short-term adverse impacts to plankton and benthic invertebrates and fish. Impacts to the overall marine invertebrate and fish populations of Cook Inlet would likely not be detectable for small, isolated spills and would not create population level impacts. This is consistent with the oil spill impact analysis for commercial fisheries, as described in Section A-3.14 of Appendix A to the FEIS. If the spill occurred in a targeted fishing area, it could result in short-term and localized impacts to commercial fishing opportunities. The FEIS discusses impacts of large spills in Sections 4.6.3, 4.13.3, and in Appendix A, Sections A-3.5.2 and A-3.14.2.

BOEM recognizes State of Alaska parks, wilderness, and critical habitat areas, federally designated critical habitat, and other state and federal special designations for areas within and adjacent to Kachemak Bay were established to protect fish, bird, and marine mammals and their habitat. Impacts of the Proposed Action on areas within and near the lease sale area are analyzed as appropriate and included in multiple sections of the FEIS, including Section 4.6.2.

Detailed Comments and Responses

- *COMMENT*: A few commenters identified fish species and invertebrates that were not specifically discussed. The commenters suggested that the FEIS include information about how the lease sale would impact the environments for these species as well as the effects on commercial fisheries and recreational fishing. The fish species and invertebrates identified included:
  - Razor clams[194]
  - Sockeye Salmon[195]
  - King Salmon[196]
  - Rougheye rockfish[197]

[194]State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC); Alaska Longline Fisherman's Association.
[195] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC); Lower Cook Inlet Defense Project
[196] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).
[197] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC); Alaska Longline Fisherman's Association; M. Byerly.

- Herring[198]
- Weathervane scallop[199]
- Eulachon[200]

RESPONSE: Because of their importance to the Cook Inlet ecosystem, these specific species are discussed in the FEIS. Relevant sections that describe the areas used by these species and the potential impacts of post-lease activities include Section 4.6 (Fish and Invertebrates), Section 4.10 (Recreation, Tourism, and Sport Fishing), and Section 4.13 (Commercial Fishing). Although herring spawn in areas that are outside the lease sale (along much of the Shelikof coast of Kodiak Island and the southern Alaska Peninsula), they are discussed in Section 4.13 due to the potential impacts from a large oil spill.

- *COMMENT*: Page 66: Water intake structures are mentioned for the first time. The amount of water taken in and over what time frame it is taken in is not discussed. BOEM should state what measures will be taken to exclude biota from being entrained.[201]

  RESPONSE: The specific design and regulation of water intake structures is more appropriately addressed at the exploration or development stage. Additionally, EPA's regulatory permitting requirements under NPDES would minimize the effect of water intake and discharges on plankton and fish larvae.

- *COMMENT*: Section 4.6.2.3: Section 316(b) of the Clean Water Act (CWA) requires EPA to issue regulations on the design and operation of intake structures, to minimize adverse impacts. The cooling water intake requirements are included in the National Pollutant Discharge Elimination System (NPDES) permit regulations at 40 CFR Parts 122 and 125 Subpart N. The FEIS should incorporate this information for future permitting coverage.[202]

  RESPONSE: The FEIS has been revised to indicate EPA's authorities more clearly for regulating the design and operation of intake structures as well as cooling water intake and discharge. The specific design and regulation of water intake structures is more appropriately addressed at the exploration or development stage and not at the lease sale stage.

- *COMMENT*: Section 4.6.2.3: The FEIS should analyze the potential impacts of discharges on fish and invertebrates, including from produced water discharge, so BOEM is not relying on unknown future conditions.[203]

  RESPONSE: An evaluation of the effects of discharges associated with exploration drilling on fish and invertebrates is included in Section 4.6.2.3 of the FEIS. In regard to produced water, BOEM's E&D Scenario (Table 4-2 in the FEIS) identifies that for development and production activities, produced water would either be injected into disposal wells or discharged in accordance with an EPA NPDES permit.

[198] Alaska Longline Fisherman's Association, Cook Inlet RCAC; Lower Cook Inlet Defense Project.
[199] Cook Inlet RCAC.
[200] Cook Inlet RCAC.
[201] National Oceanic and Atmospheric Administration.
[202] U.S. EPA Region 10.
[203] U.S. EPA Region 10.

COMMENT: A commenter provided the following statements regarding specific chapters and sections in the DEIS:[204]

- Section 4.6 describes fish and invertebrates within the affected area but uses standard terminology like organism. The chapter should specify aspects such species type, population size, or history of traits.

  RESPONSE: There are numerous references provided throughout the document regarding specific species, population status, life stages and reproduction, and history (see Sections 4.6, (Fish and Invertebrates), Section 4.10 (Recreation, Tourism, and Sport Fishing), and Section 4.13 (Commercial Fishing). Individual population size for fish and invertebrates can vary throughout Cook Inlet and over time.

- *COMMENT*: Chapter 4.6.1.1 and 4.6.1.2; Page Number: 63-65: This section lacks context in the description of the communities and magnite of species abundance and biomass. Without context on these population metrics and knowledge of the magnitude and relative abundance of the fish and invertebrates occupying the lease sale area, it will be difficult or impossible to assess pre and post exploration and development effects.

  RESPONSE: The FEIS uses the best available scientific information to provide context and background for analysis of impacts. The FEIS is not intended to be an exhaustive catalog of the flora and fauna in an area, or in the surrounding area. Where appropriate, BOEM has incorporated information regarding stock analysis and community composition to inform the decision maker of expected impacts from activities likely to result from the Lease Sale.

- *COMMENT*: Chapter 4.6.1.1; Page Number: 64: There is no mention of herring spawning in Kamishak Bay. Arguably, Pacific herring would be one of the most impacted species should, under the spill risk analysis, a large spill occur since the probability of oiling of beaches where herring spawn is one of the highest.

  RESPONSE: Section 4.6.1 of the FEIS discusses herring spawning locations, primarily along the Shelikof coast of Kodiak Island and the southern Alaska Peninsula. Text was added to the EIS to identify Kamishak Bay as a spawning area, and Section 4.13 (Commercial Fishing) describes the closure of the herring fishery in Kamishak Bay in 1999 to allow the population to rebuild from historically low abundance. In regard to effects of oil spills on the herring fishery, BOEM is unable to speculate on the future of the herring fishery in the EIS without more specific plans being released by the State of Alaska. However, the FEIS and Appendix A (Sections A-3.4 and A-3.5) analyze the effects of a large spill more generally on fish and invertebrates. Additionally, the OSRA analysis estimates a <3 percent chance that one or more large spills would occur and contact (this is referred to as the combined probability) the coastal and estuarine areas of Kamishak Bay.

- *COMMENT*: Chapter 4.6.2.1 Noise; Page Number: 65: Assess impact of sound exposure from seismic arrays on Razor clams.

  RESPONSE: Impacts of sound on invertebrates such as razor clams are analyzed in the FEIS in Sections 4.6.2 (Fish and Invertebrates) and Section 4.10.2 (Recreation, Tourism, and Sport Fishing), including the possibility of lethal and sub lethal impacts.

[204] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).

- Chapter 4.6.2.1; Page Number: 63: The statement in the last paragraph of this section that states "impacts from noise would generally be localized and short-term" may not be accurate. While seasonal restrictions may provide some mitigation, potential long-term impacts to fish and invertebrates from noise associated with additional seismic surveys could cause mortality, alter biochemistry, and affect behavior of fishes and invertebrates in the lease sale area.

  RESPONSE: Based upon the E&D Scenario, one 3D seismic survey will be conducted as a result of the lease sale. The noises will be temporary and short-term (seismic surveys are usually completed in 30–45 days). While planktonic organisms and immobile invertebrates would not be able to leave the area of noise exposure, but fish capable of swimming away will likely escape the area. Generally, noise impacts would affect a few individuals but would not result in changes to overall population or community structure.

- *COMMENT*: Chapter 4.6.2.1; Page Number: 65: The DEIS states that "Impacts from noise to fish and invertebrate communities may have acute effects on individuals close to the noise source, but overall population impacts are not expected because the noises will be temporary, and individuals will habituate or leave the area". The lethal and sublethal effects of seismic airguns have been most studied on marine mammals, have been somewhat studied for fishes, and have been studied very little for invertebrates. It is important the FEIS accurately describes the unknown but potential effects of seismic noise on all marine organisms.

  RESPONSE: Impacts of sound on fish and invertebrates are adequately addressed in Sections 4.6.2 and 4.10.2 of the FEIS, and include the possibility of lethal and sub lethal impacts. The FEIS acknowledges that planktonic organisms and immobile invertebrates would not be able to leave the area of noise exposure, but fish capable of swimming away will likely escape the area. It is also important to note that based upon the E&D Scenario, only one 3D seismic survey would be conducted as a result of the lease sale. Seismic surveys are usually completed within 30–45 days. BOEM has concluded that impacts would be temporary and short-term, and that noise impacts could affect individual organisms, but would not result in changes to overall population or community structure.

- *COMMENT*: Chapter 4.6.2.1; Page Number: 65: In the Marine Seismic Surveys section on Page 8 of the E&D Scenario, the size of the arrays that may be used for additional seismic surveys if a lease is issued are provided. The water depths in Cook Inlet are shallow, averaging 65m and averaging 45m in the scallops' beds, so sound exposure levels would be elevated relative to deeper water bodies. Seismic exposure experiments have not been conducted on weathervane scallops, but they may share similar effects. Given the size of the arrays proposed in the E&D Scenario, direct mortality to weathervane scallops and other bivalves might be expected. For patchily distributed species with concentrated population distributions, this may translate into population level effects.

  RESPONSE: Impacts of sound on invertebrates, including weathervane scallops, are adequately addressed in Sections 4.6.2 and 4.10.2 of the FEIS. The FEIS acknowledges that immobile invertebrates would not be able to leave the area of noise exposure and impacts include the possibility of lethal and sub lethal impacts. It is also important to note that based upon the E&D Scenario, only one 3D seismic survey would be conducted as a result of the lease sale. Seismic surveys are usually completed within 30–45 days. BOEM has concluded that impacts would be temporary and short-term, and that noise impacts could affect individuals but would not result in changes to overall population or community structure.

Source of Comments

- Individual/General Public
- Energy/Non-Energy Industry and Other Associations
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Federal Agencies
- State Agencies
- Tribes and Tribal Representation

Issue 5.5 Birds

Summary of Comments

Approximately 20,000 commenters, including a form letter campaign, discussed impacts on birds. Several commenters stated that the DEIS lacked analysis for potential impacts of oil spills on wildlife such as birds.[205] One commenter said that the DEIS poorly described the distributions of important prey species, particularly clams.[206] A commenter suggested that BOEM "must take a hard look" at the impact of the lease sale on Steller's Eiders-a threatened species as of June 11, 1997, due to habitat loss from development[207]. Commenters cited the marine waters of Alaska as an important feeding, resting, and wintering place for Steller's Eiders and identified Cook Inlet as an essential habitat for them.[208] Another commenter said light pollution and increased vessel and helicopter traffic and noise would disrupt the habitats of migratory birds. [209] A commenter identified State of Alaska parks, wilderness, and critical habitat areas; Federally designated critical habitat, and other state and federal special designations for areas within and adjacent to Kachemak Bay that have been established to protect fish, wildlife, and habitats. The commenter also stated that Kachemak Bay, located next to the lease sale, is an internationally important bird area.[210] Another commenter added that Kachemak Bay is also a state critical habitat area. Kittlitz's murrelet and marbled murrelet are two of the important species that breed there, and three species in particular spend the winter there in large numbers: 18,000 white-winged scoters, 6,000 black scoters and 4,500 pelagic cormorants.[211]

One commenter stated that as a result of dramatic temperature increases ecosystems in Alaska waters are already beginning to collapse as vividly illustrated in 2019 by reports of alarming die-offs of sea birds.[212] Additionally, a group of State of Alaska commenters provided an updated reference for Audubon's list of Important Bird Areas near the lease sale area.[213]

Summary Response to Comments

Section 4.7.2 of the FEIS describes the potential impacts on birds from oil spills. As noted in that section, most accidental spills would be localized and limited in area. Because small spills would dissipate

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[205] Ocean Conservancy; C. Lish; Center for Biological Diversity [Form Letter Master]; B. Rosenberg; V. Mendenhall.
[206] Cook Inlet RCAC.
[207] Natural Resources Defense Council.
[208] Natural Resources Defense Council, et al.; Cook Inletkeeper
[209] Cook Inletkeeper.
[210] B. Rosenberg.
[211] V. Mendenhall.
[212] Unitarian Universalists of Homer.
[213] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).

quickly, they would be expected to result in no more than short-term impacts on small areas, and population-level effects are not likely to occur. A large spill that contacts many marine birds or reaches coastal areas would have more persistent impacts and may require remediation, as foraging, resting, and sheltering habitats for birds may be fouled. Populations that experience spill-related effects to a large number of birds would be expected to take several years to recover, with possible long-term damage to vulnerable seabird breeding populations. Any long-term and widespread impacts from a large spill would not be categorized as severe for most populations, however, because the populations are expected to eventually recover.

BOEM has thoroughly analyzed impacts specific to the Steller's Eider throughout Section 4.7 of the FEIS. Most of the activity that could cause habitat alteration would occur outside the habitat of molting Steller's eider and other sensitive waterfowl on the west side of Cook Inlet.

Section 4.7.2 of the FEIS discusses the vulnerabilities of many birds to light attraction, particularly when migrating at night or otherwise nocturnally active, and under poor visibility conditions like fog, precipitation, or darkness. Plans for comprehensive monitoring and possible mitigation protocols, such as changes to light direction and shading, are also outlined in this section. Effects of increased vessel and air traffic on birds are also addressed in Section 4.7.2 of the FEIS. As outlined in this section, vessel traffic is expected to be heaviest only when development and production overlap, but most trips would be confined to roughly straight routes from Kenai or Homer. It is expected that most birds would quickly recover from a vessel or aircraft disturbance without measurable impacts. Flushing of dense seabird colonies by vessels or aircraft could have impacts on reproductive success; however, such flushing is expected to be avoided through existing FAA flight recommendation practices and proposed requirements for all traffic to observe a buffer around seabird colonies and minimum altitudes of 610 m (2,000 ft) over sensitive areas. Additionally, BOEM evaluated effects of noise on bird populations in Section 4.7.2 in the FEIS. As outlined in this section, noise impacts could result from seismic surveys, including disruptions or injury to diving seabirds, sea ducks, or loons during their normal feeding or escape behavior. Effects are expected to be localized and brief.

Kachemak Bay is identified as an Important Bird and Biodiversity Area, as established by the National Audubon Society, due to its abundance of intertidal habitat for geese, ducks, swans, and shorebirds. As part of the evaluation of the Proposed Action, impacts to birds and bird habitat in Kachemak Bay are considered in Section 4.7.2 of the FEIS.

Impacts from climate change, increased temperatures, and related potential ecosystem regime shifts in Cook Inlet are considered and evaluated in Section 4.7.4 of the FEIS.

In response to comments, the following specific revisions were made to the evaluation of potential impacts to birds:

- Section 4.7.2 was updated in the FEIS to include discussion of the relationship between waterfowl and benthic prey distribution.
- Table 4-19 and Figure 4-7 were updated in the FEIS to reflect that the list of Important Bird Areas is not intended to be fully comprehensive. The commenters' suggested reference for an updated list was not used because we have not found it to be available to the public in an accessible, appropriately annotated, and user-friendly format.

Source of Comments

- Individual/General Public
- Environmental Advocacy and Other Public Interest Groups (NGOs)

- State Agencies
- Energy/Non-Energy Industry and Other Associations

Issue 5.6 Marine Mammals

Summary of Comments

Approximately 41,745 commenters, including a form letter campaign, discussed impacts of the proposed lease sale on marine mammals.

Impacts on marine mammals

Many commenters argued that LS 258 would threaten the survival of marine mammals that live in Cook Inlet, such as sea lions, northern sea otters, humpback whales, orcas, and dolphins.[214]
Multiple commenters stated that the DEIS is inadequate in describing, analyzing or addressing the harmful impacts of LS 258 to marine mammals, such as sea otters, beluga whales, fin whales or humpback whales, among others.[215] According to these commenters, examples of harmful impacts that were inadequately discussed include anthropogenic noise, pollution, vessel collisions, displacement of prey species, oil spills and the cumulative effects of activities associated with LS 258 E&D Scenario.[216] Additionally, a couple of commenters argued that the EIS should consider the cumulative impacts from climate change, such as warming waters and ocean acidification, on marine mammals.[217]

A few commenters argued that the DEIS lacks appropriate baseline data to understand marine mammal presence and behavior in Cook Inlet.[218] Missing data includes data on the density, abundance, and seasonal trends of marine mammals in Cook Inlet as well as the health impacts from anthropogenic noise.[219] Specific comments cited a lack of baseline data for beluga whales, fin whales, humpback whales and sea otters.[220] A couple commenters expressed concern over the absence of Hilcorp 2019 Lower Cook Inlet 3D Seismic Survey from the DEIS.[221] The same commenters stated that when evaluating cumulative impacts, BOEM should consider unusual mortality events to fin and humpback whales occurring within the past decade in and near the lease sale area in the assessment.[222]
According to commenters there are no published reports of platforms in Cook Inlet being advantageous or providing feeding grounds for marine mammals, and the assumption that the installation of platforms could produce a positive impact needs validation or at a minimum a reference.[223]

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[214] M. Heslin; Unitarian Universalists of Homer; Natural Resources Defense Council, et al.; Cook Inletkeeper; USFWS Marine Mammals Management.
[215] Ocean Conservancy; C. Lish; Center for Biological Diversity [Form Letter Master]; Natural Resources Defense Council, et al.; Cook Inletkeeper
[216] Natural Resources Defense Council, et al.; Center for Biological Diversity [Form Letter Master]; Cook Inletkeeper.
[217] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[218] Natural Resources Defense Council, et al.; Animal Welfare Institute; Cook Inletkeeper.
[219] Natural Resources Defense Council, et al.; Animal Welfare Institute; Cook Inletkeeper.
[220] Natural Resources Defense Council, et al.; Animal Welfare Institute; Cook Inletkeeper.
[221] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[222] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[223] Natural Resources Defense Council, et al.; Cook Inletkeeper.

Impacts on beluga whales

Several commenters argued that implementation of Lease Sale 258 would pose a serious threat to the survival of beluga whales residing in the Cook Inlet.[224] Specifically, some commenters mentioned that anthropogenic impacts from the lease sale, such as noise, increased pollution, and displacement of prey species, would threaten the survival of the beluga whale population.[225] Some commenters recommended the cancelation or deferral of Lease Sale 258 because of this threat.[226] Further, other commenters expressed concern that an oil spill in Cook Inlet would devastate the beluga whale population.[227] One commenter stated that if BOEM decides to go forward with Lease Sale 258, safeguards should be implemented to ensure the exclusion of all Federally designated beluga whale critical habitat from the lease sale and seasonal restrictions (November to April) on all seismic surveys and exploratory drilling operations north of Anchor Point.[228]

Summary Response to Comments

Impacts on Marine Mammals

BOEM has employed the best available information regarding existing or baseline conditions and potential impacts to marine mammals in Cook Inlet and has added new information, when possible, to thoroughly consider the possible effects and to determine the likelihood of adverse impacts to marine mammals. The best available information included a wide variety of sources, including published and peer reviewed literature from scientific research institutions, data from natural resource management agencies, and information about the affected area from commercial and private industries. BOEM carefully reviewed the relevant sources for accuracy and reliability to identify the best available data. BOEM has determined information provided is sufficient and adequate for the evaluation and associated determinations of effects in the FEIS. Table 4-17 provides the seasonal presence, hearing range and minimum estimated abundance of marine mammals occurring in Cook Inlet, including beluga, fin, and humpback whales, and sea otters. Section 4.8.1 considers the present state of marine mammals in Cook Inlet, and Section 4.8.4 considers specific cumulative impacts, including climate change. The FEIS considers unusual mortality events, monitoring results from Hilcorp's 2019 3D Seismic survey, and the results from concurrent passive acoustic monitoring (PAM) (Castellote, Stocker, and Brewer; 2020).

BOEM recognizes that some information is incomplete, and where data is lacking, we review and evaluate alternative information sources to determine whether they can provide useful evidence for evaluating the potential effects of LS 258 in Cook Inlet. For example, regarding whether platforms in Cook Inlet are advantageous for marine mammals, the FEIS considered the installation of offshore production platforms in other cold seas to determine if they have impacts on fish-eating marine mammals. The production platform infrastructure apparently provides vertical habitat used by fish and invertebrates (Russell et al. 2014; Thomson and Johnson, 1996; Todd et al., 2009). Consequently, the presence of production platforms in Cook Inlet may also create productive feeding habitat and improved feeding opportunities for porpoises, harbor seals, Steller sea lions, and sea otters. The improvement in feeding habitat may offset some adverse impacts of seafloor disturbance and habitat alteration.

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[224] J. Booth; J. Mock; Mystic Aquarium; M. Heslin; C. Lish; Animal Welfare Institute; Unitarian Universalists of Homer; Marine Mammal Commission; Natural Resources Defense Council, et al.; T. Story; Environmental Action [Form Letter Master]; Cook Inletkeeper; N. Schmitt; Multiple Organizations (BOEM-2020-0018-0184).
[225] Animal Welfare Institute; Marine Mammal Commission; Natural Resources Defense Council, et al.; Cook Inletkeeper; N. Schmitt.
[226] J. Booth; J. Mock; W. Sonen; Mystic Aquarium; M. Heslin; Marine Mammal Commission; Natural Resources Defense Council, et al.; Environmental Action [Form Letter Master]; S. Pondolfino.
[227] J. Booth; J. Mock; Mystic Aquarium; M. Heslin; Animal Welfare Institute; Natural Resources Defense Council, et al.; Cook Inletkeeper.
[228] Marine Mammal Commission.

Effects of climate change are included in the cumulative analysis for marine mammals in Section 4.8.4. The decline in fin and humpback whale populations is discussed in Section 4.8.1.1.

Impacts on beluga whales

Impacts of Cook Inlet oil spills on beluga whales and other marine mammals are addressed in Section 4.8.2.4 and Appendix A. BOEM recognizes beluga whales could experience moderate impacts from large oil spills. The FEIS discusses anthropogenic noise, vessel collisions, displacement of prey species, oil spills and the cumulative effects of activities associated with lease sale activities in Section 4.8.2.4 and Section 4.8.4. The analysis of noise discusses behavioral impacts that could occur and temporary and permanent physical injuries. The analysis relied on the revised NOAA-OPR-055 report (NMFS, 2018) that describes and analyzes marine mammal functional hearing group thresholds, including those of beluga whales which fall under odontocetes. It established injury criteria for different functional hearing groups, based on results from previous marine mammal monitoring, studies, and biological opinions from NMFS and USFWS. Beluga whales fall under one of the mid-frequency functional hearing groups as do killer whales.

Section 4.8.3.1 discusses the environmental consequences of three alternatives which seek to reduce potential impacts to beluga whale habitat, including Alternative 3A which excludes beluga whale critical habitat from the lease sale. Alternative 3B and 3C consider and analyze seasonal restrictions on seismic surveys within the beluga whale critical habitat and within 10 miles of major anadromous streams.

BOEM received and considered many comments of an editorial nature; for example: suggested word changes and corrections, requests for clarification, questions regarding citations, and similar. Where appropriate, BOEM made these suggested revisions to the FEIS, and these revisions constitute BOEM's response to those editorial comments.

Detailed Comments and Responses

COMMENT: A commenter offered the following recommendations on Lease Sale 258's DEIS content relating to beluga whales:[229]

- The Proposed Action overlaps with Federally designated beluga whale critical habitat. The FEIS should clarify if beluga whales' known affinity for the area exposes them to more harm or less harm.

  RESPONSE: After considering public comments on the Draft EIS, BOEM developed the Preferred Alternative, which combines the two critical habitat exclusion alternatives with three mitigation alternatives and includes Alternative 3A (Beluga Whale Critical Habitat Exclusion), and Alternative 3C (Beluga Whale Nearshore Feeding Areas Mitigation). The additional mitigation measures from Alternative 3A would be adopted to further reduce potential impacts to beluga whales and their critical habitat.

- *COMMENT*: The FEIS should address additive and synergistic impacts of climate change (from additional greenhouse gas emissions) to the existing baseline conditions of the Cook Inlet beluga whale population.

RESPONSE: Cumulative impacts on marine mammals including the additive or synergistic interactions with climate change were analyzed in Section 4.8.4.

[229] U.S. EPA Region 10.

- *COMMENT*: BOEM should revise the cumulative impacts section based on Section 4.8.1.1 to reflect that the Cook Inlet beluga whale population is declining at a rate of 2.3 percent per year, despite recovery efforts.

  RESPONSE: Text of Section 4.8.1.1 was revised to reflect the 2.3 percent annual decline in the Cook Inlet beluga whale population.

COMMENT: Another commenter provided the following suggestion regarding language in Lease Sale 258's DEIS:[230]

- Chapter 4.8.4, Page 93: The second paragraph does not mention management for sustainable yield and the emphasis on 1990's beluga overharvest can be misleading.
  RESPONSE: The text was revised to focus on the present state of the beluga population and the potential effects of the Proposed Action. Current management of the population is directed by NMFS and is focused on conservation and protection of the species. BOEM is committed to responsible leasing in compliance with all environmental protection mandates, including those related to the Cook Inlet beluga whale.
- *COMMENT*: A commenter suggested that preliminary data from a BOEM funded NOAA Fisheries winter aerial survey should be used to further inform the effects analysis of the DEIS.[231]

  RESPONSE: Aerial survey data from 2018–2021 suggests belugas are consistently using the Tuxedni Bay/Kalgin Island area in spring, following herring up the west coast, and the use of this area is higher than previously observed or expected. This appears to be an important feeding area because it is the first concentrated food source in spring after belugas have spent the winter hunting flatfish and other more dispersed food resources. The herring probably help belugas recover or improve body condition before they head into upper Cook Inlet for summer breeding and calving. They are in upper Cook inlet in June, July, and August and are in the Tuxedni Bay and Kalgin Island areas in March and April. April appears to be a key time, with most of the belugas out of the area by May. The spring survey dates were mid-March to April 5, 6, 7.
- *COMMENT*: BOEM should provide population model-based quantitative examples of moderate and severe impacts to the Cook Inlet beluga whale population to aid in the evaluation of their analysis.
  RESPONSE: BOEM determined the greatest potential impacts to Cook Inlet beluga whales from LS 258 would occur only in the case of large oil spill. Oil spill modelling was conducted to help assess the likelihood and degree of possible impacts and is presented in Appendix A. Potential impacts were predicted to be greatest in the southernmost portions of Cook Inlet where beluga whales are least likely to be found. BOEM considered the population status and potential biological removal numbers listed in the NMFS stock assessments when developing and applying impact assessments for Cook Inlet beluga whales. Additional analysis of effects to marine mammals from LS 258 will be conducted during consultation with NMFS and USFWS and upon submission of exploration and development plans by lessees.

[230] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).
[231] National Oceanic and Atmospheric Administration.

- *COMMENT*: Section 2.3, Page 5: To best avoid effects to Cook Inlet beluga whales, activities should not occur within Cook Inlet beluga whale Federally designated critical habitat at any time, nor within 5 miles of any fish-bearing streams from July 1 to September 30, which Alternative 3A does.
  RESPONSE: After considering public comments on the Draft EIS, BOEM developed the Preferred Alternative, which combines the two critical habitat exclusion alternatives with three mitigation alternatives, and includes Alternative 3A (Beluga Whale Critical Habitat Exclusion), and Alternative 3C (Beluga Whale Nearshore Feeding Areas Mitigation), Alternative 4A (Northern Sea Otter Critical Habitat Exclusion), Alternative 4B (Northern Sea Otter Critical Habitat Mitigation), and Alternative 5 (Gillnet Fishery Mitigation). Under the Preferred Alternative, the 10 OCS blocks located in beluga whale critical habitat and the 7 OCS blocks in northern sea otter critical habitat would be excluded from the sale area.
- *COMMENT*: Section 2.3, Page 5: Should make it clear that exclusion of temporal mitigation will likely increase potential impacts to Cook Inlet beluga whales and their salmonid prey.

  RESPONSE: Temporal mitigation alternatives for beluga whales will be included with BOEM's Preferred Alternative. Section 2.6 provides a description of BOEM's Preferred Alternative which combines the two critical habitat exclusion alternatives with three mitigation alternatives: Alternative 3A (Beluga Whale Critical Habitat Exclusion), Alternative 3C (Beluga Whale Nearshore Feeding Areas Mitigation), Alternative 4A (Northern Sea Otter Critical Habitat Exclusion, Alternative 4B (Northern Sea Otter Critical Habitat Mitigation), and Alternative 5 (Gillnet Fishery mitigation).
- *COMMENT*: Page 82, Section 4.8.1.1 (Cook Inlet belugas): "Cook Inlet beluga whales are white, toothed whales found in upper Cook Inlet when sea ice is absent, and farther south into lower Cook Inlet after sea ice formation." This description mischaracterizes when and where belugas occur in Cook Inlet. Visual and acoustic data indicate that belugas are present throughout the inlet year-round, concentrating in certain areas on a seasonal basis.
  RESPONSE: Beluga whales are present throughout the Inlet year-round, concentrating in certain areas on a seasonal basis. Belugas usually reside in upper Cook Inlet from April through October or November when sea ice is absent in the upper inlet. From October/November through April sea ice becomes more prominent in the upper inlet, and belugas shift farther south into waters closer to Kalgin Island. The statement is fully supported by the description of critical habitat in this Section 4.8.1, which has been edited for clarity and is consistent with the commentor's information.
- *COMMENT*: Page 85, Section 4.8.2.1 (Noise): The Noise section of the Effects Analysis should address or acknowledge how noise from the Proposed Action may impact Cook Inlet beluga whale critical habitat.
  RESPONSE: Text was revised in Section 4.8.2.1 to state that distances between Cook Inlet beluga and northern sea otter critical habitat and areas where seismic surveys would occur will limit the duration and extent of noise exposure in critical habitat to rare brief episodic events having non-injurious sound levels.
- *COMMENT*: Section 4.8.2.1, Page 87, first paragraph: "Due to the affinity most beluga whales have to the upper reaches of Cook Inlet during most of the year…" This statement seems at odds with the statements on Page 82, Section 4.8.1.1.

RESPONSE: Clarifying text has been added stating that most belugas spend the ice-free months in upper Cook Inlet, at the same time seismic surveys would generally occur in the lower inlet. Seismic surveys typically don't occur during winter in the lower inlet due to pan ice, and other issues complicating offshore seismic surveys. Section 4.8.1.1. states that belugas spend April-November in the upper inlet, only shifting southward between Nov-April.

- *COMMENT*: Section 4.8.2.3, Page 90, second paragraph: "This ability of belugas to avoid being struck by vessels is indicated by a lack of documented vessel strikes on beluga whales, and a shortage of observations involving belugas with injuries from vessel encounters." While vessel strikes of Cook Inlet beluga whales are not commonly observed, this sentence is inconsistent with the findings of McGuire et al., 2020.
RESPONSE: Text in Section 4.8.2.3 has been revised to account for McGuire et al. 2020, which was unavailable when BOEM initially wrote the DEIS. Results from McGuire et al. 2020 are now discussed. Section 4.8.2.3, paragraph 3 of the FEIS was revised to read: "Beluga whales have been shown to respond to vessels by altering call types, frequency use, and call rates, and avoiding ships (Finley et al., 1990; Lesage et al., 1999). The response of belugas to vessels is thought to be partly a function of habituation (NMFS, 2017). A recent study completed in 2020 (McGuire et al. 2020) found approximately 1/3 of Cook Inlet belugas sampled showed evidence of lethal or non-lethal scarring suggesting they may be struck by small vessels more often than has been previously assumed. However, ship strikes from mid-size and large project vessels are not anticipated for belugas which should be able to detect and avoid and outmaneuver the larger slow-moving vessels as needed. Furthermore, the low number of vessels associated with the Proposed Action compared to the total number of vessels operating throughout Cook Inlet, the scarcity of beluga whales in the lower inlet for much of the year, and NMFS' standard requirements for vessels to avoid approaching cetaceans and reduce speed in the presence of whales further lessens the likelihood of any cetacean being injured by vessel traffic."
- *COMMENT*: Section 4.8.2.4, Page 90-91: This analysis contradicts what is written in Section A-3.6.1.4, which states that a large spill could have population level impacts to Cook Inlet belugas. *RESPONSE:* The FEIS analyzes what is most likely to occur in the event of a spill using data from the E&D Scenario, and from past spill events. While there is a possibility of population-level effects, the analysis determined this possibility is highly unlikely. Clarifying text was added to better distinguish the possible outcomes from the probable effects. Cook Inlet has experienced several spill events over the last 5 decades that have not produced any documented beluga whale mortalities, even though the spills occurred in or near Cook Inlet beluga whale critical habitat (https://www.boem.gov/sites/default/files/documents/regions/alaska-ocs-region/environment/BOEM_2020-051.pdf).
FEIS text (Section 4.8.2.4) was revised to read: "A large offshore oil spill could temporarily or permanently affect marine mammal physiology and behavior and could alter their habitats until the oil is removed or disperses. These impacts could affect individuals but would not affect most marine mammal populations due to the reasonably foreseeable volume of a large spill, the tendency of spilled oil to spread into smaller patches with time and distance from the point of release, and the likelihood of a gradual release of spill materials into the water rather than an instantaneous release of the full spill volume. There is a remote possibility that the Cook Inlet beluga population could be affected by a large oil spill, but only if a substantial portion of the spill contacted beluga whales while they are aggregated in an area with a higher spill contact probability in the OSRA. Appendix A (Table A6) shows a large spill had the highest contact probabilities between Tuxedni and Kamishak Bays, areas where beluga whales are no longer commonly seen, making population impacts a remote possibility."

COMMENT: Section 4.8.2.4, Page 103: A large spill has the potential to affect the Cook Inlet beluga whale population, even if it only affects a small number of individual Cook Inlet belugas.

RESPONSE: The text takes into account physiological effects, spill responses/containment, spill size and spill constituents, etc. The text states that a large spill could affect Cook Inlet belugas and their population, but goes on to explain why the level of risk is low. BOEM used analysis of contact probabilities and OSRA modeling to determine that deleterious impacts on the beluga population. Individual belugas are unlikely to be contacted by the total volume of the spill; contact would most likely be limited to small patches of spilled oil, if there is contact at all. The population size of Cook Inlet belugas was taken into consideration when performing these analyses.

COMMENT: Another commenter offered the following recommendations on Lease Sale 258's DEIS content relating to other marine mammals:[232]

- The FEIS should clarify how alternatives proposing distinct levels of protection will result in the same overall impacts to listed species. BOEM should include more protections to avoid beluga and sea otter habitats. Further, the FEIS should explain why the protections in place for endangered Steller sea lion habitat are not applied to beluga and sea otters.

  RESPONSE: BOEM analyzed several alternatives providing varying levels of temporal and spatial protections to beluga whales and sea otters. Sections 4.8.3.1 and 4.8.3.2 explain why levels of impact remain constant between the preferred alternative and Alternatives 1/3A/3B/3C/4A/4B. After considering public comments on the Draft EIS, BOEM developed the Preferred Alternative, which combines the two critical habitat exclusion alternatives with three mitigation alternatives: Alternative 3A (Beluga Whale Critical Habitat Exclusion), Alternative 3C (Beluga Whale Nearshore Feeding Areas Mitigation), Alternative 4A (Northern Sea Otter Critical Habitat Exclusion), Alternative 4B (Northern Sea Otter Critical Habitat Mitigation), and Alternative 5 (Gillnet Fishery Mitigation). Under the Preferred Alternative, the 10 OCS blocks located in beluga whale critical habitat and the 7 OCS blocks in northern sea otter critical habitat would be excluded from the lease sale area.

  There is no critical habitat for Steller sea lions within the lease sale area because it was removed during the targeted leasing process described in Chapter 2 of the FEIS.

- *COMMENT*: The FEIS should also include a discussion of the Steller sea lion and northern sea otter population trends and consider these population trends in the alternatives discussion.

  RESPONSE: Text in FEIS Sections 4.8.1.2 and 4.8.1.3 was revised to read: "Pup counts in the central Gulf of Alaska Steller sea lion subpopulation declined sharply (-18 percent) between 2015 and 2017, counter to the continuous increases observed in both regions since 2002, possibly due to changes in availability of prey associated with warm ocean temperatures in years 2014–2016 (Muto et al. 2019; Bond et al. 2015, Peterson et al. 2016).", and "The maximum possible productivity rate for the southwestern stock of northern sea otters was estimated to be 20 percent and up to 26 percent per year for the southcentral stock of northern sea otters (Muto et al. 2019)."

- *COMMENT*: Section 4.8.2.1 of the DEIS should be amended with direct language about when acoustic noise transforms from what could be reasonably considered "sound" into "shockwaves." This will clarify when noise becomes a percussive force experienced by marine biological resources.

[232] U.S. EPA Region 10.

RESPONSE: The NOAA 2018 revised report NOAA-OPR-055 (NMFS, 2018), Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts, provides technical guidance for assessing the effects of underwater anthropogenic (human-made) sound on the hearing of marine mammal species under the jurisdiction of NMFS. The report provides substantive detail and identifies the received levels, or acoustic thresholds, at which individual marine mammals are predicted to experience changes in their hearing sensitivity for acute, incidental exposure to underwater anthropogenic sound sources. The text in Section 4.8.2.1 has been revised to include this report.

COMMENT: Another commenter provided the following suggestions on language in Lease Sale 258's DEIS:[233]

- Chapter 3.3.2.1, Page 26: Should add "Vessels shall remain a distance of 500 meters offshore when traveling near harbor seal haulouts to reduce disturbances to hauled-out animals."

  RESPONSE: BOEM has revised the FEIS as follows: "Vessels shall not approach within 500 meters of harbor seal haulouts." Jansen et al. 2010 has been cited.

- *COMMENT*: Chapter 4.8.4, Page 94: The third paragraph on page 94 does not accurately describe the impact of subsistence hunting on marine mammal mortality. Marine mammals in this area are a small part of the subsistence harvest.

  RESPONSE: NMFS stock assessments and Jones et al. (2015) provided information on subsistence harvest. These reports were reviewed for accuracy, relevance, and completeness. Harvest of marine mammals is addressed in the subsistence and socio-cultural analyses.

  The FEIS (Section 4.8.1.1) was revised for accuracy and clarity to read as follows: "The beluga population estimate dropped precipitously in the 1990s because of overhunting by subsistence practitioners, leading to their designation as endangered under the ESA in 2008 (73 FR 62919, October 22, 2008; 76 FR 20189, April 11, 2011; Muto et al., 2020); subsistence hunting was voluntarily suspended in 1999. However, the Cook Inlet population has continued decreasing to an estimated 279 individuals, and despite ESA and MMPA protections continues to decline at a rate of 2.3 percent annually (Gill, 2020; NMFS, 2016; Muto et al. 2020; Shelden and Wade, 2019)."

COMMENT: A commenter offered the following recommendations on Lease Sale 258's DEIS content relating to marine mammals:[234]

- There are some places where sea lions are not included in the list of marine mammals in the DEIS, and it is unclear if this is an intentional or inadvertent omission. It would aid document clarity if greater care were taken in development of such lists, or if intentional omissions from these lists were made explicit.

  RESPONSE: Throughout the document, sea lions were often discussed together with harbor seals as "pinnipeds."

- *COMMENT*: Page 5, Alternative 3C should note that the anadromous streams referred to in this alternative are not shown on Map 2-2.

[233] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).
[234] National Oceanic and Atmospheric Administration.

RESPONSE: To protect beluga nearshore feeding areas, OCS blocks within 10 miles of all anadromous streams are subjected to the timing restriction stating that no on-lease seismic surveys can be conducted between July 1 and September 30. Due to the scale of the map, individual streams are not shown, only the buffer area 10 miles from the streams.

- *COMMENT*: Page 10, Section 2.6.4: The DEIS states that North Pacific right whales and critical habitat are not likely to be impacted by post-lease activities and that restrictions based on considerations for this species were not warranted and thus not analyzed. However, they should have taken into consideration the effects of potential oil spills/gas leaks and vessel traffic that may be impacting North Pacific right whale critical habitat.

  RESPONSE: In Appendix A, the OSRA analysis report, the contact probabilities for North Pacific Right Whale Critical Habitat were found to be so low as to be negligible. Under most trials the contact probabilities were zero, but under 30 days, probability rose to values of 0-2 percent with almost all values remaining at zero or 1 percent. This suggests that North Pacific Right Whale critical habitat is extremely unlikely to be contacted by oil or gas in the event of an accidental spill or release.

- *COMMENT*: Page 12, Table 2-1: Effects of a large oil spill are judged to be minor to moderate on marine mammals. It appears effects could be minor to major when both direct and indirect effects are considered.

  RESPONSE: Determinations regarding the effects of oil spills incorporate the potential consequences and the degree of risk. Impacts to marine mammals were assessed at the population level. None of the impacts from the spills would likely affect marine mammal populations beyond a moderate level of impact. Large spills were estimated to be less than or equal to 3,800 bbls. For this reason, the likelihood of greater than moderate impact is remote. The estimated spill size (3,800 bbls) is not large enough to create widespread or long-lasting impacts for marine mammals, especially if spill responses are implemented. A "moderate" impact level indicates a few individuals could perish, but without producing population level impacts. Considering the number of larger spills that have occurred in Cook Inlet from vessels, industries, etc., and the degree of resulting impacts on the environment (marine mammals included), a finding of moderate is most likely a conservative overestimate of impacts.

- *COMMENT*: Section 4.8.2.1, Page 86, second paragraph (Section 4.8.2, Page 98): Given the multi-decade duration of the Proposed Action, the analysis of energetic costs from abandoning important habitat should consider whether any marine mammals would likely avoid patches of important habitat for longer time periods.

  RESPONSE: Patterns of marine mammal habitat use and displacement were evaluated by considering historic and current distributions in Cook Inlet, and movements in relation to oil and gas activities. Marine mammals are displaced from habitat during discrete episodic noise events. Text was revised to add clarity: "In avoiding ensonified areas, some marine mammals may leave or temporarily abandon areas that would otherwise be considered important habitat."

- *COMMENT*: Section 4.8.2.1, Page 87, paragraph 2: "NMFS (2017) determined seismic surveys in Cook Inlet can create a 9.5-km (6-mi) radius zone with enough noise to elicit behavioral changes and injuries among marine mammals at close range." This statement may be true but without also providing the size of the air guns used for the seismic survey it could mislead a reader regarding zone sizes.

  RESPONSE: The extensive variation in airgun sizes and array structure are too great to specifically analyze in a lease sale NEPA document. However, exact airgun sizes with specific noise propagation characteristics and radii would be analyzed in subsequent permit- or project-specific NEPA analyses for seismic survey operations.

- *COMMENT*: Section 4.8.2.1, Page 88, last paragraph: There is no discussion regarding behavioral responses of Steller sea lions to aircraft. Please include a discussion of aircraft effects on Steller sea lions.

  RESPONSE: Impacts to cetaceans and pinnipeds in the water were addressed in the text of sentence 2 of the referenced paragraph. Since Steller sea lions are pinnipeds the first two sentences of the paragraph apply to them. Aircraft impacts would be limited to the single Steller sea lion haulout, located southeast of the Proposed Action area. This haulout is located away from potential flight corridors and potential pipeline landfall areas, which eliminates need for further analysis of aircraft impacts. Furthermore, the minimum altitude requirements would further greatly reduce impacts to Steller sea lions as it would with all other marine mammals.

- *COMMENT*: Section 4.8.2.2, Page 89: The Habitat Alteration analysis should address impacts to marine mammal critical habitats.

  RESPONSE: Almost all Cook Inlet beluga and southwest northern sea otter Federally designated critical habitat areas occur outside of the lease sale area. No Steller sea lion critical habitat occurs in the lease sale area. Furthermore, several alternatives provide additional protections to those critical habitat areas. Potential for habitat alteration was considered as part of the determination of effects. Additional mitigations for critical habitat are included in the lease sale (Sections 3.3.2 and 3.4) and also provide protections to individual marine mammals. In the FEIS, BOEM identified a Preferred Alternative that strives to reduce impacts to critical habitat as much as possible. The Preferred Alternative combines the two critical habitat exclusion alternatives, with three mitigation alternatives and includes: Alternative 3A (Beluga Whale Critical Habitat Exclusion), Alternative 3C (Beluga Whale Nearshore Feeding Areas Mitigation), Alternative 4A (Northern Sea Otter Critical Habitat Exclusion), Alternative 4B (Northern Sea Otter Critical Habitat Mitigation), and Alternative 5 (Gillnet Fishery Mitigation).

- *COMMENT*: Section 4.8.2.2, Page 89: The analysis should address where the pipeline landfall is likely to occur relative to biologically important coastal areas, and the effects of locating a landfall in these locations.

  RESPONSE: Those issues would be identified and addressed in greater detail in a subsequent, site-specific NEPA reviews of development and production plans. Pipeline routes were not delineated in this FEIS because there remain too many variables to accurately predict exactly where production would occur, and from there where it would be best to route pipelines.

- *COMMENT*: Section 4.8.2.2, Page 89: BOEM should provide support for the assertion that oil drilling platforms increase fish habitat and resulting foraging opportunities for porpoises, harbor seals, Steller sea lions and sea otters.

  RESPONSE: The FEIS has been revised to read: "The installation of offshore production platforms in other cold seas has had a positive impact on fish-eating marine mammals, because the production platform infrastructure provides vertical structure benefitting some fish and invertebrate species (Russell et al. 2014; Thomson and Johnson, 1996; Todd et al., 2009). Consequently, adverse impacts of seafloor disturbance and habitat alteration from the presence of production platforms could be offset by the creation of more productive feeding habitat and better feeding opportunities for porpoises, harbor seals, Steller sea lions, and sea otters, providing trends from other cold water marine areas hold true."

- *COMMENT*: Section 4.8.2.3, Page 90: "Porpoises and toothed whales frequently investigate vessels, often "playing" in the wake of moving vessels." This is true of some, but not all, porpoises, and toothed whales.

  RESPONSE: Text revised to read: "Porpoises and toothed whales, excepting harbor porpoises, frequently investigate vessels, often "playing" in the wake of moving vessels, while pinnipeds and sea otters often show limited responses to vessels, with increased alertness, diving, moving from the vessel's path by up to several hundred meters (or feet), or by ignoring the vessel (USFWS, 2017; NMFS, 2017)."

- *COMMENT*: Section 4.8.2.5, Page 91-92: "Likewise, vessel strikes could injure or kill marine mammals, but with the USFWS and NMFS mitigations, vessel strikes would not occur, [Italics: and the impacts of vessel traffic would prevent marine mammal injuries from occurring], though behavioral responses by marine mammals would continue." Inclusion of the clause in italics does not make sense.

  RESPONSE: Text was revised for clarify and reads: Likewise, vessel strikes could normally injure or kill marine mammals; however, with the implementation of USFWS and NMFS mitigations, vessel strikes would no longer be foreseeable events, though behavioral responses by marine mammals would continue. Italics were removed.

- *COMMENT*: Section 4.8.2.5, Page 92, first paragraph: It is not clear why a large oil spill would only have minor to moderate effects on marine mammals. If BOEM makes statements regarding population level effects to marine mammals, it is necessary to engage in, or refer to population modeling that supports the assertion being made.

  RESPONSE: Impacts to marine mammals were assessed at the population level and incorporate the likelihood of spills. The analysis indicates that none of the impacts from the spills would affect marine mammal populations beyond a moderate level of impacts because small populations (Cook Inlet beluga whales) are not likely to be contacted. Among large populations, a relatively small portion of individuals would be affected. Large spills, for analysis purposes, were estimated to be less than or equal to 3,800 bbls. For this reason, the likelihood of a spill with greater than moderate impacts, is remote. Oil spill modelling is presented in Appendix A. Impacts were modelled to be greatest in the southernmost portions of the Inlet where beluga whales are least likely to be found and where the sea otter population are less concentrated compared to the areas just southwest and southeast of Kalgin Island, Alaska. Additional analysis of effects to marine mammals from LS 258 will be conducted during consultation with NMFS and USFWS and upon submission of exploration and development plans by lessees.

- *COMMENT*: Section 4.8.4, Page 96 (Cumulative Effects): "...This includes the endangered beluga whale, which would be in upper Cook Inlet when the E&D Scenario activities would occur and would most likely remain unaffected by noise and disturbances." This description of the occurrence of belugas within Cook Inlet is incorrect. Please see comment associated with text on page 82.

  RESPONSE: Text was revised in 4.8.1 and 4.8.2 to reflect distribution of beluga whales when proposed activities would be occurring. Section 4.8.1.1, paragraph 2 states "Two areas consisting of 7,809 km^2 (3,016 mi^2) of marine and estuarine environments were designated as Cook Inlet beluga whale critical habitat by NMFS (76 FR 20180, April 11, 2011) (Figure 2-2) and are essential to the survival and recovery of the Cook Inlet beluga whales. Area 1 of the Cook Inlet beluga whale critical habitat encompasses all marine waters of Cook Inlet north of a line connecting Point Possession and the mouth of Three Mile Creek. This area is not within the lease sale area but provides important habitat during ice-free months and is used intensively by Cook Inlet beluga whales between April and November."

- *COMMENT*: Section 4.8.2.3, Page 101: "However, vessel traffic should not disrupt migrations or elicit responses greater than deflections around vessels." Increased risk of ship strikes due to project-related increased vessel traffic is not addressed.

  RESPONSE: Ship strike is addressed in Section 4.8.2. Section 4.8.2.3 addresses how USFWS and NMFS requirements for vessel speed will reduce risks of vessel strikes.

- *COMMENT*: Section 4.8.2.3, Page 102: The commenter recommended the following: reducing vessel speed to <10 knots when weather conditions reduce visibility to less than one mile, traveling at <5 knots when within 300 yards of a whale, and not approaching listed marine mammals within 300 yards.

  RESPONSE: BOEM agrees that reduction of vessel speed is necessary in the vicinity of marine mammals and under reduced-visibility conditions. Specific requirements regarding reduction of vessel speeds will be developed during consultation with NMFS and will be described in the ensuing Biological Opinion.

- *COMMENT*: Section A-3.6.1.2, Page A-33: Large Oil Spill (=1,000 bbl)/Gas Release: This analysis needs to address the potential impacts to resident marine mammals from a winter gas release. At present, only non-resident (i.e., migratory) marine mammals are discussed.

  RESPONSE: Section A-3.7.1.2, paragraph 2, has been clarified as follows: Resident cetaceans such as beluga, killer, and minke whales, Dall's and harbor porpoises, and Pacific white-sided dolphins could be affected by a large spill at any time; however, they only occur in small numbers within the Inlet, and belugas spend most of the year in the upper Inlet areas of Knik and Turnagain Arms, away from the lease sale area. For these reasons, population-level impacts to these species would be unlikely.

- *COMMENT*: Section A-3.6.1.2, Page A-33: This section needs to be expanded with more species-specific information (for all species, not just for North Pacific right whales) which is supported by information in cited literature.

  RESPONSE: Section A-3.7.1.2 analyzed a large oil spill and its impacts to cetaceans of all species known to occur in or near Cook Inlet, Alaska.

- *COMMENT*: Page A-34, Figure A6: ID 74 is referred to in Table A7 but does not appear in Figure A6. Please include it, and please distinguish between ID 73 (North Pacific right whale feeding areas) and ID74 (North Pacific right whale critical habitat).

  RESPONSE: Footnote of Table A8 states "Note that all ERAs with <0.5 percent chance of contact are not shown". ID 74 is not shown because its contact probability is less than 0.5 percent.

- *COMMENT*: Page A-34, Figure A6: North Pacific right whale feeding areas (ID 73) are included only in the summer (left) panel of Figure A6. Please provide the citations used in concluding that such feeding areas are not present during winter.

  RESPONSE: The reference cited was: 73 FR 19000 (April 8, 2008), which stated right whales were only detected in August and September. The following references were added:

  NMFS. 2022. Four Endangered North Pacific Right Whales Spotted in the Gulf of Alaska. National Marine Fisheries Service, National Oceanic and Atmospheric Administration. Sept. 9,

2021. https://www.fisheries.noaa.gov/feature-story/four-endangered-north-pacific-right-whales-spotted-gulf-alaska

Wade, P.R., A. De Robertis, K. R. Hough, R. Booth, A. Kennedy, R. G. LeDuc, L. Munger, J. Napp1, K. E. W. Shelden, S. Rankin, O. Vasquez, C. Wilson. 2011. Rare detections of North Pacific right whales in the Gulf of Alaska, with observations of their potential prey. Endang Species Res., Vol. 13: p. 99–109.

National Marine Fisheries Service. 2013. Final Recovery Plan for the North Pacific Right Whale (*Eubalaena japonica*). National Marine Fisheries Service, Office of Protected Resources, Silver Spring, MD.

Page v of NMFS (2013) states "The eastern population is located primarily in the U.S. Exclusive Economic Zone (EEZ), with an estimated historical seasonal migration range extending from the Bering Sea and Gulf of Alaska in the north down the west coast of the United States to Baja California in the south." In addition, page 1-6 states "Based on recorded historical concentrations of whales in the Bering Sea and recent survey sightings, it is likely that feeding areas in the Okhotsk Sea and adjacent waters along the coasts of Kamchatka and the Kuril Islands together with the Gulf of Alaska have been important summer habitats for eastern North Pacific right whales (Scarff 1986; Goddard and Rugh 1998; Brownell et al. 2001; International Whaling Commission 2001; Clapham et al. 2004; Shelden et al. 2005; Clapham et al. 2006). "

- *COMMENT*: Page A-35: More information needs to be added to this section on the effects of oil spills on Steller sea lions.

  RESPONSE: The potential effects of spilled oil on Steller sea lions are described in Appendix A. A large oil spill was analyzed for pinnipeds specifically at A-3.7.2.2 and includes a conditional and combined probability for the ERAs where pinnipeds are known to aggregate. In addition, Section 4.8.2.4 of the FEIS describes behavioral and physiological effects to mammals from oil spills.

- *COMMENT*: Page A-36-37: There is no discussion of the effects of an oil spill on the harbor seal haulouts located within and adjacent to the action area or on the Steller sea lion haulouts at the mouth of Cook Inlet and in Shelikof Strait that overlap with the oil spill projection areas.

  RESPONSE: These haulouts were analyzed collectively with the use of environmental resource areas, land segments and grouped land segments. The OSRA model does not analyze for impacts to individual, discrete, haulout/rookery areas. The sites provided by the commentor were captured and analyzed collectively in Section A-3.7.2.

Source of Comments

- Individual/General Public
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Energy/Non-Energy Industry and Other Associations
- Federal Agencies
- State Agencies
- Tribes and Tribal Representation
- Other

Issue 5.7 Terrestrial Mammals

Summary of Comments

Two commenters stated that the Cook Inlet and its surrounding habitats are home to brown bear populations due to the presence of spawning fish.[235]

Summary Response to Comments

BOEM acknowledges that there are high density brown bear populations in the coastal regions of Alaska, including Cook Inlet, due in part to salmon-bearing rivers. Potential impacts of the Proposed Action on brown bears are addressed in Section 4.9.2 of the FEIS. As discussed in this section, post-lease activities that may result from Lease Sale 258 are not expected to result in substantial effects on terrestrial mammal populations, including brown bears.

Source of Comments

- Environmental Advocacy and Other Public Interest Groups (NGOs)
- State Agencies

Issue 5.8 Recreation, Tourism, and Sport Fishing

Summary of Comments

Approximately 23,656 commenters, including form letter campaigns, discussed impacts of the Proposed Action on recreation, tourism, and sport fishing. Numerous commenters suggested that the lease sale would negatively impact recreation, tourism, and sport fishing because the natural environment of the Cook Inlet sustains these activities and drives the economy in the lease sale area. Commenters asserted that the lease sale would have adverse effects due to its potential environmental damage, thus inhibiting the recreation, tourism, and sport fishing-based economy upon which coastal communities rely.[236]

A few commenters in opposition to the lease sale stated Cook Inlet supports over $1 billion a year in economic value from local tourism and sports fishing.[237] Similarly, another commenter expressed opposition to the lease sale because Cook Inlet attracts numerous visitors each year who partake in tourist activities. The commenter said that the lease sale would disrupt and undermine the tourist attractions of Cook Inlet.[238]

Some commenters raised concern about the lack of analysis for the lease sale's impact to tourism in the DEIS. They asserted that BOEM failed to provide details regarding the economic benefits of the tourism industry.[239] One commenter stated that the Lower Cook Inlet includes protected lands, including Katmai and Lake Clark National Parks, Alaska Maritime National Wildlife Refuge and Kachemak Bay State Park, each of which support billion-dollar tourism economies which would be harmed by oil and gas development.[240]

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[235] Unitarian Universalists of Homer; State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).
[236] Friends of the Earth [Form Letter Master]; D. Hamilton; C. Lish; Evergreen Action; Unitarian Universalists of Homer; R. Gustafson; M. Puckett; P. Vadla; Lower Cook Inlet Defense Project; Salmon Habitat Information Program [Form Letter Master].
[237] Cook Inletkeeper; Kenaitze Indian Tribe; Friends of the Earth [Form Letter Master]
[238] Anonymous.
[239] Natural Resources Defense Council, et al.; Cook Inletkeeper
[240] Multiple Organizations (BOEM-2020-0018-0184).

A few commenters raised concerns about the lack of potential impact to sport fishing identified in the DEIS.[241] Some commenters called for a thorough analysis in the DEIS of how the sport fishing industry would be affected.[242]

Summary Response to Comments

Tourism is one of the driving forces behind Alaska's economy and Cook Inlet provides ample opportunity for recreation and tourism. A summary of existing recreation and tourism activities and their economic benefit are included in Section 4.10.1 of the FEIS. Although important to the region, these activities are not major economic contributors within the KPB or the State of Alaska. Thus, impacts to these industries do not substantially alter the economic analysis. Similarly, slight increases in mixed cash economies could occur in small communities, but would not substantially alter the economic analysis. Substantial economic effects from impacts on recreation, tourism, and sport fishing are not expected.

Potential impacts of the lease sale on recreation, tourism, and sport fishing are analyzed by BOEM in Section 4.10.2 of the FEIS and include an evaluation of the impacts of noise and disturbance. Regarding the analysis of protected areas, the onshore support bases that would be used are established and located in the more industrial parts of these localities, which do not immediately adjoin scenic recreational areas. Moreover, the travel lanes between the platforms and onshore support facilities would ensure that vessels and helicopters transit away from shore promptly, which would minimize the exposure of shorelines to noise. Noise from air traffic associated with the project is expected to have a short-term, localized impact, and the additional air traffic would not create a substantial increase in noise over that already present in the Cook Inlet region

Disturbance from small increases in vessel traffic associated with the Proposed Action could cause space-use conflicts with waterborne recreational activities; however, this is expected to be limited as most waterborne recreational and tourist activities occur nearshore. Impacts resulting from project activities on sport fishing or charter boats are expected to be temporary because they would mostly end after construction. Exploration and drilling activities would likely require temporary access restrictions to specific areas in Cook Inlet for sport fishers. These areas could include short term geophysical or geotechnical survey areas that would require a temporary exclusion zone around the source vessels. Under these circumstances, it is likely that charters and individual sport fishers would be able to use alternative fishing grounds. After the survey is completed, sport fishing vessels could access these areas.

Overall, the effects of the post-lease activities that may result from Lease Sale 258 on recreation and tourism are expected to be minor. While small oil spills are not expected to persist on the water long enough to affect waterborne recreational activities, large oil spills could result in impacts to recreation and tourism, primarily through reduced quality of the recreational experience and altered patterns of use, potentially resulting in moderate impacts.

Detailed Comments and Responses

COMMENT: A commenter provided the following statements regarding specific chapters and sections in the DEIS:[243]

[241] North Pacific Fisheries Association; Natural Resources Defense Council, et al.; Lower Cook Inlet Defense Project; Cook Inletkeeper; Lower Cook Inletkeeper; M. Inlet Defense Project; M. Byerly.
[242] Natural Resources Defense Council, et al.; Lower Cook Inlet Defense Project; Cook Inletkeeper
[243] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).

- Chapter 4; Section 17; Page Number 130: In recreational fisheries, there would be permanent impact from space use conflicts during the duration of the project.

  RESPONSE: These impacts would not be permanent due to the fact that operations would last for a specified length of time. The primary effect to sport fisheries would be from temporary displacement of fishing boats and charters from sport fishing grounds during exploration and drilling activities. Deep penetrating seismic and geotechnical surveys would likely require temporary restricted access to specific areas in Cook Inlet for sport fishers. This would result in a temporary and minor space-use conflict with sport fishing boats. The length of time that any particular area would be unavailable would be approximately 1 hour. The USCG would issue a Local Notice to Mariners, which would specify the survey dates and locations and the recommended avoidance requirements for sport fishing vessels. Platforms would be in place throughout the duration of the proposed action, however, these locations represent a small fraction of the entire area and sport fishers would be able to utilize alternate sites.

- *COMMENT*: Chapter 4; Section 10.2.2; Page Number 104: The distribution of the recreational halibut fishery is mischaracterized. The fleet is widely dispersed throughout the lease sale area and not just concentrated in nearshore areas. Platforms placed over Halibut "holes" would cause conflicts for charter and private boats.

  RESPONSE: FEIS text has been revised in Section 4.10.1 to account for the presence of a widely distributed halibut fishery and the presence of halibut holes located within Cook Inlet.

Source of Comments

- Individual/General Public
- Energy/Non-Energy Industry and Other Associations
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Federal Agencies
- State Agencies
- Tribes and Tribal Representation

Issue 5.9 Communities and Subsistence

Summary of Comments

Approximately 23,610 commenters, including form letter campaigns, discussed potential adverse impacts the lease sale would have on communities and subsistence. Numerous commenters found the DEIS analyses of these impacts to be inadequate, specifically regarding fishing activities. Commenters emphasized the importance of subsistence fishing in the area as well as the income earned through nearby fisheries that directly supports the community.[244] One commenter addressed the separation of impacts to sociocultural systems and impacts to fisheries in the DEIS, stating that sociocultural impacts are intergenerational and costly, and should be economically considered under a large spill scenario.[245] In consideration of the high nutritional and cultural value of subsistence food, a commenter recommended analyzing the potential impacts of LS 258 to the regional subsistence economies.[246] A couple of

[244] D. Aderhold; C. Lish; Ocean Conservancy; Lower Cook Inlet Defense Project; Alaska Longline Fisherman's Association; Friends of the Earth [Form Letter Master]; Cook Inletkeeper [Form Letter Master].
[245] Alaska Marine Conservation Council.
[246] U.S. EPA Region 10.

commenters[247] indicated the DEIS does not address potential impacts to the Lower Cook Inlet salmon set net fishery in Kachemak Bay, including long-term impacts to fishing sites.

Several commenters also discussed the potential impacts the lease sale would have on the livelihood of tribal communities. A few commenters stated tribal leaders for the Native Village of Nanwalek and the Native Village of Port Graham have expressed concern for the impacts oil and gas development would have on their subsistence resources, which they need to survive.[248] One commenter discussed the value of the resources in Cook Inlet and their importance to the physical survival, culture, and traditions of the Kenaitze Indian Tribe.[249] Another commenter stated that the lease sale area includes critical habitat for the endangered Cook Inlet beluga whale, and supports important traditional harvest for a number of Alaska Native Tribes.[250] A few other commenters echoed this statement, stating that BOEM's analysis of the effects of the Proposed Action on Alaska Native communities and subsistence activities is inadequate for it to be a "hard look." They expressed concern that BOEM has ignored the intent of the Cook Inlet Beluga Whale Recovery Plan, which aims to rebuild a beluga population capable again of supporting subsistence use by native villages.[251]

Summary Response to Comments

Communities in the Cook Inlet region are supported by subsistence and several other interconnected resources, including Economy (Section 4.12), Commercial Fishing (Section 4.13), and Recreation, Tourism, and Sport Fishing (Section 4.10). These impacts are discussed in detail in their respective sections and could translate to impacts in communities through changes in economic opportunities, population, health, and community character and identity. BOEM has evaluated the potential impacts the lease sale would have on Alaska Native communities, primarily as a result of impacts on subsistence resources. These potential impacts on subsistence resources are described in Section 4.11.2 of the FEIS and would be applicable to communities that engage in subsistence fishing or hunting. Short-term and localized impacts to subsistence activities and harvest patterns could occur throughout the 40-year lifespan associated with post-lease activities, primarily through effects on the availability of subsistence resources and space-use conflicts.

Regarding the recommendation to conduct a replacement cost analysis of impacts on subsistence harvest, BOEM has previously described impacts on subsistence activities and harvest patterns qualitatively and has not previously quantified the pounds of subsistence foods potentially lost due to Proposed Actions nor the monetary value of replacing those foods (BOEM, 2015, 2016, 2018). Similarly, other NEPA documents for oil and gas planning, leasing, or development in Alaska have not attempted to monetize subsistence impacts (BLM, 2020; USACE, 2018).BOEM contends that considering impacts on subsistence harvest patterns and activities appropriately discloses the type and level of potential impacts from a lease sale and that quantifying and monetizing impacts would be speculative information. Additionally, applying a replacement cost of store-bought foods to produce a monetary value of subsistence activities would likely undervalue the cultural and social aspects of subsistence activities and would not account for the high levels of sharing of subsistence resources throughout Alaskan communities.

Regarding a potential future opening of a subsistence hunt for Cook Inlet beluga whales, BOEM assesses impacts based on current harvest conditions including current management of Cook Inlet beluga whales based on endangered population, not on potential future subsistence hunt openings/closings. Regarding

[247] Alaska Longline Fisherman's Association; Lower Cook Inlet Defense Project
[248] M. Kuszmaul.; Unitarian Universalists of Homer.
[249] Kenaitze Indian Tribe.
[250] Multiple organizations (BOEM-2020-0018-0184).
[251] Natural Resources Defense Council, et al.; Cook Inletkeeper.

information about openings and closures of specific fisheries seasons, future NEPA reviews of a site-specific EP or DPP would review impacts on applicable fisheries and would include mitigation measures as appropriate. BOEM updated Section 4.11.1 of the FEIS, and A-3.14 of Appendix A, to include information on the lower Cook Inlet salmon set net fishery in Kachemak Bay and impacts of oil spills on these locations.

Detailed Comments and Responses

COMMENT: One commenter provided several recommendations for the FEIS to better address the fundamental importance of subsistence activities to cultural, individual and community health, and well-being. These recommendations include:[252]

- The FEIS should clarify how criteria were applied to determine a "minor" impact to communities and subsistence resources. These criteria and determinations should be reviewed and/or discussed with potentially impacted subsistence users.

  RESPONSE: For impacts to subsistence activities, factors considered include the fundamental importance of these activities to cultural, individual and community health, and well-being. Based on these unique characteristics, impacts to subsistence activities are considered severe, and thus, major, if they would disrupt subsistence activities, make subsistence resources unavailable or undesirable for use, or only available in greatly reduced numbers for a substantial portion of a subsistence season for any community. Temporary and localized impacts to subsistence activities, such as space-use conflicts, small spills and spill drills would be considered minor. BOEM's analysis discloses the potential for major impacts on subsistence activities and harvests from a large oil spill. Regarding consultation with Tribal Entities, BOEM has updated the discussion of outreach and consultation in the FEIS (Section 5.3.1).

  The EIS uses available data on subsistence harvest activities and areas, particularly data from Alaska Department of Fish and Game, Division of Subsistence. An additional recent resource recommended by ADF&G Division of Subsistence has been incorporated into the FEIS. BOEM considered information on harvest areas for subsistence resources as documented in the FEIS for Lease Sale 244 (Figures 3.3.3-1 through 3.3.3-7) as well as in more recent publications by ADF&G, Division of Subsistence (Brown et al., 2021; Jones, Holen, and Koster, 2015; Jones and Kostik, 2016; Keating et al., 2020). Most of the subsistence harvest activities are documented to occur in coastal and nearshore areas that do not overlap with the lease sale area. There is potential overlap between the lease sale area and some subsistence fish harvest activities, and BOEM discusses these potential impacts in Section 4.11.2.

- *COMMENT*: The FEIS should incorporate "changes in the quantity, quality, and/or perceived quality" of subsistence foods throughout the impacts analysis as a key recognition of the fundamental importance of these activities to regional subsistence users and tribal communities.

  RESPONSE: The FEIS considers changes in the quantity, quality, and distribution of subsistence resources, as well as harvester concerns over resource quality, in the discussion of impacts to resource availability (Section 4.11.2.1). Impacts of oil spills on the quantity, quality, and perceived quality of subsistence resources are included in the discussion of small and large spills in A-3.10, and additional language was added to acknowledge that harvester perception of impacts to resources would affect subsistence harvests.

[252] U.S. EPA Region 10.

- *COMMENT*: The FEIS should include equivalent mitigation measures described for protecting birds and reducing conflicts with commercial fishing for protecting subsistence communities and subsistence resources.

  RESPONSE: BOEM notes the recommendation to include a subsistence-specific mitigation measure for Lease Sale 258. Many of the lease stipulations and mitigation measures included in the FEIS for other resources would also support protection of subsistence resources and activities. For example, Stipulation 1, Protection of Fisheries, states: "Exploration, development, and production operations must be conducted in a manner that minimizes or prevents conflicts with fishing communities and gear, including but not limited to, subsistence, sport, and commercial fishing." The orientation program lease stipulation (Stipulation No. 3) includes requirements for an orientation program inclusion in an EP or DPP that includes, among other requirements, information concerning avoidance of conflicts with subsistence, sport, and commercial fishing activities.

  In addition to these stipulations, BOEM included an Alaska Conflict Management Plan as a lease stipulation for consideration in the Proposed Notice of Sale. The lease stipulation states: "Prior to beginning exploration or development activities, the lessee/operator will submit a Conflict Management Plan (CMP) documenting consultation with participating communities to determine best practices to prevent unreasonable conflicts with subsistence or other cultural activities, and outline specific mitigation measures the lessee/operator will implement. The CMP applies to Bureau of Ocean Energy Management (BOEM) -authorized and -permitted activities and associated support activities (such as aircraft or vessel resupplies or crew transfers), which could occur on the Outer Continental Shelf or onshore."

- *COMMENT*: Given the high nutritional and cultural value of subsistence food within Alaska, a commenter recommended analyzing the potential impacts of LS 258 to the regional subsistence economies. The commenter recommended the use of replacement cost method to quantify the monetary cost of replacing subsistence foods that may be lost because of lease activities.

  RESPONSE: BOEM added language in Chapter 4.11.1 and in A-3.10 acknowledging the interconnected subsistence-cash economy of the Cook Inlet region and that impacts on subsistence harvest patterns and activities can have economic impacts on subsistence harvesters and communities.

Regarding the recommendation to conduct a replacement cost analysis of impacts on subsistence harvest, BOEM has previously described impacts on subsistence activities and harvest patterns qualitatively and has not previously quantified the pounds of subsistence foods potentially lost due to the Proposed Action nor the monetary value of replacing those foods (e.g., BOEM, 2015, 2016, 2018). Similarly, other NEPA documents for oil and gas planning, leasing, or development in Alaska have not attempted to monetize subsistence impacts (e.g., BLM, 2020; USACE, 2018). BOEM contends that considering impacts on subsistence harvest patterns and activities appropriately discloses the type and level of potential impacts from a lease sale and that quantifying and monetizing impacts would be-speculative. Additionally, applying a replacement cost of store-bought foods to produce a monetary value of subsistence activities would likely undervalue the cultural and social aspects of subsistence activities and would not account for the high levels of sharing of subsistence resources throughout Alaskan communities.

COMMENT: One commenter discussed sections of the DEIS that require edits or further clarification, including:[253]

- Chapter 3.3.1.1; Page Number: 25; Comment: Add "harvest practices" to the statement on the orientation program in paragraph 2: "understanding of personnel to community values, customs, harvest practices, and way of life."

  RESPONSE: BOEM has made the requested revision.

- *COMMENT*: Chapter 4.11.1; Page Number: 107; Comment: The third paragraph in this section states, "to support a rural lifestyle". This should be revised to "supports customary and traditional way of life" because both state and federal management look at customary and traditional uses while the federal system manages with rural preference.

  RESPONSE: BOEM has made the requested revision.

- *COMMENT*: Chapter 4.11.2.1; Page Number: 110-111; Comment: The Space-Use Conflicts section does not mention the Alaska Board of Fisheries and Federal Subsistence Board regulations relative to the timing of activities. This section should include discussion on how lease holders would work around regulatory openings and closings.

  RESPONSE: This comment includes an open-ended statement about working around specific fishery openings and closings. Future NEPA reviews of a specific EP or DPP would assess impacts on applicable fisheries and would include mitigation measures as appropriate.

- *COMMENT*: Chapter 4.11.2.1; Page Number: 111; Comment: The last paragraph of the Space Use Conflict references "coordination between lessees/operators and Alaska Native communities". The state's definition of subsistence includes a broader population, so we recommend editing this to "coordination between lessees/operators and "communities heavily dependent on subsistence harvest and use."

  RESPONSE: BOEM has made the requested revision in Chapter 4.11.2.1 of the EIS. BOEM will provide opportunities for engagement with communities, including communities dependent on subsistence harvest and use, in reviews of exploration plans, and development and production plans, submitted for any leases resulting from Lease Sale 258.

- *COMMENT*: Chapter 4.11.2.2; Page Number: 111; Comment: This section includes the statement that a large spill could disrupt subsistence activities for "a substantial portion of a subsistence season". While the following statement does state that a large spill could cause "severe impacts to subsistence activities and harvest patterns in Cook Inlet", the impact of a large spill could be longer than one season and neither statement accurately represents this potential long-term impact.

  RESPONSE: BOEM has revised the FEIS text referenced here to clarify that impacts of a large spill may last for more than one season.

- *COMMENT*: Chapter/Section: A-3.9.1; Page Number: A-49; Comment: The last bullet in the list of impacts to sociocultural systems should include mention that disruption of economy and interruption of way of life will depend in part on the perception of impact by subsistence harvesters.

[253] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).

RESPONSE: BOEM has made the requested revision.

- *COMMENT*: Chapter/Section: A-3.10.1; Page Number: A-52; Comment: The statement "This impact would be localized, and it is anticipated harvesters could access other locations for targeted resources" does not consider the economic impacts of harvesting other resources. Additionally, harvester perception on the impact of the spill may also impact subsistence in a small spill area.

  RESPONSE: BOEM has revised the text in A-3.11.1.to acknowledge harvester perception of impacts may affect subsistence activities, and that harvesters may incur economic impacts if they need to harvest in locations not affected by a small spill or if they harvest other resources.

Source of Comments

- Environmental Advocacy and Other Public Interest Groups (NGOs)
- State Agencies
- Energy/Non-Energy Industry and Other Associations
- Federal Agencies
- Individual/General Public
- Tribes and Tribal Representation
- Other

Issue 5.10 Economy

Summary of Comments

Approximately 23,613 commenters, including form letter campaigns, discussed the impact of the Proposed Action on economies. Many commenters provided general statements regarding the potential economic impacts of the lease sale. Most comments asserted that the economies of the Cook Inlet and surrounding areas have been sustained through commercial and sport fishing, and tourism, concluding that the lease sale would conflict with and hinder the sustainable economies in the area.[254] Commenters described the Lower Cook Inlet as a resource-based economy contributing over $1 billion dollars to the region because of the marine ecosystem. The commenters stated that introducing oil and gas development in the lease area would lead to environmental risk that would hinder the region's economy.[255] Alternatively, one commenter shared how avoiding the No Action alternative would create jobs and revenue because of the development of the natural gas and oil industry. Commenters referenced the Northern Economics 2018 study that predicted petroleum development in the Cook Inlet OCS possibly generating 1,750 jobs annually and increasing the annual labor income. Commenters also asserted that responsible leasing and development in the Cook Inlet would support the nation's energy and security, economic growth, and environment.[256]

In addition to the effects of oil, one commenter discussed the potential impacts climate change would have on the economy. The commenter asserted studies have shown climate change will lead to costs ranging from $340 to $700 million for the Alaska state government.[257]

[254] Evergreen Action; S. Christiansen; C. Lish; Evergreen Action; Friends of the Earth [Form Letter Master]; Cook InletKeeper [Form Letter Master]; Lower Cook Inlet Defense Project.
[255] Alaska Longline Fisherman's Association; Lower Cook Inlet Defense Project; J. Whittier; Anonymous [BOEM-2020-0018-0183]; M. Kuszmaul; M. Byerly; Lower Cook Inlet Defense Project.
[256] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).
[257] Unitarian Universalists of Homer.

One commenter disagreed with the language of page 19 in the DEIS that identifies the loss or delay of economic benefits as a negative impact of selecting the No Action Alternative. They also recommended that the economic impacts to the Tutka Bay Hatchery and Port Graham Hatchery be analyzed and included in the FEIS.[258] Other commenters claimed inconsistencies with the application of energy substitution to the proposal's environmental harms without using the same analysis for the economic benefits. The commenters suggested that BOEM apply the substitution analysis consistently to all the proposal impacts.[259]

A few commenters provided personal anecdotes on the economic impacts they would face due to the lease sale.[260] One commenter shared that they had a guide business that was directly dependent on the health of the marine environment. They stated that an oil spill would have an immense adverse effect on their livelihood.[261] Commenters suggested that BOEM consider adding new information about an increase in mixed cash economies on subsistence communities relative to the communities of Port Graham and Nanwalek.[262]

Summary Response to Comments

Several commenters expressed concern that the Lease Sale would negatively impact the economies of Cook Inlet and surrounding areas that have been sustained through environment-based industries such as commercial and sport fishing, tourism, and recreation. Although vital to the region, these activities are not major economic contributors within the KPB or the State of Alaska. Thus, impacts to these industries do not substantially alter the economic analysis. Similarly, slight increases in mixed cash economies could occur in small communities, but would not substantially alter the economic analysis. There are currently 18 oil and gas platforms operating in the state waters of Cook Inlet. While these facilities are north of Kalgin Island, the concept that oil and gas is being "introduced" into this area is not substantiated. BOEM considered the Tutka Bay Hatchery and Port Graham Hatchery in the analysis, and they are not large economic drivers on an absolute and relative basis. Overall impacts were sufficiently addressed in commercial, sport fishing, and subsistence sections. Future site-specific analyses would be conducted if a project occurred near these hatcheries. As described in Section 4.10.2 of the FEIS, the Lease Sale is expected to result in minor impacts to recreation, tourism, and sport fishing. Impacts of the Lease Sale on commercial fishing, as described in Section 4.13.2 of the FEIS, are expected to be minor and localized due to temporary displacement during construction. Substantial economic effects from impacts on recreation, tourism, and sport fishing are not expected.

The BOEM analysis, as described in Section 4.12.2 of the FEIS, indicates that the post-lease activities conducted as a result of Lease Sale 258 are expected to provide direct employment adjusted for non-resident labor, of 52 annual jobs and up to 230 at peak employment for residents of the KPB. Statewide, the Proposed Action would be expected to support an average direct, indirect, and induced employment of 99 annual jobs with peak employment at 427, not including out of state workers. Additionally, the KPB and the State of Alaska are both expected to receive a share of revenues from assessed oil and gas exploration production facilities and pipeline property taxes, which would support some KPB residents working in local government jobs.

BOEM respectfully disagrees with the EPA's economic opinion about the loss or delay of economic benefits associated with LS 258; "EPA disagrees that the loss or delay of economic benefit being

[258] U.S. EPA Region 10.
[259] Institute for Policy Integrity at New York University School of Law; D. Hamilton.
[260] C. Mom; N. Pease.
[261] C. Mom.
[262] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).

considered a negative impact given the potential of economic gain from Federal royalties being hypothetical to date". All economic benefits from a project decrease or disappear when delayed or eliminated, based upon the Time Value of Money principal. In this case, the delay or elimination of a project reduces its value towards or to zero, thus delay or elimination would provide reduced or no economic benefit.

Historical lease sale participation in Cook Inlet has generated economic benefits in the form of industry activity, rental and bonus bid revenues. Industry interest in any lease sale is based on variables beyond BOEM's control. Future federal royalties are all hypothetical and uncertain for all federal lands, not just lands located in Cook Inlet. Substitution of alternative energy is speculative and beyond the scope of the economic analysis in this FEIS.

Geologic and economic analysis indicates Cook Inlet may contain economically viable projects, including payment of Federal royalties, meeting a key tenet of OCSLA. The primary purpose of OCSLA is to facilitate the federal government's leasing of its offshore mineral resources and energy resources. As the law itself states, "the outer Continental Shelf is a vital national resource reserve held by the Federal Government for the public, which should be made available for expeditious and orderly development, subject to environmental safeguards, in a manner which is consistent with the maintenance of competition and other national needs" (43 USC § 1332(3)).

Source of Comments

- Environmental Advocacy and Other Public Interest Groups (NGOs)
- State Agencies
- Energy/Non-Energy Industry and Other Associations
- Federal Agencies
- Individual/General Public

Issue 5.11 Commercial Fishing

Summary of Comments

Approximately 90 commenters, including a form letter campaign, discussed potential impacts of the lease sale on commercial fishing. Numerous commenters made general statements about their opposition to the lease sale due to the potential risks and threats it poses to commercial fishing.[263] One commenter pointed out that although NMFS closed the federal waters of Lower Cook Inlet to the drift salmon fleet, BOEM is moving forward with leases in the same waters for oil and gas E&D. Several commenters raised concerns related to the failure of the DEIS in discussing socioeconomic impacts of the lease sale.[264] Some commenters expressed concern related to the impacts of oil spills and climate change on commercial fisheries and the local economy.[265]

Summary Response to Comments

The impacts of noise, oil spills, space-use conflicts, and climate change on commercial fishing as a result of Lease Sale 258 are described in Section 4.13.2 and 4.13.4 of the FEIS. As described in these sections, drilling and vessel noises are unlikely to affect commercial fishing. Small spills are expected to be

[263] W. Byrnes; S. Pondolfino; M. Puckett; C. Mom; Unitarian Universalists of Homer; Evergreen Action; R. Gustafson.
[264] Lower Cook Inlet Defense Project; Alaska Longline Fisherman's Association; Natural Resources Defense Council, et al.; Cook Inletkeeper.
[265] I. Karoly-Lister; C. Lish; Kenaitze Indian Tribe; Lower Cook Inlet Defense Project; R. Gustafson; T. Kendal Smith; United Cook Inlet Drift Association; Ocean Conservancy; Natural Resources Defense Council, et al.; Lower Cook Inlet Defense Project; Alaska Marine Conservation Council; Salmon Habitat Information Program [Form Letter Master].

localized and have relatively limited impacts on commercial fishing activities and are not expected to persist long enough to result in economic effects. Large spills, however, could decrease numbers of commercially important species, resulting in decreased catch or fishery closures, which if they occur during peak salmon fishing, could result in severe economic impacts to commercial fishing. Space-use conflicts are expected primarily during construction as a result of exclusion zones and potential entanglement of equipment and vessels with commercial fishing gear, though long-term effects are expected as a result of platform construction.

Existing commercial razor clam fisheries, scallop fisheries, open and active crab fisheries, Pacific herring fisheries, Pacific cod fisheries, and Pacific halibut fisheries are described in Section 4.13.1 of the FEIS as the affected environment. Impacts to these fisheries are included in Section 4.13.2 of the FEIS which outlines the environmental consequences of the Proposed Action.

Alternative 5 was developed to reduce impacts to gillnet fisheries by restricting seismic surveys during drift gillnetting season and requiring notification of the United Cook Inlet Drift Association of any temporary or permanent structured planned during drift gillnetting season. The potential impacts of this alternative on commercial fishing are described in Section 4.13.3.3 of the FEIS.

Detailed Comments and Responses

- *COMMENT*: Specifically, commenters urged BOEM to include an in-depth impact analysis on commercial fisheries on the following:
  - Commercial razor clam fishery on the west side of Cook Inlet,[266]
  - Herring spawning stocks in Kamishak Bay,[267]
  - Pacific Herring Fishery,[268]
  - Pacific Cod Fishery,[269]
  - Halibut Harvests/Fishery,[270]
  - Open and active crab fisheries,[271]
  - Scallop Fisheries,[272]
  - Pacific Cod Fishery.[273]

  RESPONSE: Because of their commercial importance, impacts to razor clams, sockeye salmon, herring, weathervane scallops, Pacific cod, halibut, and crab fisheries are evaluated under Section 4.13. Herring spawn extensively along much of the Shelikof coast of Kodiak Island and the southern Alaska Peninsula; areas that are outside the lease sale area but could be impacted by a

[266] Alaska Longline Fisherman's Association; Lower Cook Inlet Defense Project; Alaska Longline Fisherman's Association; Natural Resources Defense Council, et al.; State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).
[267] Alaska Longline Fisherman's Association; Natural Resources Defense Council, et al.; State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC); State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).
[268] Natural Resources Defense Council, et al.; Cook Inletkeeper; M. Byerly.
[269] Cook Inletkeeper; M. Byerly.
[270] Alaska Longline Fisherman's Association; Lower Cook Inlet Defense Project; Natural Resources Defense Council, et al.; North Pacific Fisheries Association; Alaska Longline Fisherman's Association; Alaska Longline Fisherman's Association; Cook Inletkeeper.
[271] Cook Inletkeeper; Natural Resources Defense Council, et al.
[272] Cook Inletkeeper; Natural Resources Defense Council, et al.
[273] Natural Resources Defense Council, et al.

large oil spill. To facilitate analysis of fishery resources as a whole, fisheries were grouped together during the analysis, with focus on individual fisheries as necessary.

- *COMMENT*: Of these commenters, some urged BOEM to consider the effects of noise pollution,[274] vessel traffic, mechanical spills,[275] and climate change[276] when conducting the impact analysis on the fisheries.

  RESPONSE: Impacts to commercial fisheries from noise, vessel traffic, spills and climate change were discussed in Sections 4.13.2.1, 4.13.2.2, 4.13.2.3, and 4.13.2.4, respectively. As described in these sections, drilling and vessel noises are unlikely to affect commercial fishing. Small spills are expected to be localized and have relatively limited impacts on commercial fishing activities and are not expected to persist long enough to result in economic effects. Space-use conflicts are expected primarily during construction as a result of exclusion zones and potential entanglement of equipment and vessels with commercial fishing gear, though long-term effects are expected as a result of platform construction.

COMMENT: Commenters provided the following statements and suggestions regarding specific chapters and sections in the DEIS:[277]

- Chapter/Section: 4.17; Page Number: 130: Commercial fisheries would face permanent impacts from space use during the project.

  RESPONSE: Disturbances to commercial fishing operations due to space-use conflicts would be highly localized or temporary, but would span multiple fishing seasons from oil and gas operations and the presence of drilling structures. Cooperation between the exploration industry and the commercial fishing industry regarding timing and location of operations could minimize these space-use conflicts.

- *COMMENT*: Section: 4.13.2.2; Page Number: 120: Commercial fishing in this area could occur in the future and the space-use conflicts between the drilling operations and the salmon drift gillnet fleet should be considered.

  RESPONSE: Impacts to commercial fishing, including the salmon drift gillnet fishery are analyzed in Section 4.13. Mitigations are proposed that would reduce impacts to the salmon drift gillnet fishery as well as other commercial fisheries. Lease Stipulation No 1 (Section 3.3.1) requires that exploration, development, and production operations must be conducted in a manner that minimizes or prevents conflicts with fishing communities and gear. Under Alternative 5 the United Cook Inlet Drift Association must be notified of any temporary or permanent structures planned during the drift gillnetting season.

- *COMMENT*: Chapter 4.13.1.6; Page Number: 120: Revise the 5th sentence and add new sentence to more accurately reflect information on the Pacific halibut fishery: "Pacific halibut is a major commercial fishery in Alaska, including Cook Inlet, and occurs generally from late winter to late fall; Alaskan commercial harvest in 2019 was recorded to be nearly 17.5 million lbs. (IPHC, 2019). Pacific halibut harvests in Cook Inlet waters during the recent decade (2011–2020) ranged from approximately 300 to 500 thousand pounds annually."

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[274] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[275] Alaska Marine Conservation Council; Alaska Marine Conservation Council; M. Byerly.
[276] Cook Inletkeeper.
[277] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).

RESPONSE: Text revised as commenter suggested.

- *COMMENT*: Chapter 4.13.1.6; Page Number: 120: Revise 4th sentence to read: "Groundfish are harvested with trawl, pot, longline, and jig gear throughout the year." [Remove "small sunken gillnets"]

  RESPONSE: Text revised as commenter suggested.

- *COMMENT*: Chapter/Section: 4.13.2.4; Page Number: 121: Hardshell clam and herring fisheries may be disproportionally impacted. The stocks have been depressed and a large spill would likely hinder recovery.

  RESPONSE: Section 4.13.1 of the EIS discusses the existing and historic fisheries in the lease sale area. BOEM is unable to speculate on the future of the herring fishery in the FEIS, without more specific plans being released by the State of Alaska. The commenter did not provide any references to a planned reopening of the herring fishery, therefore substantive changes to the FEIS were not warranted. The FEIS discusses impacts of large spills in Sections 4.6.3, 4.13.3, and in Appendix A, Sections A-3.5.2 and A-3.14.2. The FEIS addresses: 1) fish and invertebrate resources, 2) historic fisheries present in the area, 3) current fisheries in the area, 4) stock statuses and trends, where applicable, and 5) the impacts of an oil spill on items 1-4. Further analysis on a fishery that is not likely to be affected or not reasonably foreseeable is speculative and beyond the scope of this FEIS. BOEM has made revisions regarding shellfish fisheries where appropriate.

- *COMMENT*: Chapter 4.13.1.6; Page Number: 120: Rename section to "Groundfish and Halibut".

  RESPONSE: Text revised as commenter suggested.

- *COMMENT*: Some commenters stated that potential impacts to commercial, charter and sport halibut fishing, which happen in the lease sale area, are not adequately addressed.[278]

  RESPONSE: BOEM has made several text changes to incorporate information regarding harvest levels and potential impacts to commercial fishery stocks of several species. Impacts to Sport Fishing are discussed in Sections 4.10.2.1 and 4.10.2.2. Impacts to commercial fishing are addressed in Sections 4.13.2.1 and 4.13.2.2. The disturbances on commercial fishing operations would be highly localized but would span multiple fishing seasons. Impacts to commercial fisheries and the success of residents who participate in these fisheries could affect multiple Cook Inlet region towns. New platform and pipeline locations would be identified on navigational charts, but because a relatively small area of Cook Inlet would be affected, interference with commercial fisheries is expected to be limited. Cooperation between the exploration industry and the commercial fishing industry regarding timing and location of operations could minimize these space-use conflicts.

- *COMMENT*: While a mitigation plan is proposed for the Upper Cook Inlet Salmon Driftnet Fishery, there is no such plan proposed for the halibut fishery.[279]

  RESPONSE: Although disturbances to halibut commercial fishing would span multiple fishing seasons, impacts would be temporary or localized and not cause significant impacts to the halibut fishery. Temporary displacement of fishery resources as a consequence of exploration and development activities would be expected to return to normal once activities completed.

[278] North Pacific Fisheries Association (NPFA); Alaska Longline Fisherman's Association
[279] Alaska Longline Fisherman's Association

- *COMMENT*: Commenters urged BOEM to include an in-depth impact analysis on Drift Gillnet Fishery (specifically how gear conflicts would uniquely impact this fishery),[280]. Also, regarding the drift gillnet fishery, one of these commentors stated that "…each vessel will have a net deployed that is between 900 and 1200 feet long and will be in constant motion with the tidal currents... Any stationary oil or gas exploration or production equipment in this area would present an immediate danger to these fishing vessels." [281]

  RESPONSE: BOEM is unable to speculate on a future fishery in federal waters for this EIS. Federal waters in Cook Inlet remain closed to commercial salmon fishing and the EIS does address space-use conflicts between industry and commercial fishing in Section 4.13.2.2. BOEM also included a Mitigation Alternative regarding the drift gillnet fishery. This mitigation alternative states that No on-lease seismic surveys would be conducted during the drift gillnetting season as designated by the Alaska Department of Fish and Game (ADF&G) (approximately mid-June to mid-August). In addition, the mitigation requires that the United Cook Inlet Drift Association must be notified of any temporary or permanent structures planned during the drift gillnetting season.

- *COMMENT*: A commenter said that the DEIS did not address impacts to the salmon set net fishery in Kachemak Bay.[282]

  RESPONSE: Federal waters in Cook Inlet remain closed to commercial salmon fishing and the FEIS does address space-use conflicts between industry and commercial fishing in Section 4.13.2.2. The FEIS analyzed impacts to 1) fish and invertebrate resources, 2) historic fisheries present in the area, 3) current fisheries in the area, 4) stock statuses and trends, where applicable, and 5) the impacts of an oil spill on items 1-4. Unless the commenter provided substantively new information, the impact designations would remain the same.

Source of Comments

- Environmental Advocacy and Other Public Interest Groups (NGOs)
- State Agencies
- Energy/Non-Energy Industry and Other Associations
- Federal Agencies
- Individual/General Public
- Tribes and Tribal Representation

Issue 5.13 Environmental Justice

Summary of Comments

Seven commenters discussed topics related to environmental justice. A couple of commenters suggested that BOEM revise the DEIS to uphold a commitment to environmental justice and analyze the effects of climate change on marginalized communities and local economies. A commenter encouraged BOEM to include an analysis of the cumulative impacts of downstream greenhouse gas emissions to Black, Brown, and Indigenous populations across the United States and around the world, particularly in the global south.[283] Another commenter requested further analysis of cumulative impacts relating to climate change on regional environmental justice communities.[284] One commenter specified an indigenous community

[280] Cook Inletkeeper; Natural Resources Defense Council, et al.
[281] United Cook Inlet Drift Association
[282] Alaska Longline Fisherman's Association
[283] Evergreen Action.
[284] U.S. EPA Region 10.

that would be impacted by the Cook Inlet lease sale. One commenter stated the Chickaloon Native Village community, which includes the federally recognized Ahtna Dene Tribe, would be impacted by the Cook Inlet lease sale.[285] Likewise, one commenter stated that the DEIS does not fully discuss the impact the lease sale will have on tribal communities.[286]

A commenter suggested the use of EPA's Environmental Justice Screening and Mapping Tool (EJSCREEN) as a tool to identify areas that would require an in-depth environmental justice analysis. The commenter stated ways to use the EJSCREEN analysis on large geographical areas. The commenter also acknowledged that the EJSCREEN tool does not provide data on every environmental impact that may be relevant to a particular location and recommended that other supplemental tools and research be used in pursuit of environmental justice analysis, including:

- The EPA document titled, "Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts;"
- Consideration of the definition of "disadvantaged community" as referenced in EO 14008;
- Air Quality Data;
- Extreme Heat Vulnerability Mapping Tool; and
- Center for Disease Control and Agency for Toxic Substances and Disease Registry's Social Vulnerability Index, and more.[287]

A commenter cited EO 12898 and 13985 and asserted that only Alternative 2 was consistent with those EOs regarding environmental justice and advancing racial equity for underserved communities.[288]

One commenter provided recommendations to support the inclusion of traditional (indigenous) ecological knowledge in the DEIS. The commenter did not agree with the analysis "that determined there will not be disproportionate impacts to environmental justice communities because the E&D scenario as the information provided in the DEIS does not support this conclusion."[289]

A commenter stated that on November 15, 2021, the White House issued a statement titled "Fact Sheet: Building a New Era of Nation-to-Nation Engagement." As part of combatting climate change and protecting Tribal lands, President Biden "has set a goal of conserving 30 percent of America's lands and waters by 2030 and is working in collaboration with Tribal Nations to focus on the most ecologically important lands and waters." The DEIS states that the "Seldovia Village Tribe provided written comments that expressed concerns for Cook Inlet beluga whale and northern sea otter populations and identified areas in state and OCS waters that are important for commercial, recreational, and subsistence fishing" (DEIS p. 129). The Proposed Action includes project activities in critical habitat for the beluga whale and northern sea otter. The commenter encourages consideration of this fact sheet in the FEIS analysis, particularly whether critical habitat areas in the program area should be protected to support the goals of the sheet.

Summary Response to Comments

BOEM appreciates EPA's recommendations for identifying disadvantaged or vulnerable communities and has incorporated consideration of variables of disadvantaged communities from the July 21, 2021,

[285] Chickaloon Native Village.
[286] Evergreen Action.
[287] U.S. EPA Region 10.
[288] Lower Cook Inlet Defense Project.
[289] U.S. EPA Region 10.

Memorandum for the Heads of Departments and Agencies Interim Implementation Guidance for the Justice 40 Initiative into the FEIS. BOEM agrees that variables such as housing and energy cost burden, access to transportation, and poverty can compound vulnerabilities for environmental justice communities in rural Alaska that may experience disproportionate impacts from a federal action. BOEM has updated the FEIS, Section 4.15.1 to disclose potential vulnerabilities.

BOEM will retain the recommendation for use of EPA's EJScreen tool for project- and site- specific analysis and identification of vulnerabilities for future analyses of specific exploration and development plans that may result from the lease sale. BOEM will be better able to conduct an informative analysis using the methods for employing EJScreen described by EPA when BOEM has information about potential project and site-specific activities around which to identify block groups and consider impacts in a 1-mile or greater radius. For this lease sale-stage analysis, BOEM reviewed information compiled by the State of Alaska, Department of Commerce, Community and Economic Development, Division of Community and Regional Affairs, to identify communities within the lease sale area. The Research and Analysis Section of ADCCED's Division of Community and Regional Affairs provides community-specific information on a number of metrics compiled from several sources, including US Census data and American Community Survey data and estimates, as well as state data sources. BOEM finds this state-compiled database to provide useful Alaska-specific information regarding communities.

BOEM appreciates the reference "Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts" and has reviewed the report for broad themes applicable to the lease sale area. BOEM notes the report indicates it does not analyze the impacts of climate change on socially vulnerable populations living in Alaska due to data limitations. However, BOEM agrees that some of the themes of vulnerabilities and impacts discussed in the report are applicable in the Cook Inlet region; others appear more applicable to more urbanized and developed areas of the continental U.S.

Environmental Justice communities in the region are supported by several interconnected resources, including Economy (Section 4.12), Commercial Fishing (Section 4.13), Recreation, Tourism, and Sport Fishing (Section 4.10), and Communities and Subsistence (Section 4.11). Cumulative impacts to these resource areas are discussed in detail in their respective sections in the FEIS and could translate into impacts in Environmental Justice communities through changes in economic opportunities, population, health, and community character and identity. The cumulative impacts on these resource areas range from negligible to moderate from past, present, and reasonably foreseeable future activities, but could increase to major, primarily from climate change. Moderate to major cumulative impacts on populations of fish and wildlife are anticipated through effects of climate change (Sections 4.6, 4.7, 4.8, and 4.9). Those resources with major impacts would disproportionately affect Environmental Justice communities in the region that rely on fish and wildlife resources. Analysis of cumulative impacts of climate change on Black, Brown, and Indigenous communities around the world are beyond the scope of this lease-sale level analysis.

Impacts of the Proposed Action on Alaska Native communities are included in the Environmental Justice analysis presented in Section 4.15 of the FEIS. BOEM initiated opportunities for Tribal consultation and Government-to-ANCSA consultation with Tribal entities throughout the Cook Inlet region whose members could be affected by activities related to Lease Sale 258. Details of the consultation efforts and contacted communities are provided in Section 5.3.1 and 5.3.2 of the FEIS. BOEM considered information and feedback from Tribal entities throughout this process, as well as information submitted through the public review process for the FEIS. Regarding incorporation of traditional (indigenous) ecological knowledge, BOEM reviewed and incorporated the best available information sources, some of which included elements of traditional or indigenous knowledge including harvester observations of changes in resource abundance and associated changes in harvest areas and patterns, as well as observations of the health of harvested resources (Holen, 2019; Keating et al., 2020).

In accordance with EO 12898, post-lease activities will be evaluated for any disproportionately high and adverse impacts to a resource on which an Environmental Justice community depends, using NEPA conclusions to inform assessment, where a major (significant) impact has potential for disproportionately high and adverse impacts. BOEM and other Federal agencies have followed this approach in previous NEPA assessments (BOEM, 2015, 2016, 2018; USACE, 2018). Analysis determined that no high and adverse impacts would result from E&D Scenario activities or small spills for subsistence activities and harvest patterns, air quality, water quality, or the biological resources harvested for subsistence, because major impacts on these resources were not identified. However, as described in Section 4.15.2 of the FEIS, a large oil spill could have disproportionately high and adverse effects to Environmental Justice communities, as it could have major adverse impacts to subsistence activities and harvest patterns utilized by these communities.

Regarding consideration of beluga whale and northern sea otter critical habitat areas in light of the President's goal of conserving 30 percent of America's lands and waters by 2030, BOEM works in collaboration with Tribal entities to focus on the most ecologically important lands and waters. After considering public comments on the Draft EIS, BOEM developed the Preferred Alternative, which combines the two critical habitat exclusion alternatives with three mitigation alternatives: Alternative 3A (Beluga Whale Critical Habitat Exclusion), Alternative 3C (Beluga Whale Nearshore Feeding Areas Mitigation), Alternative 4A (Northern Sea Otter Critical Habitat Exclusion), Alternative 4B (Northern Sea Otter Critical Habitat Mitigation), and Alternative 5 (Gillnet Fishery Mitigation). Under the Preferred Alternative, the 10 OCS blocks located in beluga whale critical habitat and the 7 OCS blocks in northern sea otter critical habitat would be excluded from the sale area. BOEM notes that regardless of the Secretary of the Interior's decision concerning the Alternative(s) or components of Alternatives(s) selected, BOEM would work closely with Tribal entities to avoid impacts to beluga whales and northern sea otters.

Detailed Comments and Responses

- *COMMENT*: The FEIS should consider the unique cumulative impacts caused by remote geography (off the road system), regional food equity and importance of subsistence way-of-life practices experienced by communities in and along the Cook Inlet.

  RESPONSE: The FEIS considers the importance of subsistence to EJ communities as one of the major factors in the environmental justice discussion. BOEM identifies potentially disproportionate adverse impacts to EJ communities because of potential major impacts on subsistence activities and harvest patterns from a large oil spill. BOEM incorporated additional language in the affected environment discussion for EJ acknowledging additional vulnerabilities related to the remote location on EJ communities.

- *COMMENT*: The FEIS should include a Health Impact Assessment to analyze the impacts of the Proposed Action on impacted communities more equitably. This tool would allow for a structured planning and decision-making process that analyzes the potential positive and negative impacts of the LS 258 program on the public's health.

  RESPONSE: Regarding the suggestion to conduct a Health Impact Analysis, BOEM has not previously commissioned a full Health Impact Assessment conducted by the State of Alaska at the Lease Sale stage and does not consider such an assessment necessary at this stage. BOEM will conduct further reviews of exploration and development activities should lessees submit plans as a result of LS258. BOEM will give serious consideration to a health impact assessment at the development stage when BOEM would be able to provide project-specific information to the State for incorporation into such an assessment.

Source of Comments

- Tribes and Tribal Representation
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Federal Agencies
- Individual/General Public

Issue 5.14 No Action Alternative

See Issue 3.1 for comments on this topic.

Issue 5.15 Other Comments on Affected Environment or Environmental Consequences

Summary of Comments

Approximately 10 commenters provided other discussion on the affected environment or environmental consequences.

One commenter requested that the Cook Inlet lease sale be canceled because the area is important to regional sustainability. They stated that the area meets the criteria for a United Nations World Heritage Biosphere Reserve designation and listed several surrounding areas that are protected, including Alaska Maritime Wildlife Refuge, McNeil River Sanctuary, and the Kachemak Bay State of Alaska critical habitat area.[290] Similarly, another commenter pointed out that the State waters of Kachemak Bay bordering the lease sale area were designated as important habitat areas and would likely be adversely impacted by nearby oil and gas development.[291] One commenter discussed the scale used in the DEIS to categorize the extent of potential impacts to specific resources and recommended that the FEIS transparently account for how subject matter experts applied scale parameters to categorize impacts to resources. The same commenter pointed out a section of DEIS regarding shipping impacts that the commenter believes requires more clarity.[292]

One commenter suggested that BOEM monetize the impacts of "local" pollutants in the same manner as the climate change impacts of greenhouse gas emissions. They expressed concern that BOEM devotes less analytical attention to the impacts of non-greenhouse gas pollution and emphasized the importance of monetizing the impacts of local pollutants such as nitrogen oxide, sulfur oxide, and particulate matter.[293] Similarly, a few other commenters suggested that the DEIS falls short in fully examining environmental impacts, specifically offshore fracking, and acidizing, which can lead to dangerous pollution.[294]

One commenter discussed previous simultaneous oil and gas activities in Cook Inlet and stated that potential simultaneous operations associated with oil and gas are not adequately addressed in the DEIS.[295]

A few commenters highlighted the importance of assessing the lease sale's GHG emissions in the context of commitments to address the climate crisis. These commenters stated that although the emissions predicted for this project might appear "individually minor" when compared against global totals, BOEM

[290] N. Pease.
[291] Lower Cook Inlet Defense Project.
[292] U.S. EPA Region 10.
[293] Institute for Policy Integrity at New York University School of Law.
[294] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[295] Cook Inletkeeper.

must explain the project's "incremental impact" on climate change and how the lease sale would affect the United States' commitments to limit warming to below 1.5 degrees Celsius.[296]

Summary Response to Comments

BOEM is committed to science-informed decision-making. In fulfilling its NEPA obligations through this FEIS, BOEM carefully analyzed each potentially affected environmental resource in and around the lease sale area, with due consideration for biological resources and the Cook Inlet ecosystem. BOEM has prepared this FEIS to inform the public and the decision maker about the environmental impacts that could occur as a result of the lease sale. The FEIS is based on a comprehensive review of existing literature, with appropriate emphasis on peer-reviewed scientific studies. A list of studies, reports, and other materials utilized in developing the FEIS is provided in the Literature Cited section of the FEIS. BOEM's team of analysts includes individuals knowledgeable in oceanography, biology, social science, geology, and economics. These analysts provide focused technical analyses of environmental impacts associated with the Proposed Action and alternatives. BOEM has determined that existing data concerning environmental resources in and around the lease sale area and the potential effects of the lease sale are sufficient to inform the effects analysis and facilitate a reasoned choice among alternatives. Responses to comments regarding specific data gaps perceived to occur in the FEIS are provided under other issue categories in this appendix.

The impact scale in Section 4.2 of the FEIS describes how the impact categories are applied to resource areas throughout the document. For example, "minor" describes impacts that are short-term and/or localized and are less than severe. "Severe" impacts are those that result in a clear, long-lasting change in the resource's function in the ecosystem or cultural context.

In developing this impacts scale, BOEM considered the approaches used by BOEM and other Federal agencies in their NEPA analyses of other proposed Federal actions. Examples include the approaches set forth in the Final Programmatic EIS for the Atlantic OCS Proposed Geological and Geophysical Activities (BOEM, 2014); National Petroleum Reserve in Alaska (NPR-A) Final Integrated Activity Plan/EIS (BLM, 2020); Alaska Stand Alone Gas Pipeline EIS (USACE, 2012); and the Point Thomson EIS (USACE, 2012; BOEM, 2016, 2018).

When assessing the context and intensity of impacts, analysts considered the unique attributes of the resources being evaluated. Analysts then used the best available information and their professional judgment to determine where resulting effects fall in the continuum on a relative scale from "negligible" to "major."

BOEM received and considered many comments of an editorial nature; for example: suggested word changes and corrections, requests for clarification, questions regarding citations, and similar. Where appropriate, BOEM made these suggested revisions to the FEIS, and these revisions constitute BOEM's response to those editorial comments.

Source of Comments

- Individual/General Public
- Energy/Non-Energy Industry and Other Associations
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Federal Agencies

[296] Natural Resources Defense Council, et al.; Cook Inletkeeper.

Issue 6 Consultation and Coordination

Issue 6.2 Tribal Consultation

Summary of Comments

Approximately 10 commenters discussed tribal consultation. Several commenters expressed concern that BOEM has not adequately consulted with tribal communities as part of the decision-making process. One commenter stated that the public comment period was too short to allow for meaningful review of the DEIS and inconsistent with the Biden Administration's goals for tribal engagement.[297] Similarly, one commenter stated that the DEIS leaves the impression that BOEM put minimal effort into engagement with Tribes in the region, further stating that the agency should rectify apparent omissions in its outreach efforts.[298] Another commenter echoed these statements, specifically stating that a few Native Villages expressed opposition to the lease sale and that this opposition has not been mentioned in the DEIS.[299] One commenter stated that the lack of consultation with tribes and deeper consideration of the socio-cultural impacts of this lease sale is not compliant with EO 13985.[300]

A few commenters addressed several perceived issues regarding BOEM's efforts in tribal consultation. Some of these issues included a lack of information on how BOEM offered consultation opportunities to tribes or whether BOEM held any tribal consultations in preparing the DEIS, failure to specify how the agency identified affected tribal citizens and offered government-to-government consultations to these tribes, and assumptions made by the agency that these tribes will be able to help with cleanup efforts. These commenters also pointed out a directive to consider indigenous traditional ecological knowledge as part of federal decision-making, which these commenters suggest has not happened for this lease sale.[301]

One commenter stated they support the inclusion of additional traditional (indigenous) ecological knowledge, which will help support an evidence-based analysis and allow for more informed decision-making for the lease sale.[302]

Summary Response to Comments

To fulfill its Tribal consultation obligations, BOEM actively reached out to 24 Cook Inlet Tribes, ANCSA Corporations, and Tribal entities to provide an opportunity for consultation during EIS development (see FEIS Section 5.3.1). As part of maintaining an active relationship, BOEM continued efforts to communicate with Tribes even if a response was not received. BOEM also reached out to the 10 federally recognized Tribes associated with Kodiak Island to informally survey their level of interest and develop a collaborative plan for engagement. Additional general outreach efforts included Federal Register Notices, BOEM website updates, press releases to local and statewide media, paid display ads in several newspapers, and several broadcast interviews.

Regarding incorporation of traditional (indigenous) ecological knowledge, BOEM reviewed and incorporated the best available information sources, some of which included elements of traditional or indigenous knowledge. For example, BOEM received input from the Seldovia Tribe regarding their concerns, including concerns about ESA-listed species such as beluga whale and sea otters, and important areas for subsistence and commercial fishing. These comments were considered in development of this

[297] American Petroleum Institute.
[298] Ocean Conservancy.
[299] Evergreen Action.
[300] Lower Cook Inlet Defense Project.
[301] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[302] U.S. EPA Region 10.

EIS including the development of alternatives to minimize impacts to species of concern as well as the selection of the Preferred Alternative (FEIS Chapter 2).

Regarding comments on the EIS process, the NOI to prepare an EIS was published in the Federal Register on September 10, 2020 (85 FR 55861). Publication of the NOI opened a scoping period that extended through October 13, 2020. Opportunity for public input was provided throughout the scoping period via a BOEM Virtual Meeting Room (https://www.boem.gov/ak258-scoping), four live virtual meetings (held September 29, October 1, and two on October 8, 2020), and through submittal of comments via https://www.regulations.gov. The Notice of Availability of the Draft EIS was published in the Federal Register on October 29, 2021 (86 FR 60068), beginning a 45-day public comment period that ended December 13, 2021.

Source of Comments

- Energy/Non-Energy Industry and Other Associations
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Federal Agencies
- Individual/General Public

Issue 6.4 ESA Section 7 Consultation

Summary of Comments

Three commenters discussed the Endangered Species Act (ESA) Section 7 consultation. One commenter emphasized the importance of consultation with NMFS and the USFWS at the time of leasing, relative to all marine mammals, rather than solely those listed as endangered or threatened.[303]

A few commenters urged BOEM to ensure that consultation considers the impacts of GHGs caused by the lease sale on species threatened by climate change. They commented that the anticipated GHG emissions for this lease sale will harm listed species beyond the immediate area of the proposed activity in a manner that is attributable to the agency action. They also addressed the statement in the DEIS that "any activities that would incidentally "take" marine mammals are prohibited unless authorized by a Letter of Authorization or an Incidental Harassment Authorization under the Marine Mammal Protection Act." These commenters expressed concern that the DEIS fails to address how BOEM will deal with cumulative impacts of authorized "take" and simultaneous permitted oil and gas activities.[304]

Summary Response to Comments

Contributions of the Proposed Action to GHG emissions are evaluated in Section 4.3.5 of the FEIS. Additionally, the potential effects of climate change were evaluated and considered in the FEIS within individual resource areas as each resource is uniquely impacted by climate change. See the following sections in the FEIS for evaluations of climate change on Fish and Invertebrates (Section 4.6), Birds (Section 4.7), Marine Mammals (Section 4.8), and Terrestrial Mammals (Section 4.9).

BOEM is consulting with USFWS and NMFS (the "Services") concerning potential impacts to listed species and their federally designated critical habitat. For ESA consultation on lease sales in Alaska,

[303] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).
[304] Natural Resources Defense Council, et al.; Cook Inletkeeper.

BOEM specifically requests incremental Section 7 consultations. Regulations at 50 CFR § 402.14(k) allow consultation on the first part (i.e., first increment) of the entire action as long as that part does not violate Section 7(a)(2); there is a reasonable likelihood that the entire action will not violate Section 7(a)(2); and the agency continues consultation with respect to the entire action, obtaining a Biological Opinion for each step. Accordingly, at the lease-sale stage, BOEM evaluates the post-lease activities that could occur as a result of lease issuance (e.g., seismic surveying, ancillary activities, and exploration drilling) to ensure that activities under any leases issued will not result in jeopardy to a listed species or cause adverse modification of designated critical habitat. BOEM will complete Section 7 consultation with the Services on LS 258 prior to allowing any physical work to occur and will reinitiate consultation as needed.

Source of Comments

- State Agencies
- Environmental Advocacy and Other Public Interest Groups (NGOs)

Issue 6.5 Essential Fish Habitat Consultation

Summary of Comments

One commenter provided background on the EFH consultation process, explained their role in the process, and provided a list of the requirements of an EFH assessment to assist BOEM in developing the EFH assessment and FEIS analysis.[305]

Summary Response to Comments

BOEM has reviewed the comments about the EFH consultation process and the requirements of the EFH Assessment. BOEM has considered these detailed comments in the preparation of the FEIS and the EFH Assessment. On January 19, 2022, BOEM sent NMFS an EFH assessment on the Lease Sale. NMFS responded on February 24, 2022. NMFS agreed with BOEM's determination that the Lease Sale will not result in adverse effects to EFH, they also provided conservation recommendations regarding: 1) long-term impacts to EFH associated with increased GHG emissions, and 2) the need for facilities to reduce methane and other emissions during operations. Preparations for Lease Sale 258 were interrupted in the spring of 2021 due to a court injunction, and the lease sale was subsequently canceled due to lack of industry interest. BOEM did not further pursue EFH consultation until recently when BOEM was directed by Congress in the Inflation Reduction Act of 2022, to hold Lease Sale 258 by December 31, 2022. BOEM resumed EFH consultation and responded to NMFS in mid-October 2022. While BOEM shares NMFS' concerns about the potential long-term impacts of climate change on fish species and habitats in Alaska, due to limitations of technology, data, modeling, and methods, it is not presently possible to predict the precise geographical changes to species distributions and habitats that may occur over long time scales as the result of climate change. Consequently, it is not possible to analyze, with any degree of confidence, the potential effects of the increased GHG emissions from a single lease sale on local Alaskan fisheries. BOEM and NMFS have agreed to collaborate on future studies to address impacts to fish in Cook Inlet. Regarding the reduction of methane and other emissions, lessees are already subject to regulations that require adherence to best management practices at their facilities. Specific operations restrictions to reduce methane emissions would be most appropriately addressed at the exploration or development stage, and not at the lease sale stage. Nonetheless, BOEM has developed a lease stipulation for Lease Sale 258 (No. 10, Royalties on All Produced Gas) that will serve as an incentive to reduce emissions of methane or other gases that contribute to climate change. BOEM anticipates that the

[305] National Oceanic and Atmospheric Administration.

requirements of Stipulation No. 10 will at least partially address the concerns reflected in NMFS' second EFH Conservation Recommendation.

Source of Comments

- Federal Agencies

Issue 7 Other Comments

Issue 7.1 Lease Sale Process

Summary of Comments

Two commenters discussed the lease sale process. One commenter recommended that BOEM take no additional action on the lease sale until it has developed and implemented its "Fitness to Operate" standard, which will ensure companies can meet their safety, environmental, and financial responsibilities.[306] Another commenter expressed concern that BOEM is leasing national energy resources to a company which already exercises monopoly control over Alaska's only commercial natural gas production. They urged BOEM to consider the cascading environmental impacts from what the commentors describe as Hilcorp's monopoly over Cook Inlet production and likelihood that this lease sale will exacerbate existing risks. The commenter further stated that the existence and perpetuation of monopoly power is a market condition that BOEM must not allow.[307]

Summary Response to Comments

As described in Chapter 1 of the FEIS, the U.S. Department of the Interior has jurisdiction over the OCS oil and gas lease sale in the Cook Inlet pursuant to the Outer Continental Shelf Lands Act of 1953 (OCSLA), as amended (43 USC §§ 1331 *et seq*.). OCSLA grants the Secretary of the Interior the authority to issue leases to the highest qualified responsible bidder(s) on the basis of sealed competitive bids and to formulate regulations as necessary to carry out the provisions of the statute. OCSLA does not provide BOEM with the authority, nor does it obligate BOEM to consider the potential for a lessee to form a monopoly as part of the decision-making process when analyzing a proposed lease sale under NEPA. As such, these comments are outside of the scope of analysis for the FEIS.

Regarding the proposed "Fitness to Operate" standards, BOEM may disqualify a company from acquiring a lease if it has unacceptable operating performance (see 30 CFR § 556.403). BOEM can also revoke designation of an operator if it has unacceptable operating performance and can cancel leases if companies fail to comply with any provision of OCSLA, the lease, or applicable regulations (see 30 CFR § 550.135 and 30 CFR § 556.1102). According to the DOI Report on The Federal Oil and Gas Leasing Program (November 2021), BOEM also plans to develop a fitness to operate standard for companies seeking to be designated as oil and gas operators. The intent will be to require companies to meet minimal fitness to operate standards to ensure companies have the capability to meet their safety, environmental, and financial responsibilities.

Source of Comments

- Environmental Advocacy and Other Public Interest Groups (NGOs)

[306] Ocean Conservancy.
[307] Alaska Public Interest Research Group (AKPIRG).

Issue 7.2 Environmental Review Process and Statutory Compliance

Summary of Comments

Four commenters addressed the environmental review process. One commenter addressed the importance of the required EIS under NEPA, further discussing the tendency of agencies to fill the document with an overwhelming amount of unnecessary information to avoid potential legal challenges.[308] A few commenters discussed NEPA's requirement that agencies "provide the necessary contextual information about [an action's] cumulative and incremental environmental impacts," specifically in the context of climate change. These commenters went on to say that a statement that emissions from a proposed Federal action represent only a small fraction of global emissions is not an appropriate basis for deciding whether or to what extent to consider climate change impacts under NEPA.[309] One commenter stated that per OCSLA, BOEM has the authority to shape the offshore leasing program based on environmental, climate and public health considerations and can use its discretion to cancel Lease Sale 258.[310]

Summary Response to Comments

Under the CEQ regulations that govern this EIS (40 CFR § 1500-1508, 1978 as amended in 1986 and 2005), EIS documents shall normally be 150 pages or fewer. The page limit reduces the amount of unnecessary information included in NEPA documents to help improve readability. The FEIS for Lease Sale 258 includes information that is pertinent and necessary for impact analysis and understanding the context of impacts.

Cumulative impacts from past, present, and reasonably foreseeable future activities and the impacts of climate change to resource areas are discussed in detail in their respective sections in the FEIS (Sections 4.3 through 4.14). The cumulative impacts on these resource areas range from negligible to moderate from past, present, and reasonably foreseeable future actions, but could increase to major, primarily from climate change. Moderate to major cumulative impacts on populations of fish and wildlife are anticipated through effects of climate change (Sections 4.6, 4.7, 4.8, and 4.9). In addition, the analysis completed in Section 4.3.5 of the FEIS quantifies projected GHG emissions that would occur from the Proposed Action as well as the consumption of the produced fuels to assess the Proposed Action's contribution to climate change globally.

In regard to BOEM's authority to have and/or shape the offshore leasing program, under OCSLA, the USDOI's 2012–2017 National OCS Oil and Gas Leasing Program was introduced and developed a targeted leasing model for the Alaska OCS lease sale process. The targeted leasing model was continued in the 2017–2022 National OCS Oil and Gas Leasing Program. The goal of targeted leasing is to focus oil and gas leasing on the most promising OCS blocks, while protecting important habitats and critical subsistence activities (Chapter 2, Alternatives Including the Proposed Action). Generally, the Secretary of the Interior has the ability to choose any of the alternatives, including the No Action alternative, after weighing possible benefits and adverse environmental effects. However, the Inflation Reduction Act, signed into law on August 16, 2022, precludes the selection of the No Action alternative because it directs BOEM to hold Lease Sale 258 on or before December 31, 2022.

Source of Comments

- Environmental Advocacy and Other Public Interest Groups (NGOs)

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[308] L. Pugliaresi.
[309] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[310] I. Gutierrez.

- Individual/General Public

Issue 7.3 Outreach / Public Scoping Meetings / Public Involvement

Summary of Comments

Approximately 10 commenters discussed outreach and public involvement. Some commenters requested that BOEM extend the public comment period either 30 days or 90 days.[311] One commenter stated that stakeholders require a better explanation of fundamental assumptions and a clearer presentation of data that is not publicly available.[312] A commenter recommended the FEIS incorporate details about all coordination and consultation efforts that have occurred in the NEPA process, including information about future planned consultation or outreach efforts.[313] Other commenters expressed concern that many stakeholders have not had enough time to review the DEIS and provide comments, which is necessary given their extensive knowledge of the area and ability to address inconsistencies.[314]

Summary Response to Comments

BOEM took deliberate steps to announce the availability of the DEIS, to disseminate the DEIS, to meet with interested parties, and to publicize the series of meetings scheduled. These efforts included the following:

- Publishing a Notice of Availability of a DEIS on October 29, 2021 (86 FR 60068).
- Releasing the Cook Inlet OCS Oil and Gas Lease Sale 258 DEIS to the public on October 29, 2021, through a press release and posting on BOEM's website at: www.boem.gov/ak258.
- Mailing digital copies of the DEIS to interested parties on October 29, 2021.
- Scheduling three virtual public meetings on November 16, 17, and 18, 2021.
- Using social media, such as BOEM's Facebook page and Twitter, to inform the public of the agency's efforts.
- Announcing the availability of the DEIS and soliciting public input via newspaper advertisements in major communities (Anchorage, Homer, Kenai) as well as the Alaska Journal of Commerce and Petroleum News.

The CEQ regulations require BOEM to provide a minimum 45-day public comment period on the DEIS. In the Notice of Availability of the DEIS, published on October 29, 2021 (86 FR 60069), BOEM requested that all comments be provided by the end of a 45-day comment period, or on December 13, 2021. BOEM felt that the DEIS comment period provided a meaningful and ample period of time to comment on the document. In addition to accepting written comments, BOEM accepted comments at three public hearings, held virtually. BOEM communicated key concepts to the public at these meetings using PowerPoint presentations.

Consultation efforts conducted to date are outlined in Section 5.3 of the DEIS. The assumptions upon which BOEM based its effects analysis are outlined in Chapter 3 and Section 4.1 of the DEIS.

[311] J. Childs; D. Raskin; J. Wisniewski; K. Walker.
[312] American Petroleum Institute.
[313] U.S. EPA Region 10.
[314] Alaska Jig Association; B. Rosenberg.

Source of Comments

- Energy/Non-Energy Industry and Other Associations
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Federal Agencies
- Individual/General Public

Issue 7.5 International Issues

Summary of Comments

One commenter stated that the DEIS relies on an oversimplified model that does not appropriately reflect real-world oil markets. They further stated that if BOEM is going to include foreign consumption in its modeling and perhaps base, then the model needs to be redefined.[315]

Summary Response to Comments

BOEM utilized models for the lifecycle for GHG emissions analysis, including projected foreign consumption, representing the best science and methodology available for estimating energy market impacts under the No Action Alternative and Proposed Action. Although commenters pointed out perceived deficiencies of the BOEM air quality modeling, the commenters did not provide better data, alternative information, or approaches for incorporation into the FEIS analyses. The GHG emission analysis is a new and evolving process and BOEM will continue to review and study methods utilized and will update this analysis as applicable data and methodologies become available.

Source of Comments

- Energy/Non-Energy Industry and Other Associations

Issue 7.6 Energy Policy

Summary of Comments

Five commenters discussed energy policy as it relates to the DEIS and Proposed Action. One commenter asserted the importance of investing in clean energy and renewable energy alternatives to oil and gas.[316]

A commenter stated that in addition to the analysis of the broad range of consequences beyond the local environmental and community, the DEIS should also include a range of consequences from not proceeding with the lease sale. The commenters policy suggestions included reducing GHG emissions through policies that constrict domestic oil and gas production and reducing carbon emissions.[317]

The same commenter suggested the U.S. see the current energy crisis in Europe as a “cautionary tale” regarding the importance and influence of energy policy. The commenter briefly explained the European energy crisis and how it negatively impacted energy sources and the economy. The commenter urged the development of energy policy be robust against uncertainty to provide safeguards for potential economic impact and disruptions to energy supplies.[318]

[315] American Petroleum Institute.
[316] Cook Inletkeeper.
[317] L. Pugliaresi.
[318] L. Pugliaresi.

Some commenters suggested climate goals acknowledge natural gas and oil development in Alaska. They affirmed that developing America's energy source and environmental progress with Cook Inlet energy in mind would enhance the country's economic recovery thus protecting access to affordable and reliable clean energy.[319]

According to a commenter, analysis from Rhodium Group that found that federal incentives for electric vehicles and charging infrastructure would cut gasoline and diesel demand by 4 percent by 2030. The commenter acknowledged President Biden's goal of reaching 50 percent zero emission vehicle sales by 2030 and identified a few states that currently implement electric vehicle energy policies. They asserted that vehicle emission policies would lead to a decrease in the demand for domestic oil.[320]

A few other commenters acknowledged the Biden administration's climate pledges and their potential impacts.[321] One commenter suggested that though the pledges fell short of meeting the Paris Agreement climate limit, it would put the United States on a path towards decreasing GHG and fossil fuel production.[322] Another commenter called for BOEM to model a baseline scenario that assumes the U.S. and other countries adhere to the parameters of the Paris Agreement.[323] Another commenter described the current impacts of fossil fuels and described how implementing energy policy in accordance with the Paris Agreement would lead to a decrease in fossil fuel production. [324]

Summary Response to Comments

Issues related to national and international energy and climate policies are beyond the scope of this analysis, except to the extent they directly pertain to regulatory requirements associated with the Proposed Action. However, BOEM disagrees with the notion that producing oil and gas from the Lease Sale 258 is incompatible with various national policies and global GHG emissions goals. Market forces dictate if oil and gas were not produced from the Lease Sale 258, this energy would be procured from other sources to keep supplies in step with energy demand.

Though the Proposed Action would likely provide an energy and revenue source for the region, an analysis of the changes in availability of affordable energy to the citizens of Alaska or other areas of the U.S. is beyond the scope of the FEIS and therefore cannot be verified. In addition, while it is assumed the Proposed Action will support current and future regional energy needs, this is not a requirement of the project.

Source of Comments

- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Individual/General Public
- State Agencies

[319] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).
[320] Natural Resources Defense Council, et al.
[321] Natural Resources Defense Council, et al.; Cook Inletkeeper.
[322] Natural Resources Defense Council, et al.
[323] Natural Resources Defense Council, et al.
[324] Cook Inletkeeper.

Issue 7.7 Other Comments on the DEIS

Summary of Comments

Four commenters provided other comments on the DEIS. Some commenters expressed concern regarding Hilcorp's poor environmental and safety track record. These commenters stated that Hilcorp is the only oil company currently holding leases in federal waters in the Cook Inlet OCS Planning Area, which they say makes it even more important for BOEM to consider the company's previous environmental and safety violations and accidents, as well as how this reality may affect the environmental impacts of its activities under Lease Sale 258.[325]

One commenter pointed out a specific section of the DEIS that mentions the "Port of Anchorage." The commenter stated that this name has been changed to "Port of Alaska" and requested that BOEM replace any reference to Port of Anchorage in the document.[326]

Summary Response to Comments

The regulations and other mechanisms BOEM and BSEE use to ensure operators meet safety standards are summarized above in Issue 2. In short, BOEM may disqualify an operator from acquiring a lease based on unacceptable operating performance (see 30 CFR § 556.403); BOEM has the authority to revoke the designation of an operator if it has unacceptable operating performance and to cancel leases if operators fail to comply with any provision of OCSLA (see 30 CFR § 550.135 and 30 CFR § 556.1102); BOEM and BSEE regulations require operators to use the Best Available and Safest Technologies as per the 1978 OCSLA amendments and the Energy Policy Act of 2005; and regulations at 30 CFR § 556.900 require bonds and other means of financial assurance to demonstrate coverage for compliance with all obligations associated with pipeline right-of-way grants, leases, and activities proposed. Additionally, as per the DOI Report on The Federal Oil and Gas Leasing Program (November 2021), BOEM plans to develop a "Fitness to Operate" standard for companies seeking to be designated as oil and gas operators. The intent will be to require companies to meet minimal fitness to operate standards to ensure companies have the capability to meet their safety, environmental, and financial responsibilities. No completion date for the "Fitness to Operate" standard has been determined yet.

BOEM has updated the FEIS to consistently use "Port of Alaska" where appropriate.

Source of Comments

- Environmental Advocacy and Other Public Interest Groups (NGOs)
- State Agencies

[325] Natural Resources Defense Council, et al.; Cook Inletkeeper; Alaska Public Interest Research Group (AKPIRG).
[326] State of Alaska Dept of Natural Resources, Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADFG) and the Alaska Oil and Gas Conservation Commission (AOGCC).

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